DISSERTATION

STUDENTS' PERCEPTIONS OF THE IMPORTANCE OF THE FACULTY DIMENSIONS OF TECHNICAL CURRENCY, TEACHING TECHNIQUES, AND COMMITMENT TO STUDENT SUCCESS FOR THEIR LEARNING/ SUCCESS IN A TECHNOLOGY BASED BACCALAUREATE PROGRAM

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY AHMED S. KHAN ENTITLED STUDENTS' PERCEPTIONS OF THE IMPORTANCE OF THE FACULTY DIMENSIONS OF TECHNICAL CURRENCY, TEACHING TECHNIQUES, AND COMMITMENT TO STUDENT SUCCESS FOR THEIR LEARNING/ SUCCESS IN A TECHNOLOGY BASED BACCALAUREATE PROGRAM BE ACCEPTED AS FULLFILING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

STUDENTS' PERCEPTIONS OF THE IMPORTANCE OF THE FACULTY DIMENSIONS OF TECHNICAL CURRENCY, TEACHING TECHNIQUES, AND COMMITMENT TO STUDENT SUCCESS FOR THEIR LEARNING/ SUCCESS IN A TECHNOLOGY BASED BACCALAUREATE PROGRAM

The primary objective of this study was to explore the relationships between students' perceptions of the importance of three faculty dimensions --- technical currency, teaching techniques, and commitment to student success --- to their learning/success, expressed in terms of self-reported technical competencies and GPA in a technology-based baccalaureate electronics engineering technology (EET) program at a teaching university.

The sample (N=225) was composed of seniors of the BSEET program (Fall 2003) from 13 geographically diverse campuses of a teaching university. More than 75% of the EET seniors agreed that the constructs of faculty technical currency, teaching techniques, and commitment to student success, are important to their learning/success.

Statistical analyses also revealed that: (a) there was no significant difference between the means of faculty technical currency (FTC), and faculty teaching techniques (FTT), (b) there was a significant difference between the means of faculty technical currency (FTC) and faculty commitment to student success (FCSS), with small effect size, and, (c) there was a significant difference between the means of the faculty teaching techniques (FTT), and faculty commitment to student success (FCSS), with a small effect size.

Regression analyses revealed significant and direct relationships between: (a) faculty technical currency (FTC) and student learning/success in terms of self reported technical competency (effect size is medium), (b) faculty teaching techniques (FTT) and student learning/success in terms of self reported technical competency (effect size is medium-to-large), (c) faculty commitment to student success (FCSS) and student learning/success in terms of self-reported technical competency (effect size is medium), (d) faculty technical currency (FTC) and faculty teaching techniques (FTT) [large effect size], and, (e) faculty technical currency (FTC) and faculty commitment to student success (FCSS) [effect size is large]. The multiple regression analyses also revealed 16.6% of the variance in student learning/success can be predicted from the three faculty constructs of FTC, FTT, and FCSS.

Student GPA failed to reveal any significant relationships with faculty dimensions of technical currency, teaching techniques, and commitment to student success.

The recommendations based on the study suggest ways to improve faculty development and training activities to promote student learning in the domains of engineering technology.

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CHAPTER 1: INTRODUCTION

This chapter presents the discussion about the purpose of the study, research questions, definition of terms, delimitations, assumptions and limitations, significance of the study, and the researcher's perspective.

Rapid technological growth has put new demands on engineering and engineering technology educators. Industry seeks graduates with up-to-date technical knowledge. The half-life of an engineer's technical skills – how long it takes for half of everything an engineer knows about the field to become obsolete – is becoming strikingly short (Smerdon, 1996). The pace of technological change has also imposed new challenges on faculty development and technical currency of programs.

Faculty professional development activities and technical currency play an important role in promoting student learning and success. Especially for non-research (purely teaching) institutions that offer technology driven programs, one of the most important factors determining student success is the technical currency of faculty members (Khan, Karim, Gloeckner & Morgan, 2004).

Predicting the success of students engaged in higher education is important. Many models have been developed to predict student success in chosen fields of study, as well as at the chosen college or university. Success in education has been linked to a variety of intellectual and non-cognitive skills (Bean, 1980; Cambino et al., 2000; Camara and

Echternacht, 2000; Dyer and Breja, 1999; Lam et. al 1999; Rodriguez, 1996; Pascarella, 1980; Spady, 1971; Tinto, 1982; Webb, 1989).

Researchers at various private and public research universities historically have used traditional student predictor variables (GPA, retention rate, and graduation rate) to predict student success. Even for non-research (purely teaching) schools that offer technology driven programs, one of the most important factors determining student success would seem to be the technical currency of faculty members. The accreditation bodies such as Accreditation Board for Engineering and Technology (ABET) place high emphasis on the technical currency of faculty, and require institutions to provide opportunities for faculty to keep abreast of the pace of technological advances. ABET's 2003-2004 criteria for accrediting engineering technology programs state (ABET, 2003):

> In engineering technology programs, technical currency is important and must be assured by such means as a competent and inquisitive faculty, an active industrial advisory committee, and an adequately funded budget which encourages continuing faculty development, and a modern library collection with an adequately funded program for continuous renewal. Positive procedures must be established and closely monitored to safeguard against technical obsolescence. (p. 5)

Accreditation bodies have placed high emphasis on technical currency of faculty in the technology based programs, but the subject has received little attention in the literature. Further, no studies have been conducted to investigate the associations between the faculty dimensions of faculty technical currency, faculty teaching techniques, and faculty commitment to student success, and self-reported student learning and success. Therefore, an investigation is warranted to explore the relationship between student learning/success with these faculty constructs.

Purpose of the Study

The purpose of this research project is to explore students' perceptions of the importance of three faculty dimensions – technical currency, teaching techniques, and commitment to student success – for their self-reported learning/success in a technology-based baccalaureate electronics engineering technology (EET) program at a teaching university.

Research Questions

The research project will answer the following questions:

1. How do students perceive the importance of three faculty dimensions – technical currency, teaching techniques, and commitment to student success – for their learning and success? (Are means high or low?)
2. Are there significant differences between student ratings of their perceptions of the importance of the three faculty dimensions of technical currency, teaching techniques, and commitment to student success? (As there differences among the means of the three constructs?)
3. Are there associations between the importance of faculty technical currency (FTC) [in terms of up-to-date technical knowledge of subject matter, computer hardware and software skills, knowledge of new and emerging technologies, publications of technical papers and textbooks, and participation in technical seminars, workshops and conferences] and student's learning/success (expressed in terms of self-reported technical competency and GPA), as perceived by seniors in the EET program?
4. Are there associations between the importance of faculty teaching techniques (FTT) [in terms of lectures, use of a variety of technological teaching tools, use of

PowerPoint, use of a variety of teaching strategies, use of group presentations, coordinating lab work with lecture, organization and preparation of class/lab activities, use of individual lab projects, and providing timely feedback on class/lab projects] and student learning and success (in terms of self-reported technical competency and GPA), as perceived by seniors in the EET program?

5. Are there associations between the importance of faculty commitment to student success (FCSS) [in terms of dedication to students, high expectations of students, approachability by students, encouragement of student accomplishment, and concern for student success] and student learning/success (expressed in terms of self-reported technical competency and GPA), as perceived by seniors in the EET program?
6. Is there a combination of the factors of faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS), that predicts student learning/success (expressed in terms of self-reported technical competency and GPA) better than one alone, as perceived by seniors in the EET program?

Definitions of Terms

For the purpose of this study, the following definitions of terms were used.

Faculty Technical Currency (FTC): Technical currency of faculty is expressed in terms of technical competency /up-to-date technical knowledge of the subject matter, computer hardware and software skills, publication of technical papers and textbooks, participation in technical seminars, workshops, conferences, and professional organization activities.

Faculty Teaching Techniques (FTT): This consists of lectures, use of a variety of technological tools to support lectures, use of PowerPoint to deliver lectures, use of a variety of teaching strategies, use of group presentations, coordinating lab work with theoretical concepts covered in class, use of individual lab projects, and providing timely feedback on class and lab projects.

Faculty Commitment to Student Success (FCSS): This refers to a faculty member's dedication to students, high expectations of students, being approachable by students, encouraging student accomplishment, and concern for student success.

Student learning/success: It is expressed in terms of self-reported technical competency, GPA, number of job offers, highest starting salary, and membership in professional and honor societies.

Delimitations

This study is delimited to faculty members who teach technical courses in the electrical and electronics technology (EET) program at DeVry University, a private, for profit, teaching institution. Thus the results of the study are limited to purely teaching institutions and may not generalize to research universities.

Assumptions and Limitations

For this study some of the assumptions and limitations are:

1. Student success can be measured in terms of student's self-reported technical competency, GPA, number of job offers, highest starting salary, and membership in professional and honor societies.
2. A medium sample size of 200-500 will be adequate to detect relationships.
3. A convenience sampling technique will be adequate.

4. Results will be based on graduating seniors' self-reports of their learning/success rather than the use of an achievement test scores or actual later success.
5. Students will know and answer honestly about the importance of the faculty dimensions.
6. Students will understand the concept of faculty technical currency.

Significance of Study

A body of research has been emerging in recent years, reporting intellectual and non-intellectual factors as predictors of student success in higher education. These predictors include high school grade point average (HSGPA), school rank, admission scores (Rodriguez, 1996), entrance exam math and English scores, ACT scores (Cambino, Denny, & DeVore, 2000; Lam et al. 1999), retention rates (Dyer and Breja, 1999), high school grades, and SAT scores (Camara and Echternacht, 2000). Non-academic predictors dealing with the motivational and demographic characteristics of students have also been studied in relation to the issues of retention, persistence, attrition, and dropout (Bean, 1980; Pascarella, 1980; Spady, 1971; Tinto, 1982; Webb, 1989).

Post-secondary educators often try to devise methods that will reliably predict student success. These methods are important to both the educational institution and the student. For institutions, predictive information is helpful for future institutional planning and budgets. For students, reliable predictive methods would greatly aid in counseling and advising new admissions to enter either into developmental or other programs commensurate with their abilities and aptitude (Berlin, 1998).

The present study explored the student-perceived value of faculty technical currency, faculty teaching techniques, and faculty commitment to student success as predictor variables for student learning and student success. It underscored the need for faculty development and training, and recommended ways to improve student learning in a non-research, teaching university environment, where the nature of scholarship is different from a traditional university, at which faculty both do research and teach. Student learning/success predictor variables are also directly related to retention. Student success and retention play a key role in the profitability of an institution.

Researcher's Perspective

The exponential rate of technological advances is forcing a paradigm shift in education. Teaching in today's world requires new approaches to instruction. The profound and pervasive changes occurring in education are placing new demands on educators. Educators are expected to be technically current and learn the mechanics of teaching/learning in order to become effective teachers. The new challenges are transforming teachers into life-long learners.

The author believes that the majority of faculty in purely teaching schools, especially those teaching in technology-based and career-oriented programs, are lagging behind the pace of technological change in terms of their professional development activities due to lack of planning, demands to do research, and financial cutbacks.

The author also thinks that the key factors which contribute to student learning/success and effective teaching are faculty technical currency, faculty teaching techniques, and faculty commitment to student success. Out of these three, the technical currency is the pivotal factor that promotes effective teaching/learning in the technical curricula. Therefore, the present study was conducted to determine if the author's idea of the importance of these factors is in sync with students' perceptions about their learning/success in terms of the relative importance of professors' technical currency, teaching techniques, and commitment to student success.

CHAPTER 2: LITERATURE REVIEW

As stated in Chapter 1, a body of research has been emerging in recent years reporting intellectual and non-intellectual factors as predictors of student success in higher education. Post-secondary educators often try to devise methods that will reliably predict student success. These methods are important to both the educational institution and the student. For institutions, predictive information is useful for future institutional planning and budgets. And for students, reliable predictive methods would greatly aid in counseling and advisement of new admissions into programs that match with their abilities and skills.

This chapter presents a literature review about the variables which have been used to predict student success, and it explores effective teaching and learning strategies, and the status of research in the areas of faculty development and faculty technical currency by answering the following questions:

1. What is learning?
2. What are the different learning styles?
3. What factors have been identified to predict student success?
4. What are successful teaching strategies for promoting learning?
5. What is faculty development?
6. What is the status of research in the area of technical currency?

7. What is the role/importance of technical currency in the new Internet economy?

What is Learning?

Professor Benjamin Bloom of the University of Chicago and co-workers who met from 1948 to 1953 devised six major steps or levels to learning: knowledge, comprehension, application, analysis, synthesis, and evaluation. These levels are known as Bloom's taxonomy, and pertain to thinking, or the cognitive domain.

Bloom's Taxonomy encourages a learner to de-emphasize the acts of remembering and reporting knowledge, and focus on applying and translating information into new forms by applying it to new contexts and domains by the processes of analysis, synthesis and evaluation (Bloom et al., 1956).

In his 1985 essay "Concept and Action in Adult Education," Mezirow expounds on learning and the mission of adult education. According to Mezirow:

> Learning always involves making explicit, elaborating and contextualizing; it may involve validating or performing as well. (1985, p. 142)

> Learning may be understood as the process of using prior interpretation to construe a new or a revised interpretation of meaning of one's experiences in order to guide future action. (1991, p.12)

> Learning is defined as the social process of constructing and approaching a new or revised interpretation of the meaning of one's experiences as a guide to action. (1994, p. 222)

Mezirow's transformative learning theory is grounded in the nature of human communications. Mezirow states that:

> Transformation theory maintains that human learning is grounded in the nature of human communication; to understand the meaning of what is being communicated – especially when intentions, values, moral issues and feelings are involved – requires critical reflection of assumptions. (1998, p.188)

Mezirow's transformative theory is an attempt to identify common elements of adult leaning, but it is built on language and communicative proficiency.

The American Psychological Association (APA) has made a comprehensive attempt to define the current perceptions of psychological principles that pertain to the successful learner and learning process. Table 2.1 lists the summary of 14 principles (APA, 1997).

Table 2.1

Factors Involved in the Learning Process

Cognitive and Metacognitive Factors	
1. Nature of Learning Process	The learning of complex subject matter is most effective when it is an intentional process of constructing meaning from information and experience.
2. Goals of Learning Process	The successful learner, over time and with support and instructional guidance, can create meaningful, coherent representations of knowledge.
3. Construction of Knowledge	The successful learner can link new information with existing knowledge in meaningful ways.
4. Strategic Thinking	The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals.
5. Thinking about Thinking	Higher order (metacognitive) strategies for selecting and monitoring mental operations facilitate creative and critical thinking.
6. Context of Learning	Learning does not occur in a vacuum but is influenced by environmental factors, including culture, technology, and instructional practices.
Motivational and Affective Factors	
7. Motivational and Emotional Influences on Learning	What and how much is learned is influenced by learner's motivation. Motivation to learn, in turn, is influenced by the individual's emotional state, beliefs, interest and goals, and habits of thinking.
8. Intrinsic Motivation to Learn	The learner's creativity, higher order thinking, and natural curiosity all contribute to motivation to learn.

Table 2.1 (continued)

9. Effects of Motivation on Effort	Acquisition of complex knowledge and skills require learner effort and guided practice. Without learner's motivation to learn, the willingness to exert this effort is unlikely without coercion.
Developmental and Social Factors	
10. Developmental Influence on Learning	As individuals develop, they encounter different opportunities and experience constraints for learning.
11. Social Influence on Learning	Learning can be enhanced by social interactions, interpersonal relations, and communications with others.
Individual Differences Factors	
12. Individual Differences in Learning	Learners have different strategies, approaches, and capabilities for learning that are a function of prior experience and heredity.
13. Learning and Diversity	Learning is most effective when differences in learner's linguistic, cultural, and social background are taken into account.
14. Standards and Assessment	Setting appropriately high and challenging standards and assessing the learner and learning progress – including diagnostic, process, and outcome assessment – are integral part of the learning process.

Source: Learner centered psychological principles. APA, 1997.

What Are the Different Learning/Teaching Styles?

Learning style theory begins with Carl Jung (1927), who observed major differences in the ways people perceive, make decisions and how active or reflective they are while interacting. Jung's work has influenced a number of researchers trying to understand the differences in the human learning.

Learning styles can be described as a set of factors, behaviors, and attitudes that facilitate learning for an individual in a given situation. There is no right way to learn or teach, but there are certain styles that are more appropriate for a given situation or learner. A learning style is a way in which a learner begins to concentrate on, process, and retain new and difficult information (Dunn & Dunn, 1987). Sternberg (1994) observes, "A style is a preferred way of using one's abilities. It is not in itself an ability but rather a preference" (p. 36). Curtis and Winsor (1993) argue, "The adult learner generally is more culturally diverse and often presents a diversity of learning styles." A number of learning style formats have been identified and developed to promote student learning. The most significant work thus far has been achieved by Anthony Gregorc (1979), who conducted extensive research on children, adolescents, and adults in various learning environments. His research shows that most individuals learn more easily in certain environments and under certain conditions than others. Gregorc argues that individuals think either abstractly or concretely and their thoughts are organized either sequentially or randomly: He outlines four distinct patterns of learning styles: Concrete Sequential, Abstract Sequential, Abstract Random, and Concrete Random. Table 2.2 compares Gregorc's learning styles.

Table 2.2

Gregorc's Learning Styles

Styles	Learner/Traits/Likes
Concrete Sequential	Structure and pattern, direction, details, practical problems, realistic situations, hands on learning
Abstract Sequential	Reason and logic, ideas and information, theory and concepts, analysis and evaluation and independent study
Abstract Random	Interpretation, explanation, communication, illustration, peer-teaching
Concrete Random	Open-ended activity, exploration, investigation, experimentation, options, brainstorming, simulations, games, experiments, finding alternatives

Silver et al. (1997) contends that learning models have not addressed how context and purpose affect learning, and they point out the following limitations:

1. They may fail to recognize how styles vary in different content and disciplines.

2. These models are sometimes less sensitive than they should be to the effects of context of learning. Emerging from a tradition that viewed styles as relatively permanent, many learning-styles advocates advised altering learning environments to match or challenge a learner's style. Either way learning-style models have largely left unanswered the question of how context and purpose affect learning. (p. 23)

In 1983, psychologist Howard Gardner proposed the Multiple Intelligence Theory, which suggested that there are seven distinct types of intelligence: musical, verbal, logical/mathematical, interpersonal, intrapersonal, and bodily/kinesthetic. Gardner (1993), in the 10th anniversary edition of his classic work *Frames of Mind: The Theory of Multiple Intelligences*, expounds on the idea of multiple intelligences:

> In the heyday of the psychometric and behaviorist eras, it was generally believed that intelligence was a single entity that was inherited; and that human beings – initially a blank slate – could be trained to learn anything, provided that it was presented in an appropriate way. Nowadays an increasing number of researchers believe precisely the opposite; that there exists a multitude of intelligences, quite independent of each other; that each intelligence has its own strengths and constraints; that the mind is far from unencumbered at birth; and that it is unexpectedly difficult to teach things that go against early 'naive' theories or that challenge the natural lines of force within an intelligence and its matching domains. (p. xxiii)

Gardner (1983) explains how learning to program a computer might incorporate multiple intelligences:

> Logical-mathematical intelligence seems central, because programming depends upon the deployment of strict procedures to solve a problem or attain a goal in a finite number of steps. Linguistic intelligence is also relevant, at least as long as manual and computer languages make use of ordinary language...an individual with a strong musical bent might best be introduced to programming by attempting to program a simple musical piece (or to master a program that composes). An individual with strong spatial abilities might be initiated through some form of computer graphics -- and might be aided in the task of programming through the use of a flowchart or some other spatial diagram. Personal

> intelligences can play important roles. The extensive planning of steps and goals carried out by the individual engaged in programming relies on intrapersonal forms of thinking, even as the cooperation needed for carrying a complex task or for learning new computational skills may rely on an individual's ability to work with a team. Kinesthetic intelligence may play a role in working with the computer itself, by facilitating skill at the terminal... (p. 390)

Gardner's theory implies that the process of learning/teaching should focus on the particular intelligences of each person. The theory also suggests that different intelligences represent different content domains and learning modalities. Another implication of this theory is that the assessment of abilities should incorporate all forms of intelligence. The theory lacks direct empirical support and has not been readily accepted within academic psychology. It has been primarily focused on child development although it is applicable to all ages.

Student engagement is one of the most important factors required for learning to take place. What is engagement? Goslin (2003) defines engagement as:

> The words that come readily to mind when we try to describe engagement in learning involve the investment of energy or effort on the part of the learner. They include paying attention, listening, concentrating, trying to remember, mentally rehearsing, thinking, and practicing. (p. 15)

There exists a complex relationship between the skill or knowledge to be acquired and the learner's effort level. Engagement in learning is affected by many physiological, psychological, educational, social and cultural factors. The learning process is also dependent on the characteristics of learner, task and environment.

Goslin identifies three ways for teachers to promote learning by engaging learners: (1) teacher should induce prospective learners to make the necessary psychological investment, (2) teacher should try to sustain learners' attention even when the going gets rough, and (3) teacher should do everything possible to facilitate the learning process itself.

Regarding the traits of an effective teacher, Goslin identifies two important dimensions: (1) the ability to explain things or present information in such a manner that makes the learning process as easy as possible, and (2) the ability to keep the learner fully engaged in the learning process.

Thomas Guskey (1988), University of Kentucky, in his book *Improving Student Learning in College Classrooms*, identifies the shortcomings of new and experienced college professors. For new college professors, he identifies a key shortcoming: their lack of pedagogical skills or lack of formal training in pedagogy. He observes that:

> New professors generally come to their positions through an informal apprentice system, are immediately given enormous teaching responsibilities, and yet have had little or no opportunity to study teaching in an organized systematic way. Left on their own to develop pedagogical skills, they typically fall back upon recollections of former teachers from their own student days and attempt to model the classroom practices they recall as best. (p.5)

Regarding the experienced college teachers, Guskey points out their key weakness:

> Research shows that after the first couple of years in the college classroom, most professors and instructors settle into a fairly stable pattern of instructional practices. Based almost on trail-and-error learning, they develop personal repertoire of instructional techniques that is only occasionally refined as a result of classroom experiences. Although typically derived without the benefit of critical reflection or collegial feedback and exchange, this repertoire provides these veterans of college classroom with a sense of security and certainty about what to do, how to do it, what will work, and what is likely not to work. Suggestions of major revision to their instructional practices threaten that hard-earned security and certainty. Not only would such revision require additional time and effort in an already burdensome schedule, it also carries the risk of diminished effectiveness and possible failure. For these reasons experienced college teachers are usually reluctant to make major changes in the way they teach…" (p.6)

Guskey argues that the new knowledge we have gained from modern studies of college teaching has identified various aspects of the teaching and learning process that can be altered with relative ease and yet can be very powerful in helping students build successful learning experiences. These aspects cost very little to change in terms of professor's time or effort, but can significantly enhance student learning. Thus experienced professors and instructors can become more effective in their teaching without incorporating major changes in their teaching techniques or repertoire.

To study the influence of college teachers on student learning, Guskey investigated the effect of differences in institutions, departments, courses, and teachers on student learning. He conducted a study to estimate the effects of each factor on the "earned credit rates" in various college classes. According to Guskey "earned credit rate… is simply the percent of students initially enrolled in a class who receive a passing final grade at the end of the semester. It is a measure of the both achievement and retention of students in a course." (p. 10)

Guskey examined the earned credit rate from 180 college classes. He found that a very large portion of the variation in earned credit rates (71%) was attributable to the four factors he had considered. Institutional differences accounted for 42 percent of the explained variation in the earned credit rates. Teacher differences accounted for 52 percent of the explained variation in the earned credit rates. Departmental differences and course level differences both had relatively minor influence, accounting for only 4 and 2 percent, respectively, of the explained earned credit rate variation. Guskey admits that earned credit rate is very limited and potentially biased index of student learning, and that it is only one of a large number of indexes college teachers use in judging the success of their teaching.

Guskey argues that a number of other studies conducted using different indices of student learning have yielded very similar results (Good, Biddle, & Prophy, 1975; Rakow, Airasian, & Madaus, 1978). All of these studies indicate that regardless of the institution, department or level of the course, teachers make a very important difference in students' learning. In studies teachers are consistently found to be the most important factor in explaining differences in learning outcomes, regardless of how those outcomes are defined or measured.

What Factors Have Been Identified to Predict Student Success?

Predicting the success of students engaged in higher education is important. Many models have been developed to predict student success and retention in chosen fields of study, as well as at the chosen college or university. Success in education has been linked to a variety of intellectual and non-cognitive skills. Researchers have historically used high school GPA, entrance exam math and English scores, retention rates etc. to predict student success (Dorio et al., 1980). Universities across the nation have established criteria for the selection of students for admission. While the selection criteria vary among universities, most universities use some combination of high school grade point average, high school class rank, and the ACT or SAT examination.

Levin and Wyckoff (1988) have studied a variety of non-intellectual factors such as attitude toward high school mathematics and physics in a model to predict success. Additional non-academic factors such as personality, motivation, student background and attitude toward self, level of parent education, attitude toward studying, and prior knowledge of the engineering majors have been shown to be useful as predictive of retention and success variables.

The ACT scores also play a role in predicting student success. Institutions that admit students with a score of 26 or higher experience the lowest freshman year attrition rates (10%). In comparison institutions that admit students with scores below 15, experience 41 percent attrition (Cambino, Denny, & DeVore, 2000). Another factor that plays an important role is high school GPA. Just like the ACT and SAT, there have been numerous studies indicating that high school GPA and high school curriculum play an influential role in college success. In addition, students with low secondary school GPA's are at the greatest risk of attrition and are considered at-risk students for institutions (Cambino, et al., 2000).

Lam et al. (1999) investigated the high school GPA and ACT composite test scores as predictors of success for minority engineering students. They found that the only significant predictor of graduation with an engineering degree was high school GPA. However, both high school GPA and ACT scores were significantly correlated with undergraduate GPA. The ACT test score was a significant predictor of undergraduate GPA but not of eventual graduation.

Students' academic performance and their continued enrollment through attainment of a bachelor's degree are a concern for universities and their respective colleges. Several studies have placed high monetary values on student retention (Dyer, Lacey, & Osborne, 1996; Glennen, Farren, & Vowell, 1996). Dyer and Breja (1999) reported that retention could be predicted by examining the criteria by which students were admitted.

Regrettably, the literature indicates very little evidence of comprehensive research in the area of faculty personality traits and their impact on student learning and success in the domains of higher education. Hatala (2002) examined the beliefs of college of education professors about learning and teaching, and the relationship of this to their classroom practices. The findings of the study indicate that each professor's beliefs guided his or her practices in the classroom. Hatala argues that a relationship exits between higher education professors' beliefs about teaching, concepts of student learning, and their classroom practices.

All institutions of higher education, both public and private, are striving to improve student retention rates (Roach, 2000). Student persistence, as measured in terms of retention and graduation, is an important factor used in measuring institutional effectiveness. Student retention plays a significant role for the success of both private and public institutions. Both retention and student success are directly related to the viability of the organization. In both private and public institutions, post-secondary educators often try to formulate methods that will reliably predict student success. Predictive information is helpful for future institutional planning and budgets when specialized degree programs have high costs (Hazard & Danner, 1974).

The retention of students based on gender and minority difference has also been evaluated. Felder et al. (1995) reported that although women begin their pursuit of an undergraduate engineering degree with equal or better credentials than their male peers, by the end of their sophomore year they were twice as likely to drop out as compared to male students.

Most researchers in most traditional public colleges have used traditional predictors to predict success. For all purely teaching institutions and research institutions, technical currency of faculty members is of paramount importance. Accreditation bodies such as the Accreditation board for Engineering and Technology (ABET), place high emphasis on the technical currency of faculty:

> The field of technology is changing rapidly. Thus the currency of material being taught and people teaching the material is of paramount concern to TAC of ABET. Faculty members must maintain current knowledge of their field and understanding of the tasks industry expects technicians and technologists to perform. Faculty members normally remain current by active participation in professional societies; reading the literature; continuing education; applied research; consulting and periodic return to industry. (ABET, 2002, p. 8.)

The accreditation agencies require schools that offer technology-oriented programs to keep the faculty abreast with the pace of technological advances. In this regard, research is warranted to investigate the relationship between student success and the technical currency of faculty.

What Are Successful Teaching Strategies For Promoting Learning?

The relationship between teaching and learning is a complex process. How students learn and how teachers teach are complicated processes, difficult to understand and even harder to master. Effective teaching is one of the means to ensure maximum student learning. What is effective teaching? Hativa (2000) makes the following observation:

> The effective teaching is defined as teaching that brings about effective and meaningful student learning. Successful student learning is achieved through a continuous process of students' linking new knowledge to their experiences and

> their existing knowledge base. This process fosters the expansion of new knowledge and its integration with learners' prior knowledge and understanding, so that it can be used most effectively in new tasks and transferred more readily to new situations (p. 23).

Chickering and Gamson (1987) identified seven research-based principles of effective undergraduate education. They propose that good practice in undergraduate education: (1) encourages contacts between students and faculty, (2) develops reciprocity and cooperation among students, (3) uses active learning techniques, (4) provides prompt feedback, (5) emphasizes time on task, (6) communicates high expectations, and (7) respects diverse talents and ways of learning.

Thomas Guskey (1988), in his book titled *Improving Student Learning in College Classrooms*, presents the results of a study he conducted to identify the traits of highly effective teachers. His study was restricted to faculty members who taught introductory level courses within their discipline because the research has shown that introductory level courses are generally considered more difficult to teach than advanced courses for the same academic discipline. Introductory courses are also often required courses and enroll large number of students with widely varied backgrounds and skills. For the study, he selected teachers who had relatively higher levels of student achievement in their classes, and lower rates of student attrition.

Guskey interviewed 28 teachers, representing approximately the same number of male and female teachers and also an equal number of white and minority teachers, who taught in the disciplines of biology, English, mathematics, and social science at six urban community colleges. The study did not find any set of personal traits or background characteristics that was common to these highly effective teachers. However, the study discovered striking consistency among these teachers in terms of their teaching behavior, both across campuses and across academic discipline. The common behaviors are divided into fours categories (Guskey, 1988).

1. Planning, organization, and cues: All teachers spend considerable time planning and organizing their courses prior to the first class meeting.
2. Positive regard for students: All teachers emphasized that students generally want to be regarded as individuals with identifiable and unique strengths, weaknesses, and interests. Teachers make special effort to become aware of such individual traits and interests, in order to illustrate to students their positive regard for them. The teachers also avoid situations in which they might embarrass or seem to harass students with their questions and demands.
3. Student participation: All highly effective college teachers expressed a keen sensitivity to students' involvement in class sessions. They constantly assess the class to determine if students are "with" them. If not, they immediately make adjustments to their presentation format.
4. Feedback, correctives, and reinforcement: All the teachers stressed the importance of providing students with regular and specific feedback about their learning progress. In most cases, the feedback was communicated in form of written comments on assignments and exams. Overall effective teachers emphasized that "reinforcement and recognition from the teacher" is very important to their students and a very powerful motivational device.

Commenting on the importance of teacher traits on student learning, Professor Guskey observes, "Despite the influence of factors that lie beyond the control of professors and instructors, such as students' background and previous learning experiences, the quality of their teaching has a very strong effect on students' learning. In other words college teachers do make a difference" (p. 4). On the transformation of professors into effective college professors, Professor Guskey observes, "Enhancing one's effectiveness as a college teacher clearly requires a certain amount of time, effort and commitment. It also requires some experimentation, and a tolerance for the occasional failures and setbacks that are likely to occur." (p.27)

Knowles (1980) proposes four fundamental assumptions about designing instruction for adults: (a) adults need to know why they need to learn something, (b) adults need to learn through experience, (c) adults tend to approach learning as problem-solving, and (d) adults learn best when the subject content is of clear and immediate importance.

Caine and Caine (1991) state that brain-compatible teaching is based on 12 principles: (1) the brain is a parallel processor, (2) learning engages the entire physiology, (3) the search for meaning is innate, (4) the search for meaning occurs through "patterning," (5) emotions are critical to patterning, (6) the brain processes parts and wholes, (7) learning involves both focused attention and peripheral perception, (8) learning always involves conscious and unconscious processes, (9) the brain has at least two different types of memory: a spatial memory system, and a set of systems for rote learning, (10) humans understand and remember best when facts and skills are embedded in natural, spatial memory, (11) learning is enhanced by challenge and inhibited by threat, and (12) each brain is unique. Based on these principles, the authors recommend that teachers should incorporate a variety of experiential learning strategies in order to promote learning. Thus, the findings of Knowles and Caine and Caine reinforce the importance of learning/teaching styles, the use of technological tools and the incorporation of interactive strategies for promoting learning and enhancing effective teaching.

In summary, educators have to refrain from monotonous and passive activities and should incorporate stimuli that promote learning in students with different learning styles. Recent brain research findings suggest that classroom activities which incorporate motivation, a stimulating environment and critical thinking promote development of the brain in the form of growth of new dendrites. To achieve this end, educators can use tools like multi-media, group exercises, Internet exercises, and group lab projects to enhance and support direct instruction. Educators can also enhance student learning by conducting lectures in a friendly manner, so that nobody feels stress or is afraid to ask a question. Little learning can take place in a tense environment.

What is Faculty Development?

What is faculty development? Several definitions of faculty development are found in the literature. Faculty development refers to helping faculty members improve their competencies as teachers and scholars (Elbe & McKeachie, 1985). Alstete (2000) defines faculty development as follows:

> "Faculty development" is a phrase that has both a broad and a narrow definition. Broadly, it covers a wide range of activities that have as their overall goal the improvement of student learning. More narrowly, the phrase is aimed at helping faculty members improve their competence as teachers and scholars. Faculty development programs vary in their purpose, but are commonly designed to enhance personal and professional development, instructional development, and/or organizational development. (p. iii)

The practice of sabbatical leave, as a vehicle for professional development, started at Harvard University in 1810 (Blackburn, Pellino, Boberg, & O'Connell, 1980). The purpose was to provide faculty an opportunity to gain sufficient competence to teach a subject. In later years, financial assistance to attend professional conferences became another conventional form of support offered to faculty members at many schools. Both sabbatical and travel assistance were provided to support research activities, but neither was really aimed at improving pedagogical skills (Guskey, 1988).

Many schools have ongoing professional development programs for faculty, but until very recently the objective of these programs have been to support research and scholarly activities, not improve pedagogical skills of faculty members.

Elbe and McKeachie (1985), makes the following observation regarding the lack of support for professional development for faculty:

> One must recognize that faculty development has never had a prominent place in the routine budgets of American collegiate institutions. Customary support for faculty development has not been primarily directed toward improving teaching, and while an increase in faculty development activities in the seventies did aim at developing faculty members as teachers, such activities are currently less well supported.

Light (1984) observed that college teaching tends to be a profession in which only secondary attention is given to teaching itself. Guskey (1988) points out the reasons why the staff development programs in colleges and universities have focused on research and scholarship, and not on improvement of faculty pedagogical skills. Guskey observes:

1. Advancement in the academic ranks has been traditionally tied to scholarly activities. Many faculty members see support for their scholarly work as essential to success and survival in the academic environment.

2. While the "publish or perish" philosophy with respect to academic promotion may not prevail at all institutions of higher education, scholarly productivity is certainly regarded very highly at most.

3. ...the reason for emphasis on research is that the prestige of an institution is often tied to the scholarly activities of its faculty. As faculty members gain prominence through their research, the reputation of their institution is also enhanced. And since research projects are often financed through external funding agencies such as federal, state, governments, private foundations, businesses, and like, faculty members who engage in research also provide their institutions with financial resources that can be very important in times of budget constraints. (p. 122)

During the past 30 years, faculty development programs have been incorporated in the domains of higher education, but the impact of these programs is not evident in the classroom. Why have faculty development programs not been very effective? The literature does not provide a clear cut answer; however, many observers tend to agree with the assessment presented by Schwartz (1990):

> In many cases so far, activities aimed at improving teaching, and thus trying to answer faculty questions, have had no more than short-term effects. Although these activities aroused faculty interest while underway, they generally failed to prompt instructional staff to reflect on their teaching practices over a longer period of time. (p. 99)

Murray (1999) conducted a survey to examine the efficacy of faculty development programs in terms of the components of an effective faculty development program (a climate that fosters and encourages faculty development; a formalized, structured, and goal-directed development program; a connection between faculty development and the reward structure; faculty ownership; support from colleagues for investment in teaching; and a belief that good teaching is valued by administrators). Murray's survey covered 130 community colleges in the United States. His findings indicate that: (a) the community colleges involved in the study did in fact have three of the six components for effective faculty development, (b) good teaching is valued and connected to evaluation and tenure decisions, and (c) lack of leadership and a formalized, structured program indicated serious detriments to effective faculty development.

During the past 70 years, student evaluations have become an essential tool for gauging teacher's effectiveness. The majority of post secondary schools employ student evaluations as one of, and often the most important measure of teaching effectiveness (d'Apollonia & Abrami, 1997). There are a number of different instruments and processes used for faculty assessment at various institutions, but practitioners agree that the ultimate goal of faculty evaluation is to help faculty grow professionally. Researchers have raised questions about the construct validity of student evaluations. There are a number of variables (such as student motivation, expected grade, and teacher's presentation style) which may lead to biased student evaluation (Cashin, 1988). Despite these concerns about validity of student evaluation instruments, institutions continue to use data collected by such instruments to make important decisions related to faculty tenure and promotion.

Centra (1993) in his book *Reflective Faculty Evaluations: Enhancing Teaching and Determining Faculty Effectiveness,* argues for enhancing teacher effectiveness by re-examining the ideas about faculty evaluations. Centra stresses the use of faculty's reflective practice in a manner that would lead to new ways of implementing quality formative and summative evaluations which will help institutions make decisions about faculty tenure and promotion. Centra also proposes a "NVHM " model of change. NVHM is an acronym for four conditions which must be satisfied in order for change to take place: (1) new knowledge, (2) value, (3) how to change, and (4) motivation. Centra argues that these conditions are the key for improving teaching vis a vis formative evaluation. The first condition "new knowledge" recommends that the teacher must learn something new about teaching. The second condition "value" suggests that teacher must value information. The third condition "how to change" implies that the teacher must recognize how to change. And the fourth condition, "motivation" indicates that a teacher must be motivated inherently.

Eble and McKeachie (1985) recommend that faculty development activities should give emphases to the following constructs:

1. *Enlarging teaching capabilities*: Faculty professional growth should involve activities that would help faculty members to enhance their teaching capabilities by learning theory and pedagogy practices.

2. *Developing additional teaching skills:* Faculty development activities should place emphasis on developing additional teaching skill. Skills in planning and organizing course, skills in using a variety of teaching methods, skills in modeling and stimulating problem solving and learning strategies are all learnable and useful to develop as a faculty member.

3. *Gaining a better understanding of students*: A faculty member must gain a better understanding of students. In order to teach effectively, one must build bridges between what the teacher knows and what the students is trying to grasp.

4. *Interpersonal relationship with students:* The sense that the teacher cares about the student is vital to most students' learning. Research has shown that most effective faculty members work closely with students outside of class as well as in.

5. *Potential for promoting faculty growth:* Faculty members can become effective teachers by gaining greater understanding of how their disciplines' organizational structures facilitate or inhibit student learning. Simply knowing a field as a scholar is not the same as understanding its structure for teaching.

6. *Motivation and enthusiasm:* Other things being equal, those faculty members who are most highly motivated and most enthusiastic about teaching are likely to be most effective. Faculty development activities that enable faculty members to find greater intrinsic satisfactions in their teaching are important for continued development.

7. *Learning how to continue learning from one's experiences and to increase opportunities for faculty to learn from one another.* The ability to analyze the teaching situation, to monitor one's own effectiveness, and to adapt one's methods to a particular class and a particular teaching situation are elements in continuing development as faculty member.

8. *Collegiality among faculty:* Development in working with other faculty members, in establishing communication with colleagues who can support, critique, and assist in one's teaching --- these are all important for continued learning and development. Many schools, small and large, currently suffer from a lack of collegiality among faculty.

Guskey (1988) outlines the following characteristics for an effective faculty development program:

1. There is balance of faculty and administrator planning in the program, rather than domination by either group (p.125).

2. Change is seen as a gradual process that requires strong administrative support (p.126).

3. Faculty members receive feedback on the results of their efforts (p. 127).

4. Faculty members receive continued support and follow-up activities (p. 128).

These characteristics appear to be common sense in nature, but combination of these factors is rarely implemented at most colleges as most faculty members and administrators continue to live in their "isolated cocoons," and they fail to make efforts to collaborate in order to promote student learning and success in this day and age of rapid technological change and digital economy.

Alstete (2000), make the following observation regarding the development of tenured faculty members:

> The average age of faculty members in higher education is rising each year... students are still entering college in large numbers after completing secondary school, and some wonder whether faculty in their 50s, 60s, and beyond have the capability and desire to be productive and effective with all that is happening in this postindustrial, information-driven society. *The digital Economy: Promise and Peril in the Age of Networked Intelligence* (Tapscott, 1996) asks whether the

> formal education system can transform itself. Geoffrey Bannister, president of Butler University, answers, "Just wait till the generation of teenage Internet users hit the universities when the average age of tenured professors is 50. Sparks are going to fly!"(p. 1)

Faculty technical currency and pedagogical skills will continue to become important assets of faculty members, especially for faculty teaching in the technology-based programs at teaching schools, as students entering these programs will have a higher level of technological knowledge -base. It would be interesting to observe, "Who will be teaching whom? The traditional modes of teaching will not work with the "Internet generation" entering colleges, as the role of faculty transforms from information provider to information facilitator. Therefore, it is imperative that effective faculty development programs focusing on enhancing faculty's technical currency and pedagogical skills be developed and implemented. In this regard, the key element of an effective faculty development program is the involvement of faculty members and administrators in planning faculty development programs. Both faculty and administrators must be collaboratively engaged in the process, and, as Professor Guskey observed, the domination by either group is detrimental to program success.

What is the Status of Research in the Area of Technical Currency?

Rapid technological growth has put new demands on engineering and engineering technology educators. Industry seeks graduates with up-to-date technical knowledge. The half-life of an engineer's technical skills – how long it takes for half of everything an engineer knows about his or her field to become obsolete – is becoming strikingly short. According to the National University Continuing Education Association, for mechanical engineers the half-life is 7.5 years; electrical engineers, 5 years; and software engineers, a mere 2.5 years (Smerdon, 1996). These estimates were made almost a decade ago;

considering the rapid pace of technological growth, those numbers are surely even smaller today. Therefore the rapid pace of technological change coupled with the shortened "half-life" of engineers mandates faculty to remain current in their areas of specialization in order to help students acquire an up-to-date technological knowledge base.

For non-research (purely teaching) schools that offer technology driven programs, one of the most important factors determining student success would seem to be the technical currency of faculty members. Accreditation bodies such as the Accreditation Board for Engineering and Technology (ABET) place high emphasis on the technical currency of faculty and require institutions to provide opportunities for faculty to keep abreast of the pace of technological advances. ABET's 2003-2004 criteria for accrediting engineering technology programs states:

> In engineering technology programs, technical currency is important and must be assured by such means as a competent and inquisitive faculty, an active industrial advisory committee, an adequately funded budget which encourages continuing faculty development, and a modern library collection with an adequately funded program for continuous renewal. Positive procedures must be established and closely monitored to safeguard against technical obsolescence. (ABET, 2003, p. 5)

ABET's new criteria for accrediting engineering technology programs, known as Technology Criteria 2000 (TC2k), also emphasize the importance of faculty technical currency. They state:

> The overall competence and effectiveness of the faculty are manifested by such factors as formal education, industrial experience, professional certification, teaching experience, teaching effectiveness, technical currency, scholarly activity, professional society participation, communication skills, extracurricular support for student activities, and similar attributes appropriate to the goals of the program. (ABET, 2003, p.34)

A review of the literature indicates very little evidence of comprehensive research in the area of faculty technical currency and its relationship to student learning and success. Mihel (1988) explored the effectiveness of sabbatical leaves to maintain technical currency of instructors. In this study, perceptions were measured from faculty and administrators from 10 DeVry Institutes of Technology (presently DeVry University) campuses throughout the United States. The study found out that:

> Sabbatical leave participation had no significant effect on the perceived technical currency of faculty. Although faculty who had not been on leave perceived themselves as being as technically current as their counterparts, there is a strong sense that leave participation does or can enhance the currency of faculty (p. ii).

The study implied that the faculty's participation in a sabbatical leave does have enormous potential for enhancing the currency of faculty, but this method of updating technical knowledge of faculty has fallen short of its potential. The study also recommended that a regular program of continuing education, required for promotion, may provide a more manageable method for development of faculty currency.

Gunter (1992) investigated the relationship between faculty development activities and student outcomes. The study also explored the relationship between funds spent for faculty development and student performance outcomes. Gunter collected data from 171 community colleges located in California, Florida, Illinois, and Texas. The study did not clearly establish a relationship between funding for faculty development and student performance outcomes. But three important findings did emerge from the study:

1. Institutions often did not have student performance data readily available.
2. Institutions did not evaluate faculty development programs from the perspective of student performance outcomes.

3. Institutions with the highest percentages of developmental students allocated the least percentage of instructional budget to faculty development.

In his book, *The Reflective Practitioner: How Professionals Think in Action*, Donald Schön contrasts the epistemology of practice, which he calls "technical rationality," with a creative practice known as "reflection-in-action." Schön believes that universities are not devoted to production and distribution of fundamental knowledge; rather these institutions are committed to a particular epistemology that fosters selective inattention to practical competence and professional artistry. Commenting on technical rationality, Schön states:

> According to the model of Technical Rationality – the view of professional knowledge which has most powerfully shaped both our thinking about professions and the institutional relations of research, education, and practice – professional activity consists in instrumental problem solving made rigorous by application of scientific theory and technique. (p. 21)
> If the model of Technical Rationality is incomplete, in that it fails to account for

practical competence in "divergent" situations, so much the worse for the model.

Describing reflection-in-action, Schön states:

> The practitioner allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique. He reflects on the phenomena before him, and on the prior understandings which have been implicit in his behavior. He carries out an experiment which serves to generate both a new understanding of the phenomena and a change in the situation... When someone reflects-in-action, he becomes a researcher in the practice context. He is not dependent on the categories of established theory and technique, but constructs a new theory of the unique case. (p. 68)

Reflection-in-action epistemology is also described as 'thinking on our feet,' involves use of past experiences to construct understanding of new situations.

Khan, Karim, Gloeckner, and Morgan (2004) conducted a national survey to: (a) gauge the status of professional development activities vis-à-vis faculty technical currency at personal, departmental and institutional levels in the domains of engineering technology, and (b) determine predictor variables for maintaining faculty technical currency. The survey was conducted through the ASEE ETD (American Society of Engineering Education, Electronics Technology Division) listserv which (in November 2003 when the survey was conducted) had a membership of more than 3,000 faculty members and professionals belonging to more than 677 institutions. Appendix A shows the instrument used for the study. The following is a summary of the findings reported by Khan, Karim, Gloeckner, and Morgan, (2004).

Table 2.3 summarizes the frequency and percentage of responses indicating faculty perceptions about the various aspects of technical currency, its relationship to student learning/success, and the impact of the Technology Accreditation Commission (TAC) of ABET's TC2k accreditation criteria on the revision of institutional policies to promote faculty development activities and on allocation of financial resources for faculty developmental activities.

Modes for maintaining technical currency: Figure 2.1 shows the frequency distribution of various modes used by respondents to maintain their technical currency. Reading books, magazines and journals; attending conferences/technical workshops/seminars; and keeping up-to-date via the Internet are the most widely used modes for faculty to maintain their technical currency. Working as consultants and transferring knowledge/skills from senior faculty/colleagues are the least practiced modes.

Table 2.3

Findings of Khan et al. (2004) Faculty Technical Survey. (Technical Currency Issues)

N= 226	Disagree	No Opinion	Agree
Technical Currency Issues	%	%	%
1. Because of the application orientation of engineering technology programs, technical currency of faculty is essential to make student learning more relevant.	2.2	-	97.8
2. I believe that there is a strong relationship between the technical currency of the faculty member and student learning/success.	8	4.0	88
3. My institution supports and encourages faculty members to maintain technical currency.	16.4	8.8	74.8
4. My chairperson supports and helps me plan professional development activities to maintain technical currency.	23.5	6.8	69.7
5. I believe that I have maintained technical currency during the past 5 years, enabling me to teach courses effectively.	8.8	3.5	87.7
6. My institution has allocated sufficient funds for the professional development activities of faculty during the past 5 years.	42.9	13.3	43.8
7. There is an urgent need in my department/ program to improve existing policies in order to allow faculty to enhance their technical currency.	25.2	16.4	58.4
8. There is an urgent need in my department/ program to increase funding for faculty development activities.	18.5	12.8	68.7
9. ABET's new TC2K accreditation criteria will encourage my institution to revise policies in order to promote faculty development activities in order to keep faculty technically current.	25.2	34.1	59.3
10. ABET's new TC2K accreditation criteria will encourage my institution to allocate adequate financial resources for faculty development activities.	30.6	37.2	32.2

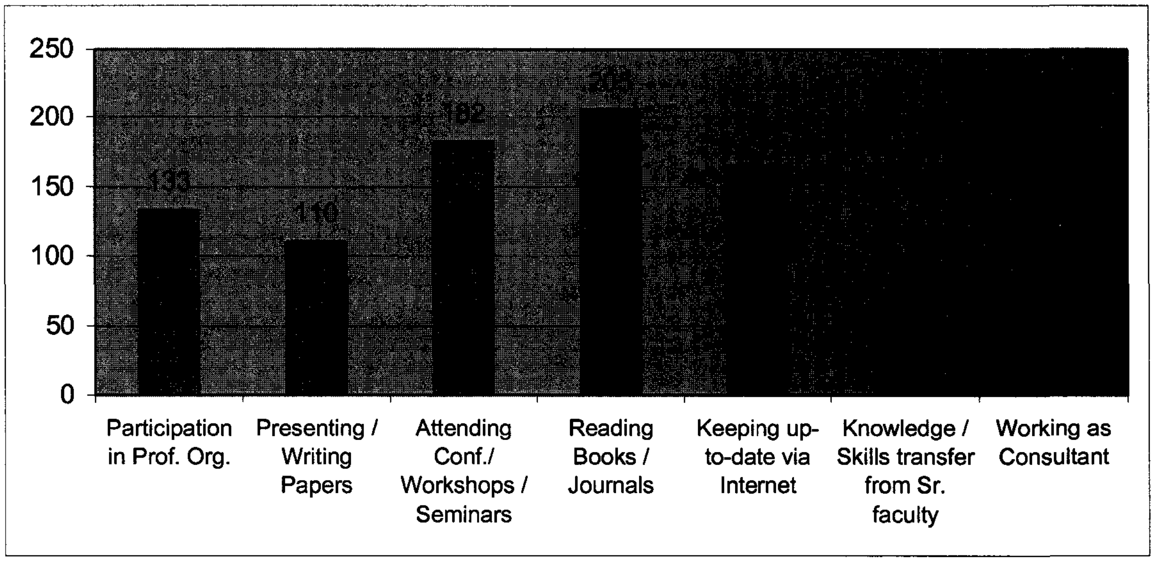

Figure 2.1. Modes used to maintain faculty technical currency.

Computer Competency/Information Technology (IT) hardware skills (PC & Networking): Figure 2.2 illustrates the respondents' computer/IT/networking hardware skills. Nineteen percent reported low-level skills (i.e., they have a basic understanding of computer hardware/network systems); 54.4 percent of respondents said that they have medium-level skills (i.e., they have understanding of computer/network systems); and 26.5 percent reported to have high-level skills (i.e., they can design hardware/network systems).

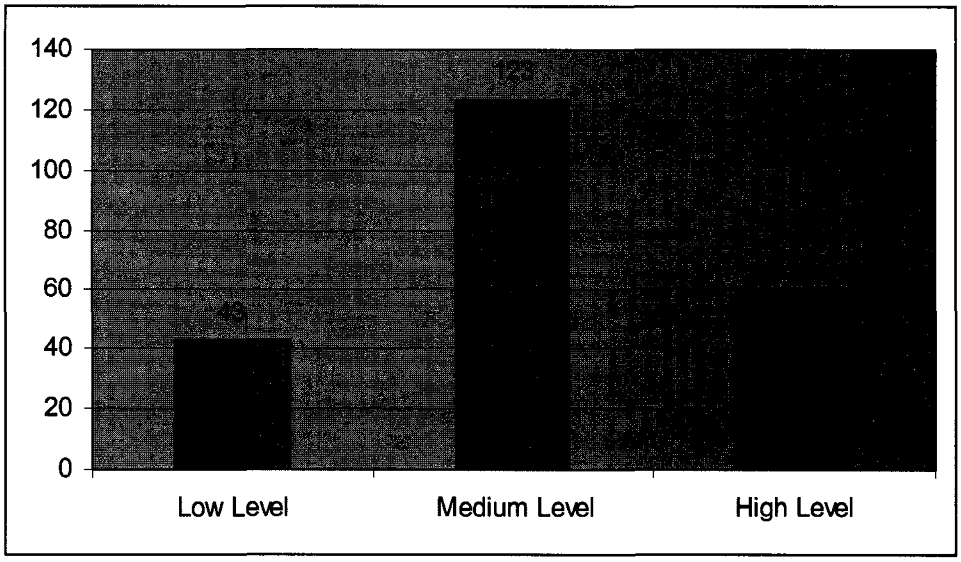

Figure 2.2. Computer competency/information technology (IT) hardware skills (PC & networking).

Computer Competency/Information Technology (IT) software skills (PC & Networking): Figure 2.3 illustrates respondents' computer competency/IT/networking software skills, with 14.2 percent reported low-level skills (i.e., they can use application software like MS-word, PowerPoint, Internet browsers, etc.); 49.1 percent of participants said that they have medium-level skills (i.e., they can write simple programs); and 36.7 percent reported high-level skills (i.e., they are proficient in programming using high-level languages).

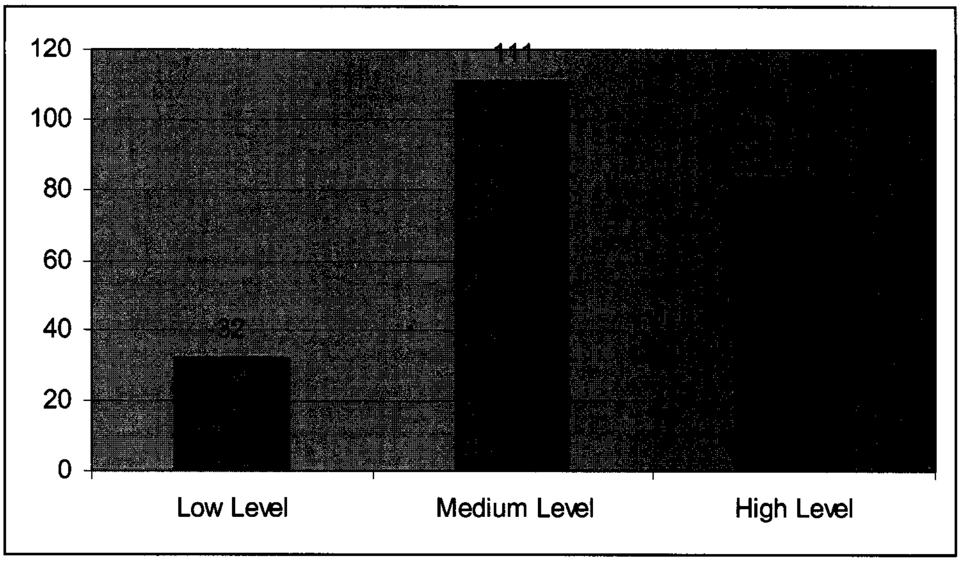

Figure 2.3. Computer competency/Information Technology (IT) software skills (PC & Networking).

Departmental Funds Provided for Professional Development Activities: Figure 2.4 shows the participants' reports of departmental funds for professional development on an annual basis; 17.7% participants reported that no funds were provided for professional development; 20.4% were provided $1 - $200; 20.8% were given $201 - $ 500: 19% were provided $501 - $1000; 16.4% were given $1001 - $1500; and 13% reported that they were granted more than $1500 per year for professional development activities.

Personal Funds used for professional development activities: Figure 2.5 illustrates the participants' use of personal funds for professional development; 18.1% of participants reported that they did not use any personal funds; 27.4% spent $1 - $ 200; 20.8% used $201 - $500; 19% paid $501 - $ 1000; 7.5% spent $1001 - $1500; and 7.1% of participants said that they used more than $1500 of personal funds for professional development.

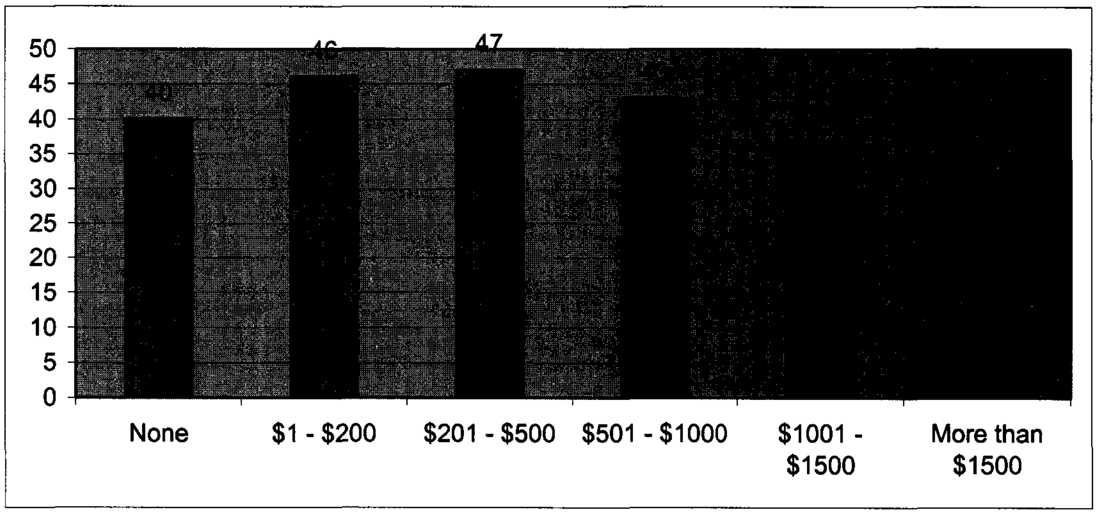

Figure 2.4. Department funds provided for professional development activities.

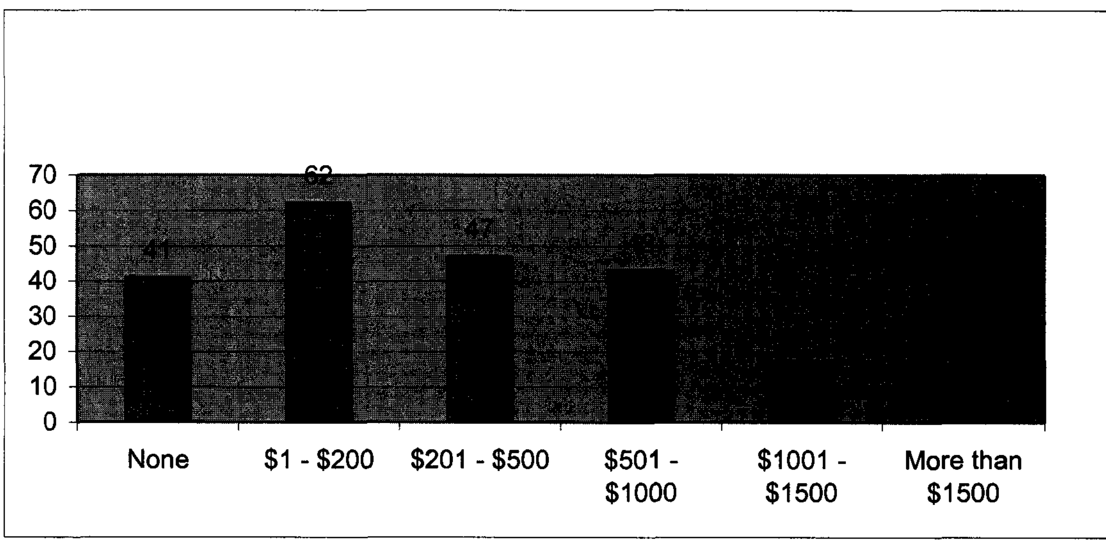

Figure 2.5. Personal Funds used for professional development activities.

Recent Industrial/Consulting Experience: Fifty percent of participants reported more than 5 years of industrial/consulting experience; 15.9% reported 2-4 years experience; 18.6% stated 1-4 years' experience; and 15.5% reported no recent industrial or consulting experience.

Institutional expectations for conducting research/publications: Seventy-one percent of respondents reported that they are not expected to conduct research and do publications; and 29% reported that they are required to do so.

Training in Pedagogy: Out of 226 participants, 52.7% reported that they did receive training in the pedagogy, and 47.3% said that they did not receive such training.

Predictors for Maintaining Faculty Technical Currency: Institutional support and encouragement for maintaining technical currency, and the allocation of funds for professional development are the most significant predictors of faculty technical currency. Table 2.4 lists the Pearson Correlation Coefficients for significant associations for technical currency.

The multiple regression analyses revealed that the multiple correlation coefficient (*R*), using all the predictor variables simultaneously, is 0.486, and the adjusted R square is 0.219 which means that 21.9% of the variance in faculty member maintaining technical currency can be predicted from the 5 independent variables (faculty member's belief that there is a strong relationship between the faculty and student learning, institutional support and encouragement for maintaining technical currency, chairperson's support to plan professional activities to maintain technical currency, institutional allocation of funds for faculty development, and number of years of recent industrial experience/consulting). This finding is statistically significant. The Khan et al study findings can be summarized as follows:

Table 2.4

Pearson Correlation Coefficients for Significant Associations for Technical Currency [Khan et al., 2004]

Independent Variables (Predictor Variable)	I believe that I have maintained technical currency during the past 5 years, enabling me to teach courses effectively (Dependent Variable)	Significance Level (Probability, p)	Effect Size* (According to Cohen [1988])
I believe that there is a strong relationship between the technical currency of the faculty member and student learning/success.	0.21	0.001	Small-medium
My institution supports and encourages faculty members to maintain technical currency.	0.40	< 0.001	Medium-large
My chairperson supports and helps me plan professional development activities to maintain technical currency.	0.21	0.001	Small-medium
My institution has allocated sufficient funds for the professional development activities of faculty during the past 5 years.	0.32	< 0.001	Medium
Number of years of recent industrial experience/consulting	0.20	0.001	Small-medium

**Note: Effect size scale, $r = 0.100 – 0.150$ (small), $r = 0.151 – 0.249$ (small-medium) $r = 0.250 – 0.350$ (medium), $r = 0.351 – 0.449$ (medium-large), $r \geq 0.45$ (large)*

The faculty technical currency survey findings suggest that the majority of the participants believe that:

1. Because of the application orientation of engineering technology programs, technical currency of faculty is essential to make student learning more relevant.
2. There is a strong relationship between faculty technical currency and student learning.
3. The institutional support and encouragement for maintaining technical currency, and allocation of funds for professional development are the most significant predictors of faculty technical currency.
4. There is a need to revise institutional/developmental polices in order to encourage faculty to maintain technical currency.
5. There is a need for the allocation of appropriate funds for professional development activities for faculty.
6. ABET's TC2k accreditation criteria will not necessarily encourage institutions to (a) revise policies to promote faculty development activities, or (b) allocate adequate financial resources for faculty development activities.

What is the Role/Importance of Faculty Technical Currency in New Internet Economy?

During the past decade, the phenomenal growth of the personal computer (PC) industry has led to emergence of a new form of economy called the "Internet economy," which is rapidly becoming an integral part of the overall U.S. economy. The magnitude of the growth in the Internet economy is evident by the following indicators released by the Center for Electronics Commerce, Graduate School of Business, University of Texas at Austin (Center for Electronics Commerce, http://www.internetindicators.com/overview.html, 2004).

1. The Internet economy now directly supports more than 3 million workers.
2. Employment in the Internet economy companies is growing much faster than in the overall economy.
3. The Internet economy generated an estimated $830 billion in revenues in 2000, a 58 percent increase over 1999. The $830 billion in revenues is a 156 percent increase from 1998, when the Internet accounted for $323 billion in revenues.

Table 2.5 compares the growth of the U.S. economy with the emergence of the Internet economy for 1995 and 1999 (Sapertein & Rouach, 2002)

Table 2.5

Emergence of the New Internet Economy

	1995	1999	Cumulative Annual Growth Rates (CAGR)
United States -Gross Domestic Product (GDP)	$ 6,762 b	$ 7,801 b	3.5%
New Internet Economy	$ 5 b	$ 507 b	213%

Source: Center for Electronics Commerce, Graduate School of Business, University of Texas at Austin

The swift pace of technological change is transforming the global economy into a knowledge-based economy, in which organizations are no longer valued on the basis on their physical assets but rather on the knowledge base of their employees. And in this new knowledge-based economy, the wealth of a nation is determined by its intellectual capital.

The emergence of the Internet economy (knowledge-based economy/digital economy) due to the growth of PC/networking technologies has also led to an increase in enrollment in distance education programs in public and private institutions. The scale of this increase can be gauged by the following facts and figures published by the National Center for Education Statistics in its report titled "*Distance Education at Degree Granting Postsecondary Institutions: 2000-2001*" (NCES 2003):

> Fifty-six percent (2,320) of all 2-year and 4-year degree granting institutions offered distance education courses for any level or audience…Ninety percent of public 2-year and 89 percent of public 4-year institutions offered distance education courses, compared with 16 percent of private 2-year and 40 percent of private 4-year institutions…(Distance education was defined for this study as education or training courses delivered to remote [off-campus] sites via audio, video [live or prerecorded], or computer technologies, including both synchronous [i.e., simultaneous] and asynchronous [i.e., not simultaneous] instruction) (p. iii).
>
> There were an estimated 3,077,000 enrollments in all distance education courses offered by all 2-year and 4-year institutions…Public 2-year institutions had the greatest number of enrollments in distance education courses, with 1,472,000 out of 3,077,000 or 48 percent of the total enrollments in distance education. Public 4-year institutions had 945,000 enrollments (31 percent), and private 4-year institutions had 589,000 enrollments (10 percent of the total) (p. iv)
>
> The Internet and two video technologies were most used as primary modes of instructional delivery for distance education courses during the 12- month 2000-2001 academic year (p. v)

With this mushrooming growth of distance education programs in private and public institutions, faculty technical currency thus becomes a pivotal factor for the design, implementation and delivery of effective online programs that can promote student learning/success.

In his book *The Digital Economy: Promise and Peril in the Age of Networked Intelligence,* Tapscott proposes a dozen themes for this new economy. The first is knowledge. On the requirements of the digital economy and faculty practices, he makes the following observations (Tapscott, 1996):

> The digital economy requires a far-reaching rethinking of education and, more broadly, learning and the relationship (among) working, learning, and daily life as consumer. (p.197)
>
> With tenured professors, teachers threatened by technology, less competition, and teaching traditions dating back centuries, many educational institutions have become mired in the past. (p.201)

In 1996, the National Commission on Teaching and America's Future issued its report titled *What Matters Most: Teaching for America's Future*. The commission drew the conclusion that effective school reform would depend primarily on investments aimed at providing teachers with increased access to the knowledge they need to meet the demands of the profession.

The concept of faculty development deals with helping faculty members improve their competence as teachers and scholars (Elbe & McKeachie, 1985). Furthermore, improving faculty competence is a part of improving overall instructional quality. The efforts to increase instructional quality depend on faculty development (focus on faculty), instructional development (focus on student, course and curriculum), and organizational development (focus on structure and process) [Diamond 2002].

Faculty in purely teaching institutions (non-research environment), especially those teaching in technology-based and career-oriented programs, generally lag behind the pace of technological change in terms of their professional development activities due to their non-association with research activities. They face two major challenges: how to incorporate and teach new applications of new technologies in the curriculums they teach and how to maintain their professional currency (Khan et al., 2004).

Therefore, in summary, the rapid pace of technological change mandates faculty to remain current in their technical areas of specialization as technology leapfrogs and new domains of technology evolve; they need to become reflective practitioners.

Conclusion

This chapter explored the learning process in terms of current perceptions and principles that pertain to the successful learner and learning process. It also surveyed predictor variables for student success. Furthermore, it discussed traits of effective teaching strategies and the current literature in the areas of faculty development issues, faculty technical currency and its role and importance in the new Internet economy (knowledge-based or innovation based economy).

CHAPTER 3: METHOD

Description of Research Design, Questions, and Variables

Chapters 1 and 2 presented a discussion of the learning process, traits of effective teaching/learning, predictor variables for student learning/success, and the current literature in the area of faculty technical currency. This chapter presents details about the research design in terms of research questions, variables, sampling method, participants, data collection procedure and instrument used. It also discusses the validity and reliability of the instrument and the statistical methods used for data analysis.

The purpose of this research project is to explore the relationship between students' perceptions of the importance of three faculty dimensions – technical currency, teaching techniques, and commitment to student success – and their self-reported learning and success. The research project will answer the following questions:

1. How do students perceive the importance of three faculty dimensions – technical currency, teaching techniques, and commitment to student success, for their learning and success? (Are means high or low?)
2. Are there significant differences between student ratings of their perceptions of the importance of the three constructs of faculty technical currency, faculty teaching techniques, and faculty commitment to student success? (Are there differences among the means of the three constructs?)

3. Are there associations between students' perception of the importance of faculty members' technical currency (in terms of up-to-date technical knowledge of subject matter, computer hardware and software skills, knowledge of new and emerging technologies, publication of technical papers and textbooks, and, participation in technical seminars, workshops and conferences, and professional organization activities) and students' self-reported learning/success (expressed in terms of self-reported technical competency and GPA) as perceived by seniors in the EET program?
4. Are there associations between students' perception of the importance of the faculty teaching techniques (FTT) [in terms of lectures, use of a variety of technological teaching tools, use of PowerPoint, use of a variety of teaching strategies, coordinating lab work with lecture, organization and preparation of class/lab activities, use of group presentations, use of individual lab projects, and providing timely feedback on class/lab projects] and student's self-reported success/learning (expressed in terms of self-reported technical competency and GPA), as perceived by seniors in the EET program?
5. Are there associations between students' perception of the importance of faculty commitment to student success (FCSS) [in terms of dedication to students, high expectations of students, being approachable by students, encouraging student accomplishment, and concern for student success] and student's self-reported success/learning (expressed in terms of self-reported technical competency, and GPA), as perceived by seniors in the EET program?

6. Is there a combination of the factors of faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS), that predict self-reported student learning/success better than one alone, as perceived by seniors in the EET program?

The proposed study used a quantitative paradigm. The associational research approach was used to study the relationship between independent variables and dependent variables. (See Table 3.1 and Figure 3.1.)

Table 3.1

Description of Variables

Variable Type	Variable Description
Independent Variables Student perceptions of the importance of: 1. Faculty Technical currency (FTC) 2. Faculty Teaching Techniques (FTT) 3. Faculty Commitment to Student Success (FCSS)	Faculty technical currency construct is expressed in terms of the following; • Technical competency/technological knowledge/skills in the subject matter (up-to-date technical knowledge) • Computer hardware skills • Computer software skills • Knowledge of new and emerging technologies • Publications of technical papers and textbooks • Participation in technical seminars, workshops & conferences, and professional organization activities. Faculty teaching techniques construct is expressed in terms of following factors: • Lectures • Use of a variety of technological teaching tools • Use of PowerPoint • Use of a variety of teaching strategies • Use of group presentations • Coordinating lab work with theoretical concepts covered in lecture • Organizing and preparing of class and lab activities • Use of individual lab projects • Providing timely feedback on class and lab projects

(table continued)

Table 3.1 (continued)

	Faculty commitment to student success construct is represented by: • Dedication to students • Requiring high expectations • Being approachable • Encouraging student accomplishments • Concern for student success
Dependent Variables Students' perception of their learning / success in terms of: 1. GPA 2. Self-reported technical competency (SRTC1) [Critical Thinking] 3. Self-reported technical competency (SRTC2) [Job Preparation] 4. Self-reported technical competency (SRTC3) [Construction of a Prototype]	Student learning / success measured is terms of: • GPA • Self-reported technical competency (SRTC) [in terms of analytical and critical thinking, knowledge of EET, and design and implementation of a system] • Given a technical challenge, a student can analyze a problem by thinking critically (SRTC1 [Critical Thinking]) • Student has confidence in his/her technical knowledge to be successful as an electronics engineering technology (EET) job (SRTC2) [Job Preparation] • Given a technical problem or specification for a system design, a student can propose a solution by designing the necessary sub-system/circuits and by constructing a prototype of the system (SRTC3) [Construction of a prototype] • Number of job offers • Starting salary offer • Professional /honor society membership

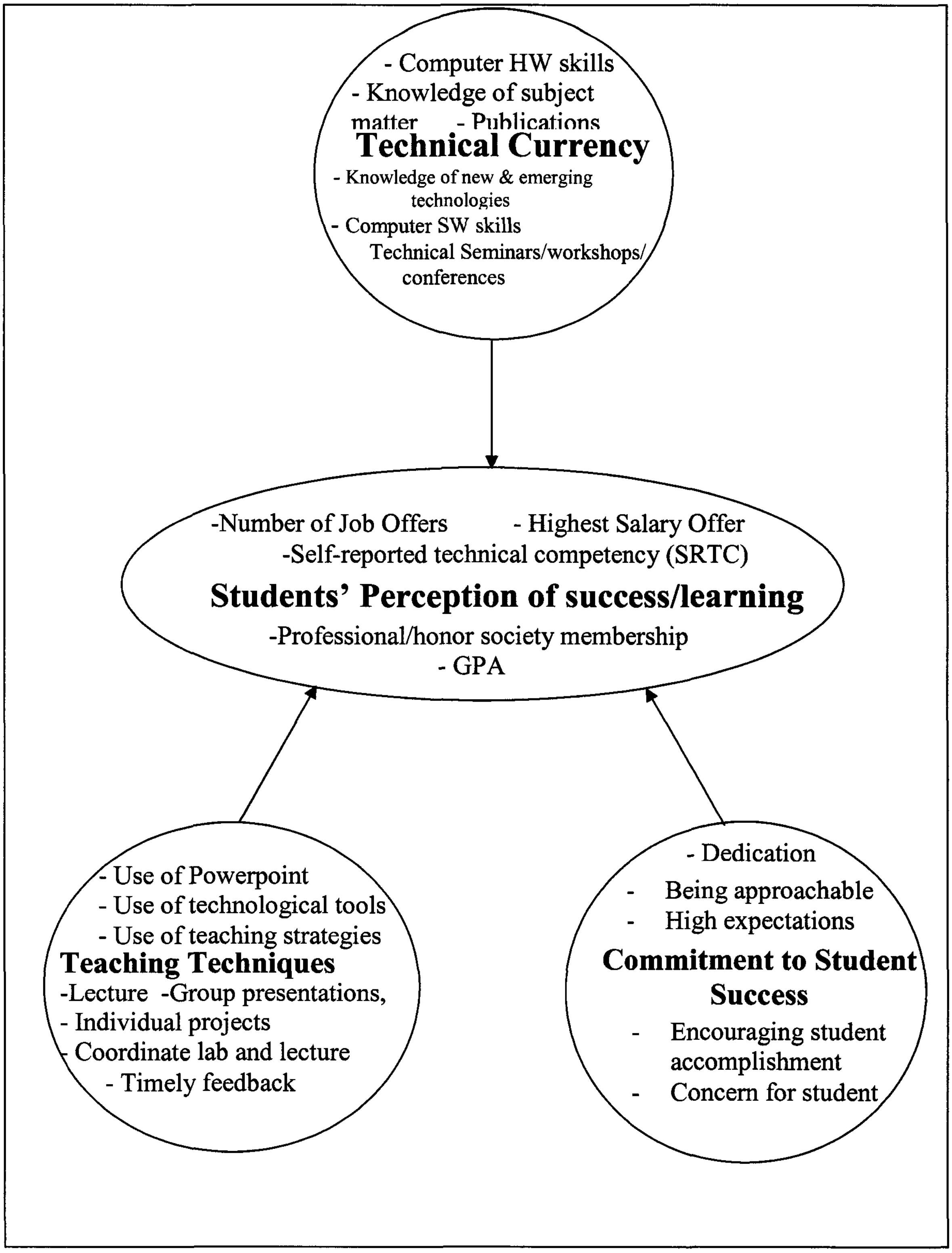

Figure 3.1. Universal set of independent and dependent variables expressed in terms of students' perceptions of the importance of faculty dimensions for their self-reported learning/success.

Description of Sample and Sampling Design

Sampling

Considering the time and cost limitations, a convenience sampling approach was employed. Figure 3.2 illustrates the sampling scheme.

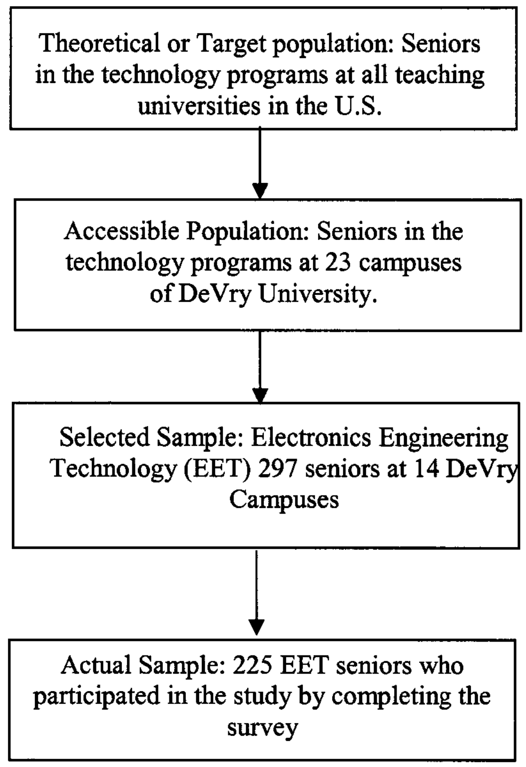

Figure 3.2. Sampling design for student survey.

Participants

Data were collected from seniors belonging to the electronics engineering technology (EET) program at 13 DeVry campuses (Addison, IL; Alpharetta, GA; Chicago, IL; Columbus, OH; Dallas, TX; Decatur, GA; Fremont, CA; Kansas City, MO; Long Beach, CA; Long Island City, NY; Phoenix, AZ; Pomona, CA; and Tinley Park, IL). These campuses were selected for the diversity represented in terms of student population and geography.

Data Collection Procedures

A survey packet was sent to all deans of the EET program at the 13 selected DeVry University campuses. The EET program dean at each campus arranged to conduct this survey in one of the EET technical class sessions during the 12th - 14th week of the Fall 2003 term. The dean selected a Faculty Assistant (FA), a student employee, to conduct the survey. The survey packet contained the following:

1. A cover letter for the survey packet addressed to EET deans (see appendix B).
2. Letter of support from DeVry University (see Appendix C)
3. Instructions for the Faculty Assistant (FA) for conducting the survey (see Appendix D).
4. A cover letter for the student survey, requesting participation and assuring confidentiality (see Appendix E).
5. Survey questionnaire (see Appendix F)

Instrument

The data were collected using a questionnaire. The survey questionnaire allowed the participant to check a box, circle a number or provide a short written response. The instrument used twenty 7-point Likert scales to collect data about student perceptions of their faculty. The questionnaire was designed to seek the following data from the participants:

1. Student's perception about the effect of professors' technical currency, in terms of knowledge of subject matter, on student learning/success.
2. Student's perception about the effect of professors' technical currency, in terms of computer hardware skills, on student learning/success.

3. Student's perception about the effect of professors' technical currency, in terms of computer software skills, on student learning/success.
4. Student's perception about the effect of professors' technical currency, in terms of being current in new and emerging technologies, on student learning/success.
5. Student's perception about the effect of professors' technical currency, in terms of technical publication of papers and text books, on student learning/success.
6. Student's perception about the effect of professors' technical currency, in term of participation in the technical seminars, workshops and conferences, on student learning/success.
7. Student's perception about the effect of professors' lectures on student learning/success.
8. Student's perception about the effect of professors' use of a variety of technological tools (e.g. computer simulation, internet, and videos) on student learning/success.
9. Student's perception about the effect of professors' use of PowerPoint to deliver lectures on student learning/success.
10. Student's perception about the effect of professors' use of a variety of teaching strategies (e.g. individual work, discussions as well as lecture), on student learning/success.
11. Student's perception about the effect of professors' use of group presentations on student learning/success.

12. Student's perception about the effect of professors' coordinating lab work (experiment and projects) with theoretical concepts covered in lecture on student learning/success.
13. Student perception about effect of professors' organization and preparation of class and lab activities on student learning/success.
14. Student's perception about the effect of professors' use of individual lab projects on student learning/success.
15. Student's perception about the effect of professors' timely feedback on class and lab projects on student learning/success.
16. Student's perception about the effect of professors' dedication to their students, on student learning/success.
17. Student's perception about the effect of professors' high expectations on student learning/success.
18. Student's perception about the effect of professors being approachable on student learning/success.
19. Student's perception about the effect of professors' encouragement towards student accomplishments in class and lab on student learning/success.
20. Student's perception about the effect of professor's concern for student success on self-reported student learning/success.
21. Student's self-perceptions about their competency in terms of analytical and critical thinking, knowledge of electronics engineering technology, and design and implementation of a system.
22. Student demographics (gender, age, ethnicity)

23. Student success variables (GPA, number of job offers, starting salary offers, professional/honor association membership)

Response Rate

Figure 3.3 illustrates the response rate for the survey at 13 campuses. The response rate range was 29% - 100% for all campuses, except for West Hills, CA, campus for which the completed surveys were received after the submission deadline and therefore, were not included in the survey results.

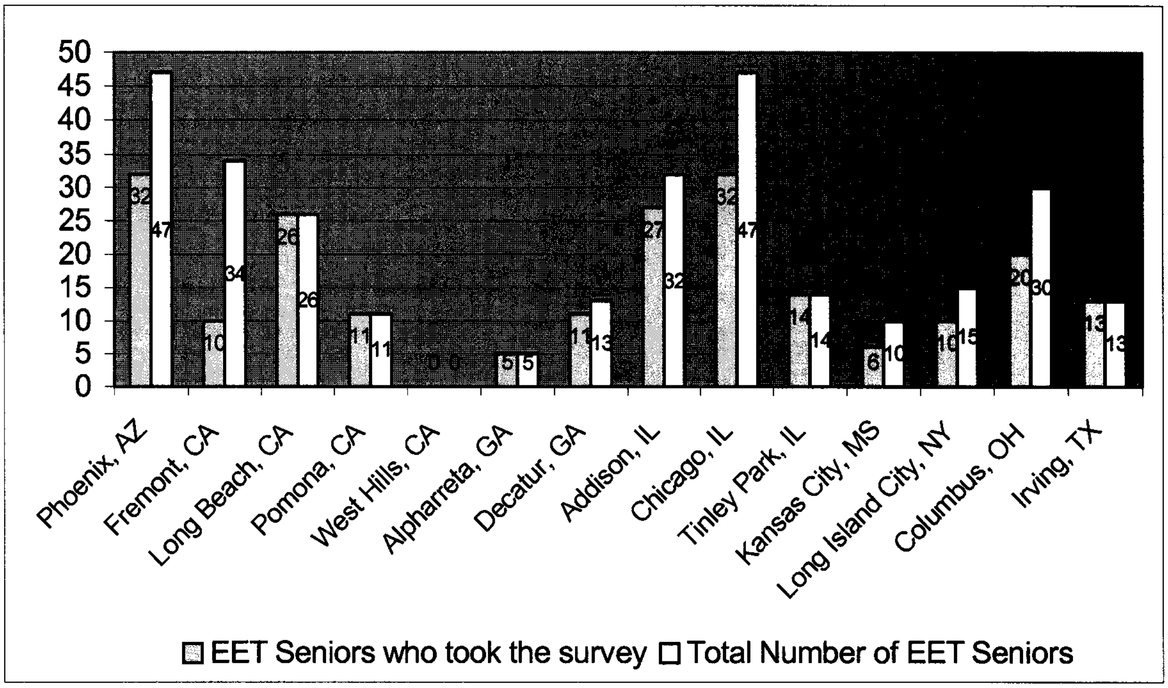

Figure 3.3. Comparison of response rates for 13 campuses.

Sample Profile

Table 3.2 presents a summary of sample profile in terms of average GPA, seniors with job offers, average salary offered, seniors who are currently working, average number of hours worked/week, gender, and average age. Figure 3.4 illustrates the ethnicity/race distribution and figure 3.5 presents seniors' membership in honor/professional organizations.

Table 3. 2

Self-Reported Sample Profile

Characteristic	Data
Average GPA	3.26/4.00
Students who have job offers	16.4%
Average salary offered (range of salary offered)	$36,994 ($25,000 - $65,000)
Students who are working presently	75.6%
Average number of hours worked/week	22.04 hours
Gender	Male: 87.1 Female: 12.9%
Average age (range)	25.65 years (20 – 49 years)

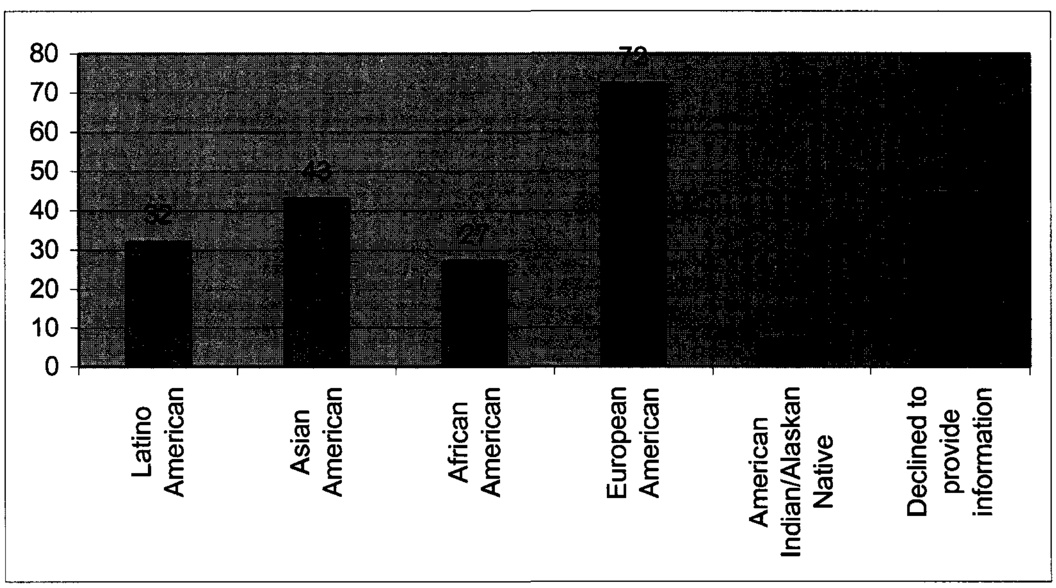

Figure 3.4. Ethnicity/race distribution for the survey participants.

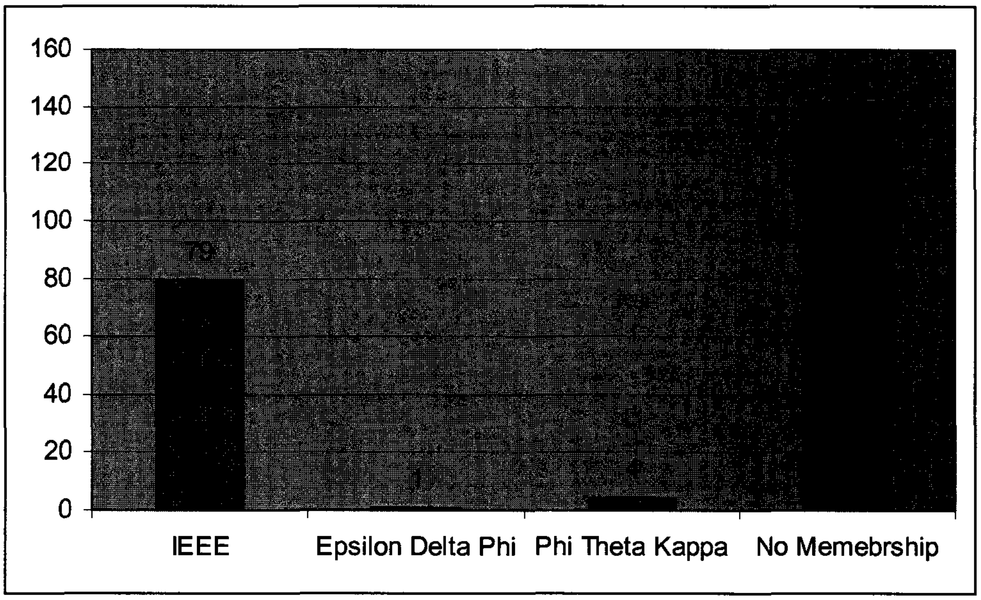

Figure 3.5. Membership in national honor and professional organizations for the survey participants.

Validity and Reliability of Measures

The review of the literature revealed that no survey instrument existed to measure the relationship between the importance of the faculty constructs of technical currency, teaching techniques, and commitment to student success and student learning/success. Therefore, a new survey instrument was developed to measure these faculty constructs. The first version of the instrument had 14 faculty sub-constructs. The content validity of the instrument (the degree to which the survey matches theoretical constructs of measurement for faculty technical currency [FTC], faculty teaching techniques [FTT] and faculty commitment to student success [FCSS]) was established using feedback from the dissertation committee and selected engineering technology (ET) subject experts who are members of American Society of Engineering Education (ASEE)

To measure the internal consistency reliability, a pilot study was conducted at DeVry University, Addison, Illinois; Cronbach's coefficient alpha was calculated for the three faculty constructs ($\alpha = 0.60, 0.68, 0.78$). Exploratory factor analyses (EFA) were also performed on the collected data to determine how well the sub-constructs are grouped together within a construct. Based on the results of the internal reliability and exploratory factor analyses, to increase the validity and internal reliability, additional sub-constructs were added in the faculty constructs of teaching techniques and commitment to student success. Also three additional dependent variables (three self-reported technical competency, SRTC, ratings) were added in the student success construct. Then a second pilot study was conducted, again at the DeVry University, Addison, Illinois, campus; and Cronbach's coefficient alpha was calculated for the three faculty constructs ($\alpha = 0.87, 0.68, 0.52$). Based on the pilot study results, the instrument was modified again to improve the content validity and internal reliability, and was used for data collection in January 2004. Table 3.3 presents the summary of Cronbach's alpha values for the two pilot studies and the actual study.

Statistical Analysis

The study is mostly correlational in nature; there are also descriptive and comparative research questions. In a correlational study, data are collected from a group of participants with an objective to determine the relationship between two sets of data. Creswell (2002) defines a correlation as a statistical test to determine the tendency or relationship for two or more variables (or two sets of data) to vary consistently. The statistic that expresses a correlation statistic as a linear relationship is called the Pearson product-moment correlation coefficient, r.

Table 3.3

Comparison of Cronbach Alphas for Pilot Studies and Actual Study

Construct	Number of Items in the Construct (Pilot Study-I)	Cronbach α for Pilot Study-I (N = 32)	Number of Items in the Construct (Pilot Study-II)	Cronbach α for Pilot Study II (N=22)	Number of Items in the Construct (Actual Study)	Cronbach α for Actual Study (14 campuses) (N=225)
Faculty Technical Currency (FTC)	6	0.60	6	0.87	6	0.85
Faculty Teaching Techniques [FTT]	4	0.68	9	0.68	9	0.84
Faculty Commitment to Student Success [FCSS]	4	0.78	5	0.52	5	0.85
Self-reported Student Technical Competency SSTC)	None	-	3	0.69	3	0.84
[with GPA added]					4	0.73

Multiple linear regression was used to assess the effect of several independent variables (students' perceptions of the importance of faculty technical currency [FTC], faculty teaching techniques [FTT], and faculty commitment to student success [FCSS]) on the dependent variables (Students' self-reported technical competencies [SRTC1-SRTC3, GPA). Creswell defines multiple regression or multiple correlation as a statistical procedure for examining the combined relationship of independent variables with a single dependent variable. In regression, the variation in the dependent variable is explained by or predicted from the variance of each independent variable, as well as the combined effect of all independent variables, designated by R^2.

The statistical software package, SPSS, was employed to analyze the data collected from the respondents of the survey. Table 3. 4 presents a summary of statistical methods used for the research questions.

Table 3.4

Summary of Statistical Methods Used for the Research Questions

	Nature of Relationship	Type of statistical method used
Research Question 1	Explores students' perceptions of the importance of three faculty dimensions --- technical currency, teaching techniques, and commitment to student success --- on their learning, and compares the means of the three constructs.	Descriptive statistics used to calculate means and standard deviations of the three constructs.
Research Question 2	Compares the means of the three faculty constructs of technical currency, teaching techniques, and commitment to students, to determine significant differences in student perceptions of the importance of these faculty constructs.	Repeated measures ANOVA, with Greenhouse-Geisser correction, was conducted to explore the differences in the means. Paired sample t-tests were performed to explore the source of differences.
Research Question 3	Explores the association between students' perception of the importance of faculty members' technical currency (in terms of up-to-date technical knowledge of subject matter, computer hardware and software skills, knowledge of new and emerging technologies, publication of technical papers and textbooks, and, participation in technical seminars, workshops and conferences, and professional organization activities) and student perceptions of self-reported learning/success (expressed in terms of self-reported technical competency and GPA)	Pearson correlation coefficients (regression analyses) were calculated.
Research Question 4	Explores the association between students' perception of the importance of faculty teaching techniques (FTT) [in terms of lectures, use of a variety of technological teaching tools, use of PowerPoint, use of a variety of teaching strategies, coordinating lab work with lecture, organization and preparation of class/lab activities, use of group presentations, use of individual lab projects, and providing timely feedback on class/lab projects] and students' perceptions of self-reported success/learning expressed in terms of self-reported technical competency, and GPA.	Pearson correlation coefficients (regression analyses) were calculated.

(table continued)

Table 3.4 (continued)

Research Question 5	Explores the association between students' perception of the importance of faculty members' commitment to student success (FCSS) [in terms of dedication to students, high expectations of students, being approachable by students, encouraging student accomplishment, and concern for student success] and students' perceptions of student learning/success expressed in terms of self-reported technical competency, and GPA	Pearson correlation coefficients (regression analyses) were calculated.
Research Question 6	Explores the inter-correlations between the students' perception of the importance of faculty dimensions of technical currency, teaching techniques, and commitment to student success, and students' self-reported learning/success.	Multiple linear regression analyses were performed to determine inter-correlations.

CHAPTER 4: FINDINGS

Overview

The previous chapter presented a discussion about the research design and measures, description of variables, sample, sampling design and participants, and methods of data collection and procedures used for the analyses of data.

This chapter presents the results of data analyses applicable to research questions. The focus of the study was to explore the relationships between three faculty dimensions (three independent variables) of technical currency, teaching techniques, and commitment to student success, with four student dimensions (four dependent variables) of student learning/success expressed in terms of self reported technical competencies and GPA.

Description of Technical Currency, Teaching Techniques, and Commitment to Student Success

Question 1: How do students perceive the importance of three faculty dimensions – technical currency, teaching techniques, and commitment to student success, for their learning and success? (Are the means high or low?)

Faculty Technical Currency (FTC)

The main area of the inquiry in this research question dealt with exploring the students' perceptions about the importance of faculty technical currency for their self-reported learning/success. Descriptive statistics were performed using the SPSS software to characterize the students' perceptions. Table 4.1 presents the summary of students' perceptions of the importance of faculty technical currency to their learning/success. Out of 225 respondents, 85 percent or more agreed that faculty's up-to-date technical knowledge, computer hardware and software skills, and knowledge of new and emerging technologies, are important to their learning and success. And, for the importance of publications/technical papers/textbooks and participation in technical seminars/professional societies activities in student learning/success, more than 50 percent of EET seniors agreed.

Table 4.1

Students' Perceptions of the Importance of Faculty Technical Currency (FTC) to Student Learning/Success (N=225)

Technical Currency Sub-construct	Agree	No Opinion	Disagree	Mean	Standard Deviation
Up-to-date technical knowledge	91.40%	4.00%	4.60%	5.90	1.16
Computer hardware skills	87.40%	7.60%	6.00%	5.62	1.30
Computer software skills	84.50%	7.40%	8.10%	5.49	1.36
Knowledge of new and emerging technologies	85.70%	7.60%	6.70%	5.58	1.28
Publications/ technical papers/textbooks	51.10%	25.80%	23.10%	4.44	1.66
Participation in technical seminars /professional societies activities	57.40%	24.90%	17.70%	4.75	1.48
Average				5.30	1.37

Faculty Teaching Techniques (FTT)

Table 4.2 presents the summary of students' perceptions of the importance of the faculty teaching techniques to their learning/success. More than 90 percent agreed that professor's lectures, coordinating lab with lecture, and organization and preparation for class and lab activities, are important for their learning and success. About half of the respondents considered use of group presentations important for their

Table 4.2

Students' Perceptions of the Importance of the Faculty Teaching Techniques (FTT) to Student Learning/Success (N=225)

Teaching Style Sub-construct	Agree	No Opinion	Disagree	Mean	Standard Deviation
Professors' lectures	90.0%	7.0%	3.0%	5.90	1.12
Use of a variety of teaching tools	85.7%	6.7%	7.6%	5.63	1.29
Use of PowerPoint	32.1%	25.3%	42.6%	3.60	1.68
Use of a variety of teaching strategies	87.5%	6.7%	5.8%	5.63	1.23
Use of group presentations	49.7%	25%	25.3%	4.39	1.55
Coordinating lab with lecture	91.9%	3.6%	4.5%	6.10	1.16
Organization and preparation for class and lab activities	91.2%	4.4%	4.4%	5.99	1.15
Use of Individual projects	79.9%	11.6%	8.5%	5.43	1.35
Timely feedback	83.1%	9.8%	7.1%	5.62	1.26
Average				5.36	1.31

learning/success, but 42.5 percent disagreed with the importance of the use of PowerPoint for their learning and success. Seventy-nine percent or more EET seniors agreed that use of a variety of teaching strategies, and use of individual projects are important for their learning/success.

Faculty Commitment to Student Success (FCSS)

Table 4.3 presents the summary of students' perceptions of the importance of faculty commitment to student success (FCSS) [in terms of dedication to students, high expectations, being approachable, encouragement towards accomplishments, and concern for student success] to their learning and success. Out of 225 respondents, about 80 percent agreed that the faculty commitment dimensions of dedication to students,

Table 4.3

Students' Perceptions of the Importance of the Faculty Commitment to Student Success (FCSS) to Student Learning/Success (N=225)

Faculty Involvement	Agree	No Opinion	Disagree	Mean	Standard Deviation
Dedication to students	86.6%	7.6%	5.8%	5.71	1.31
Professor's high expectations	76.5%	12.4%	11.1%	5.29	1.31
Professor being approachable	84.1%	9.3%	6.6%	5.83	1.28
Professor's encouragement towards accomplishments	83.6%	8.4%	8.0%	5.62	1.24
Professor's concern for student success	79.0%	12.9%	8.1%	5.44	1.41
Average				5.58	1.31

being approachable and providing encouragement towards student accomplishment are important to their success and learning. And more than 75 percent of seniors agreed that professor's high expectations and concern for student success are important for their learning/success.

Differences Between the Three Faculty Constructs

Question 2: Are there significant differences between student ratings of their perceptions of the importance of the three constructs of faculty technical currency, faculty teaching techniques, and faculty commitment to student success? (Is there difference between the means of the three constructs?)

Table 4.4 lists the means of three constructs and Figure 4.1 illustrates the comparison of three means.

Table 4.4

Means for Three Constructs: Students' Perceptions of the Importance of Faculty Technical Currency, Faculty Teaching Techniques, and Faculty Commitment to Student Success

Construct	Mean	Standard Deviation
Faculty Technical Currency (FTC)	5.30	1.37
Faculty Teaching Techniques (FTT)	5.36	1.31
Faculty Commitment to Student Success (FCSS)	5.58	1.30

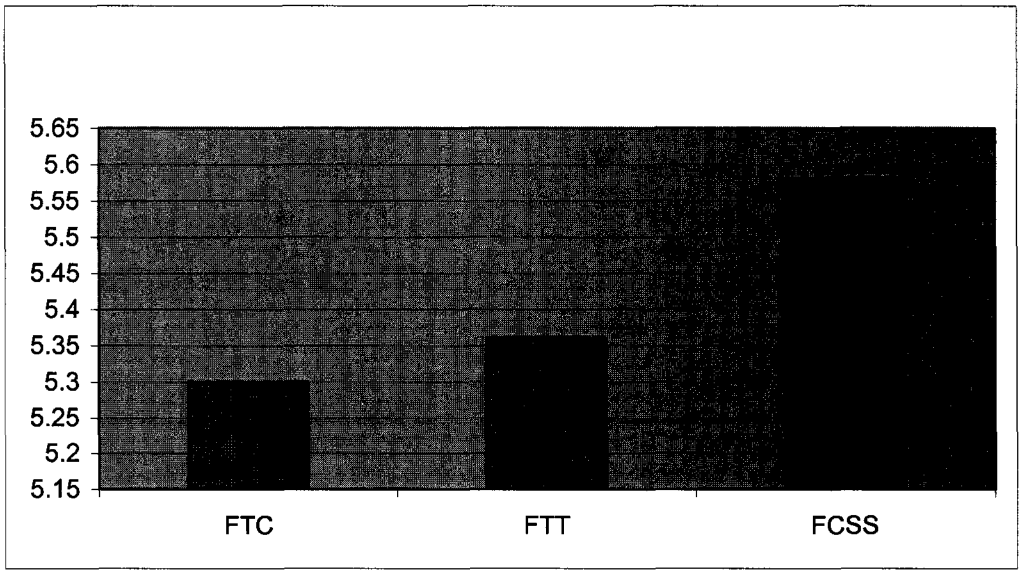

Figure 4.1. Bar chart for means of three constructs: faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS).

A repeated measures ANOVA, with Greenhouse-Geisser correction, was conducted to determine whether there were differences between the means of the three constructs of faculty technical currency, faculty teaching techniques, and faculty commitment to student success. Results indicate that there are differences among the means of the three constructs, $F\ (1.8, 5.7) = 9.80, p < 0.001, \eta = 0.20$

To determine the source of the differences, paired sample t-tests were conducted to compare each pair of the three constructs. The results indicates that:

1. There was no significant difference between the faculty technical currency (FTC), and faculty teaching techniques (FTT), $t\ (224) = -\ 1.14, p = .257, d =$ 0.08. This indicates an insignificant effect size.
2. There was a significant difference between the faculty technical currency (FTC) and faculty commitment to student success (FCSS), $t\ (224) = -\ 3.62, p < .001, d = 0.24$. Commitment to student success was rated by students as

more important than the technical currency and there is a small effect size, according to Cohen (1988).

3. There was a significant difference between the faculty teaching techniques (FTT) and faculty commitment to student success (FCSS), t (224) = - 3.43, p = .001, d = 0.23. Commitment to student success was rated by students as more important than the teaching techniques and there is a small effect size.

Association Between Students' Perceptions of the Importance of Faculty Technical Currency (FTC) and Student Self-reported Learning/Success

Question 3: Are there associations between students' perceptions of the importance of faculty members' technical currency (in terms of up-to-date technical knowledge of subject matter, computer hardware and software skills, knowledge of new and emerging technologies, publication of technical papers and textbooks, and, participation in technical seminars, workshops and conferences, and professional organization activities) and student's self-reported learning/success (expressed in terms of self-reported technical competency and GPA) as perceived by seniors in the EET program?

Table 4.5 presents a correlational matrix relating the components of the technical currency construct and students' self-reported learning/success expressed in terms of self-reported technical competency, and GPA.

Table 4.5

Pearson Correlation Coefficients for the Relationship Between Students' Perceptions of the Importance of Faculty Technical Currency and Students' Perceptions of Learning/Success Expressed in Terms of Their Self-reported Technical Competency and GPA (N = 225)

	Self-reported technical competency (SRTC1) [Critical Thinking]	Self-reported technical competency (SRTC2) [Job Preparation]	Self-reported technical competency (SRTC3) [Construction of a Prototype]	Summated SRTC	GPA
Up-to-date technical knowledge (FTC1)	0.19**(sm)	0.21**(sm)	0.28***(m)	0.27***(m)	- 0.01
Computer hardware skills (FTC2)	0.25***(m)	0.13*(s)	0.19**(sm)	0.21**(sm)	- 0.01
Computer software skills (FTC3)	0.24***(sm)	0.23***(sm)	0.31***(m)	0.30***(m)	- 0.03
Knowledge of new and emerging technologies (FTC4)	0.19**(sm)	0.11*(s)	0.19**(sm)	0.19***(sm)	- 0.07
Publications/technical papers/text books (FTC5)	0.22 **(sm)	0.20**(sm)	0.25***(m)	0.25***(m)	- 0.21**(sm)
Participation in technical seminars / professional societies activities (FTC6)	0.24***(sm)	0.12*(s)	0.13*(s)	0.18**(sm)	- 0.10*(s)
Summated FTC construct	0.29***(m)	0.22**(sm)	0.29***(m)	0.30***(m)	- 0.12*(s)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Note: Effect size scale, small (s) = 0.1 – 0.15, small-medium (sm) = 0.151 – 0.249, medium (m) = 0.25 – 0.35, medium-large (ml) = 0.351 – 0.449, large (l) ≥0.45
SRTC1: Given a technical challenge, a student can analyze a problem by thinking critically
SRTC2: Student has confidence in his/her technical knowledge to be successful as an electronics engineering technology (EET) job
SRTC3: Given a technical problem or specification for a system design, a student can propose a solution by designing the necessary sub-system/circuits and by constructing a prototype of the system

For the relationships between faculty technical currency and the first indicator of student learning/success (students' self-reported technical competency variable, SRTC1

Critical thinking]), all Pearson coefficient (r) values are statistically significant and positive (direct relationship) but show small-to-medium effect sizes ($r = .19 – .25$) according to Cohen (1988), except for the "summated FTC construct" where the correlation coefficient value (.29) reveals a medium effect size.

For the relationship between faculty technical currency and the second indicator of student learning/success (students' self-reported technical competency variable, SRTC2 [Job preparation]), Pearson coefficient values are significant and positive (direct relationship) but mostly indicate small effect sizes ($r = .11 – .23$).

For the relationship between faculty technical currency and the third indicator of student learning/success (students' self-reported technical competency variable, SRTC3 [Construction of a prototype]), all correlation coefficient values are also significant and positive but fall in the small effect size range, except for computer software skills, and the summated faculty technical currency (FTC) where the values (.31 & .29) are in the medium effect size range ($r = .25 - .35$).

For relationships between summated self-reported technical competency (SRTC) and up-to-date technical knowledge, computer software skills, and summated technical currency, the correlation coefficients exhibit a medium effect size. For relationships between summated self-reported technical competency (SRTC) and computer hardware skills, knowledge of new and emerging technologies, and participation in technical seminars/professional societies activities, the effect sizes are in small-to-medium range.

For the relationship between faculty technical currency and the fourth indicator of student learning and success, GPA, most Pearson coefficient (r) values are negative (inverse relationship) but are not significant, except for the relationship between faculty publications and student GPA, for which the effect size falls in the small-to-medium range ($r = -.21$). This indicates that students perceive that faculty technical currency, in terms of publications, is inversely related to their learning/success measured in terms of GPA. The students who rated faculty publications as an important factor for their learning/success had relatively low GPAs and vice versa.

Likewise, there is an inverse relationship between the summated faculty technical currency (FTC) and GPA, and the effect size is small. This indicates that students perceive that faculty technical currency, in general, is inversely related to their learning/success measured in terms of GPA. The students who rated faculty technical currency as an important factor for their learning/success had relatively low GPAs and vice versa.

Association Between Students' Perceptions of the Importance of Faculty Teaching Techniques (FTT) and Self-reported Learning/Success and GPA

Question 4: Are there associations between students' perceptions of the importance of the faculty teaching techniques (FTT) [in terms of lectures, use of a variety of technological teaching tools, use of PowerPoint, use of a variety of teaching strategies, coordinating lab work with lecture, organization and preparation of class/lab activities, use of group presentations, use of individual lab projects, and providing timely feedback on class/lab projects] and student's self-reported success/learning (expressed in terms of self-reported technical competency, and GPA), as perceived by seniors in the EET program?

Table 4.6 lists the Pearson correlation coefficients for the relationship between students' perceptions of the importance of faculty teaching techniques (FTT) and

Table 4.6

Pearson Correlation Coefficients for the Relationship Between Students' Perceptions of the Importance of Faculty Teaching Techniques (FTT) and Students' Perceptions of Learning/Success Expressed in Terms of Their Self-reported Technical Competency and GPA (N = 225)

	Self-reported technical competency (SRTC1) [Critical Thinking]	Self-reported technical competency (SRTC2) [Job Preparation]	Self-reported technical competency (SRTC3) [Construction of a Prototype]	Summated SRTC	GPA
Professors' lectures (FTT1)	0.07	0.17**(s)	0.16**(sm)	0.17**(sm)	0.03
Use of a variety of technological teaching tools (FTT2)	0.20**(sm)	0.16**(sm)	0.16**(sm)	0.20**(sm)	-0.13*(s)
Use of PowerPoint (FTT3)	0.14*(s)	0.18**(sm)	0.19**(sm)	0.20**(sm)	-0.07
Use of a variety of teaching strategies (FTT4)	0.20**(sm)	0.22***(sm)	0.26***(m)	0.21***(sm)	0.07
Use of group presentations (FTT5)	0.23***(sm)	0.22***(sm)	0.25***(m)	0.27***(m)	-0.17**(sm)
Coordinating labs with lectures (FTT6)	0.23***(sm)	0.19**(sm)	0.29***(m)	0.27***(m)	0.04
Organization and preparation of class and lab activities (FTT7)	0.22***(sm)	0.23***(sm)	0.23***(sm)	0.26***(m)	-0.02
Use of individual lab projects (FTT8)	0.30***(m)	0.27***(m)	0.34***(m)	0.35***(m)	0.03
Timely Feedback on class and lab projects (FTT9)	0.19**(sm)	0.25***(m)	0.32***(m)	0.29***(m)	0.02
Summated FTT	0.30***(m)	0.32***(m)	0.37***(ml)	0.38***(ml)	-0.07

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Note: Effect size scale, small (s) = 0.1 – 0.15, small-medium (sm) = 0.151 – 0.249, medium (m) = 0.25 – 0.35, medium-large (ml) = 0.351 – 0.449, large (l) ≥0.45

SRTC1: Given a technical challenge, a student can analyze a problem by thinking critically
SRTC2: Student has confidence in his/her technical knowledge to be successful as an electronics engineering technology (EET) job
SRTC3: Given a technical problem or specification for a system design, a student can propose a solution by designing the necessary sub-system/circuits and by constructing a prototype of the system

students' perceptions of learning/success expressed in terms of their self-reported technical competency and GPA.

For the relationship between faculty teaching techniques and the first indicator of student learning/success (students' self-reported technical competency, SRTC1 [Critical thinking]), Pearson coefficient (r) values are very low except for use of individual lab projects and the summated FTT construct, where the values are close to a medium effect size ($r = .3$).

For the second indicator of student learning/success (students' self-reported technical competency variable, SRTC2 [Job preparation]), Pearson coefficient values are all significant but indicate a small effect size for all teaching approaches, except for "summated FTT," which has a medium effect size.

For the third indicator of student learning/success (students' self-reported technical competency, SRTC3 [Construction of a prototype]), correlation coefficient values are all significant but also fall in the small effect size range, except for use of individual lab projects, timely feedback on lab and class projects, and the summated FTT, where the values fall in the medium effect size range.

The relationships between all FTT sub-constructs and summated self-reported technical competency (SRTC) are all significant but indicate a small effect size, except for use of individual lab projects, and the summated FTT, which exhibit a medium effect size.

Finally, the fourth indicator of student learning and success, GPA, the correlation coefficient values are not statistically significant for all sub-constructs, except for use of a variety of technological tools, and use of group presentations, which are significant, where the magnitude of the effect size is small, and the direction is negative (an inverse relationship). This indicates that students perceive an inverse relationship between faculty's use of a variety of technological tools, and use of group presentations, and, students' learning/success expressed in terms of their GPA.

Again it was surprising to note that the self-reported GPA was not predicted by student learning/success ratings of most of the teaching approaches and two (use of a variety of technological teaching tools, and use of group presentations) were significant, but minimally, negative predictors.

Association Between Students' Perceptions of the Importance of Faculty Commitment to Student Success (FCSS), and Students' Self-reported Learning/Success

Question 5: Are there associations between students' perceptions of the importance of faculty commitment to student success (FCSS) [in terms of dedication to students, high expectations of students, being approachable by students, encouraging student accomplishment, and concern for student success] and student's self-reported success/learning (expressed in terms of self-reported technical competency, and GPA), as perceived by seniors in the EET program?

Table 4.7 lists the Pearson correlation coefficients for the relationship between students' perceptions of the importance of faculty commitment to student success (FCSS) and students' perceptions of learning/success expressed in terms of their self-reported technical competency and GPA.

Table 4.7

Correlation Coefficients for Students' Perceptions of the Importance of Faculty Commitment to Student Success and Students' Self-reported Learning/success and GPA

	Self-reported technical competency (SRTC1) [Critical Thinking]	Self-reported technical competency (SRTC2) [Job Preparation]	Self-reported technical competency (SRTC3) [Construction of a Prototype]	Summated SRTC	GPA
Dedication to students (FCSS1	0.17**(sm)	0.25***(m)	0.20**(sm)	0.24***(sm)	-0.03
High expectations of students (FCSS2	0.27***(m)	0.25***(m)	0.31***(m)	0.32***(m)	0.13*(s)
Approachable by students (FCSS3)	0.18**(sm)	0.15*(s)	0.19**(sm)	0.20**(sm)	0.02
Encouraging student accomplishment (FCSS4)	0.21**(sm)	0.26***(m)	0.27***(m)	0.29***(m)	-0.04
Concern for student success (FCSS5)	0.21**(sm)	0.29***(m)	0.26***(m)	0.30***(m)	-0.06
Summated FCSS	0.26***(m)	0.30***(m)	0.31***(m)	0.34***(m)	0.002

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Note: Effect size scale, small (s) = 0.1 – 0.15, small-medium (sm) = 0.151 – 0.249, medium (m) = 0.25 – 0.35, medium-large (ml) = 0.351 – 0.449, large (l) ≥0.45
SRTC1: Given a technical challenge, a student can analyze a problem by thinking critically
SRTC2: Student has confidence in his/her technical knowledge to be successful as an electronics engineering technology (EET) job
SRTC3: Given a technical problem or specification for a system design, a student can propose a solution by designing the necessary sub-system/circuits and by constructing a prototype of the system

For the relationship between students' perceptions of the importance of faculty commitment to student success, and the first indicator of student learning/success (students' self-reported technical competency, SRTC1 [Critical thinking]), all Pearson coefficient (*r*) values are significant and positive (direct relationship) but show a small to medium effect size according to Cohen.

For the relationship between students' perceptions of the importance of faculty commitment to student success and the second indicator of student learning/success (students' self-reported technical competency variable, SRTC2 [Job preparation]), all Pearson coefficient values are significant and positive (direct relationship) but indicate a small to medium effect size, except for "concern for student success" and "summated FCSS" where the values are in the range of medium effect size ($r = .30$).

For the relationship between students' perceptions of the importance of faculty commitment to student success, and the third indicator of student learning/success (students' self-reported technical competency, SRTC3 [Construction of a prototype]), all correlation coefficient values are also significant and positive. Four sub-constructs (high expectations of students, encouraging student accomplishment, concern for student success, and the summated FCSS) show a medium effect size ($r = .30$), and the rest of the values fall in the range of small to medium effect size. Students perceive that a faculty member's high expectation of students, encouraging student accomplishment, and concern for student success are directly related to their learning/success.

The relationships between summated self-reported technical competency (SRTC) and high expectation of students, encouraging student accomplishment, concern for student success, and summated FCSS, have a medium effect size. Students perceive that faculty members' high expectations, encouraging student accomplishment, and concern for student success contribute to their learning/success as measured by the sum of the three self-reported technical competencies. And the relationships between summated self-reported technical competency (SRTC) and the remaining sub-constructs (dedication to students, and approachable by students) reveal a small to medium effect size.

For the relationship between students' perceptions of the importance of faculty commitment to student success and the fourth indicator of student learning and success, GPA, none of the Pearson coefficient (r) values are significant, except for high expectations of students where the value (r =.13) indicates a small effect size. Students perceive that faculty commitment in terms of high expectations of students is related to student learning/success in terms of student GPA.

Inter-correlations of Students' Perceptions of the Importance of Faculty Technical Currency (FTC), Faculty Teaching techniques (FTT), and Faculty Commitment to Student Success (FCSS) and Their Prediction of Self-reported Student Learning/Success

Question 6: How are the factors of faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS) interrelated, and is there a combination these factors that predicts self-reported student learning/success better than one alone, as perceived by seniors in the EET program?

This research question dealt with exploring the inter-correlations between the students' perceptions of the importance of faculty dimensions of technical currency, teaching techniques, commitment to student success, and students' self-reported learning/success.

Multiple linear regression analyses were performed to explore the association between the three summated independent variables of faculty constructs (technical currency, teaching techniques, commitment to student success) and two dependent variables of student learning/success (summated self-reported technical competency and GPA). Tables 4.8 and 4.9 present a summary of the results using the technical competency rating as the dependent variable. All correlations shown in table 4.8 are highly significant. The correlation of technical currency and commitment to student success has a medium to large effect size. Teaching Techniques is related to the two other faculty dimensions with a large effect size.

The multiple regression analyses revealed that the multiple correlation coefficient (*R*), using all the predictor variables simultaneously, is 0.42, and the adjusted *R* square is 0.166, which means that 16.6% of the variance in student learning/success can be predicted from the three independent variables [faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS)] combined. The R value of 0.42 indicates a medium to large effect size.

The multiple regression Table (4.8) shows that a combination of faculty teaching techniques and commitment to student success (but not faculty technical currency) are both significant when all three are used to predict student success in terms of self-reported technical competencies.

Table 4.8

Pearson Correlations for Faculty Dimensions of Technical Currency, Teaching Techniques, Commitment to Student Success, and, Students' Self-reported Technical Competency

Faculty Dimensions (Independent Variables)	Dependent Variable (Self-reported Tech Competency)	Faculty Technical Currency	Faculty Teaching Techniques	Faculty Commitment to Student Success
Self-reported Tech Competency	1.000			
Faculty Technical Currency	0.30*$^{(m)}$	1.000		
Faculty Teaching Techniques	0.38*$^{(ml)}$	0.61*$^{(l)}$	1.000	
Faculty Commitment to Student Success	0.34*$^{(m)}$	0.37*$^{(ml)}$	0.51*$^{(l)}$	1.000

* $p < 0.001$
Note: Effect size scale, small (s) = 0.1– 0.15, small-medium (sm) = 0.151 – 0.249, medium (m) = 0.25 – 0.35, medium-large (ml) = 0.351 – 0.449, Large (l)> 0.45

Table 4.9

Multiple Regression Using Students' Perceptions of the Importance of Faculty Technical Currency, Faculty Teaching Techniques, and Faculty Commitment to Student Success to Predict the Summated Self-reported Learning/Success

Construct	Standardized β	Significance (p)
Faculty Technical Currency (FTC)	0.10	0.196
Faculty Teaching Techniques (FTT)	0.22	0.009
Faculty Commitment to Student Success (FCSS)	0.19	0.009

The multiple regression analyses for determining the correlations between the independent variables [faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS)] and GPA (dependent variable), revealed that the multiple correlation coefficient (R), using all the predictor variables simultaneously, is .129 and the adjusted R square is 0.003 which means that 0.3% of the variance in student learning/success in terms of GPA can be predicted from the three independent variables. This is statistically not significant.

Summary of Results

Table 4.10 presents a summary of results for students' perceptions of the importance of three faculty constructs for their self-reported learning/success. The highest level of agreement (90 percent or more) is revealed by four faculty sub-constructs: coordinating labs with lectures, up-to-date technical knowledge, organization and preparation for class and lab activities, and professors' lectures. Note that one of the faculty technical currency (FTC) and three of faculty teaching techniques (FTT), but none of the faculty commitment to student success (FCSS) items were among the sub-constructs that 90 percent or more of the students agreed were important for their learning/success.

Table 4.10

Summary of Results: Highest and Lowest Levels of Agreement for Students' Perceptions of the Importance of The Faculty Constructs of Technical Currency, Teaching Techniques, and Commitment to Student Success.

Sub-construct (Construct)	Agree	Mean	Standard Deviation
Highest Level of Agreement (≥90%)			
Coordinating lab with lecture (FTT)	91.9%	6.10	1.16
Up-to-date technical knowledge (FTC)	91.4%	5.90	1.16
Organization and preparation for class and lab activities (FTT)	91.2%	5.99	1.15
Professors' lectures (FTT)	90%	5.90	1.12
Lowest level of Agreement (≤60)			
Participation in technical seminars /professional societies activities (FTC)	57.4%	4.75	1.48
Publications/ technical papers/textbooks (FTC)	51.1%	4.44	1.66
Use of group presentations (FTT)	49.7%	4.39	1.55
Use of PowerPoint (FTT)	32.1%	3.60	1.68

And the lowest level of agreement (60 percent or less) is revealed by the faculty sub-constructs of participation in technical seminars /professional activities, publications/ technical papers/textbooks, use of group presentations, and use of PowerPoint. It is a very interesting to note that out of 20 faculty sub-constructs, "how PowerPoint is used by the faculty", had the lowest level of agreement. This is especially surprising when one considers how often PowerPoint is used in academia for onsite and online (web based or web supported) classes whether for synchronous or asynchronous delivery modes.

Table 4.11 presents a summary of strongest relationships ($r \geq 30$) between students' perceptions of the importance of faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS) and students' perceptions of learning/success expressed in terms of their self-reported technical competency (SRTC). The first dependent variable, critical thinking (STRC1) has two relationships of $r \geq .30$ with the independent variables: use of individual lab project of the summated faculty teaching techniques. The second dependent variable, job preparation (SRTC2), also has two relationships of $r \geq .30$ with the independent variables: summated faculty teaching techniques, and summated faculty commitment to student success. The third dependent variable, construction of a prototype (SRTC3) has six relationships of $r \geq .30$ with the independent variables: computer software skills, use of individual lab projects, timely feedback on class and lab projects, summated faculty teaching techniques, high expectation of students, and summated faculty commitment to student success. And, the fourth dependent variable, summated self reported technical competency (SRTC), which is the sum of critical thinking, job preparation and construction of a prototype, has seven relationships of $r \geq .30$ with the independent variables, two with faculty technical currency constructs, two with faculty teaching techniques constructs, and three with faculty commitment to student success constructs. Only 1 relationship, out of 92 possible relationships between four dependent variables and 23 independent variables, was not statistically significant.

Table 4.11

Summary of Results: Pearson Correlation Coefficients for the Relationship Between Students' Perceptions of the Importance of Faculty Technical Currency (FTC), Faculty Teaching Techniques (FTT), and Faculty Commitment to Student Success (FCSS) and Students' Perceptions of Learning/Success Expressed in Terms of Their Self-reported Technical Competency (N = 225)

Faculty Sub-Construct (Construct)	Self-reported technical competency (SRTC1) [Critical Thinking]	Self-reported technical competency (SRTC2) [Job Preparation]	Self-reported technical competency (SRTC3) [Construction of a Prototype]	Summated SRTC
Statistically Most Significant Relationships (r ≥.30)				
Computer software skills (FTC)	-	-	0.31	0.30
Summated FTC construct	-	-	-	0.30
Use of individual lab projects (FTT)	0.30	-	0.34	0.35
Timely Feedback on class and lab projects (FTT)	-	-	0.32	-
Summated FTT	0.30	0.32	0.37	0.38
High expectations of students (FCSS)	-	-	0.31	0.32
Concern for student success (FCSS)	-	-	-	0.30
Summated FCSS	-	0.30	0.31	0.34
Total (No. of Statistically Significant Relationship)	2	2	6	7

Note: For all listed correlations $p < 0.001$ and the effect size is medium
SRTC1: Given a technical challenge, a student can analyze a problem by thinking critically
SRTC2: Student has confidence in his/her technical knowledge to be successful at an electronics engineering technology (EET) job
SRTC3: Given a technical problem or specification for a system design, a student can propose a solution by designing the necessary sub-system/circuits and by constructing a prototype of the system

Table 4.12 lists the Pearson correlation coefficients for the two highest relationships between the students' perceptions of the importance of the faculty dimensions of technical currency, teaching techniques, and commitment to student success and students' perception of learning/success expressed in terms of GPA. Out of 23 possible relationships between the dependent variable, GPA, and the 23 independent variables, only two relationships can be classified as having an effect size of at least

Table 4.12

Summary of Results: Pearson Correlation Coefficients for the Relationship Between Students' Perceptions of the Importance of Faculty Technical Currency (FTC), Faculty Teaching techniques (FTT), and Faculty Commitment to Student Success (FCSS) and Students' Perceptions of Learning/Success Expressed in Terms of Their Self-reported GPA (N = 225)

Faculty Sub-Construct (Construct)	GPA
Significant Relationships	
Publications/technical papers/text books (FTC)	- 0.21
Use of group presentations (FTT)	-0.17

Note: Both correlations are statistically significant at $p < .01$, and the effect size is small-to-medium

small to medium ($r \geq .151$). The first relationship is between faculty publications/technical papers/text books (FTC) and student learning/success in terms of GPA. For this relationship, the negative sign indicates that it is an inverse relationship; i.e., this indicates that students perceive that faculty technical currency in terms of publications is inversely related to their learning/success. This also suggests that students who rated faculty publications as important for their learning/success, had relatively low GPAs and vice versa. The second relationship is between faculty use of group presentations (FTT) and student learning/success in terms of GPA. In this relationship, the Pearson correlation coefficient's direction is negative, which suggests again an inverse relationship. The EET seniors who considered faculty use of group presentations as an important factor for their learning/success had lower GPAs and vice versa. In summary, based on the data, it can be concluded that, the student self-reported GPA was not a strong predictor of student success, as it failed to show any associations with self-reported student learning/success that had even a medium effect size. Six relationships out of 23 are statistically significant. Five out of these six are negative and only one is positive.

CHAPTER 5: DISCUSSION

Overview

The previous chapter presented the results of the data analyses. This chapter presents a discussion of the research questions based on the results/data interpretation, limitations of the study, recommendations and implications for practice, and recommendations for future research.

The purpose of the study was to explore the relationship between students' perceptions of the importance of the faculty constructs of technical currency, teaching techniques, and commitment to student success, and students' self-reported learning/success, expressed in terms of self-reported technical competency and GPA.

The available literature has provided little information regarding the impact of students' perceptions of the importance of faculty technical currency, teaching techniques, and commitment to student success, on students' perceptions of their learning and success in the domains of higher education in general and at technology-based baccalaureate programs in specific. During the last three decades, technological change has transformed the global economy into a knowledge-based or innovation-based economy, in which organizations are no longer valued on the basis on their physical assets but rather on the knowledge base of their employees (Khan et al, 2004). In this day and age, a knowledge-based and innovation-based economy is playing a pivotal role in the development of nations around the globe. For nations to acquire or to maintain the technological edge, the technical competency of graduates has become of paramount importance. Rapid technological growth puts new demands on educators. The global marketplace seeks manpower with an up-to-date technical knowledge base. The pace of technological change also imposes new challenges for faculty development and the technical currency of academic programs. Faculty professional development activities and technical currency play an important role in promoting student learning and success.

This study was an attempt to identify the key predictor variables for student learning/success in terms of faculty dimensions of technical currency, teaching techniques, and commitment to student success.

The study investigated seniors, through a survey, in the B.S.E.E.T program for the Fall 2003 term at 13 DeVry University campuses spread all over the country. These campuses were chosen to incorporate diversity of study population and diversity of geographic locations. As reported in chapter 3, the sample size was 225 seniors, and the response rate was in the range of 29% - 100% for all 13 campuses. The survey sought descriptive information about the student perceptions about the importance of several faculty characteristics for their learning.

The survey instrument (Appendix F) sought descriptive information about the students' perceptions of the importance of faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS) for their learning/success expressed in terms of 3 areas of self-reported technical competency and GPA. The survey also asked students to provide information about gender, age, ethnicity, membership in professional/honor societies, and number of hours of work/week (if they were working presently).

Discussion of the Findings

Question 1: How do students perceive the importance of three faculty dimensions – technical currency, teaching techniques, commitment to student success for their learning and success? (Are means high or low?)

In order to investigate the student perceptions of the importance of faculty dimension on their learning/success, descriptive statistical analyses were performed using SPSS software.

Faculty Technical Currency (FTC)

The analyses revealed that EET seniors perceive that the technical currency of faculty is important for their learning and success, as more than 80 percent of 225 EET seniors agreed that up-to-date technical knowledge, computer hardware and computer software skills, and knowledge of new and emerging technologies are important for their learning and success.

These results are significant when looked in light of the faculty technical currency study conducted by Khan et al. (2004). The study reported that more then 95 percent of faculty members surveyed agreed that technical currency of faculty is essential to make student learning more relevant. Further, 78 percent agreed that there exists a strong relationship between technical currency and student learning. The survey also revealed that only 26 percent of faculty members said that they have high-level skills in computer competency /IT/hardware area, and 49 percent reported that they have medium level skills in the software area. So there is a need for faculty to enhance their computer hardware and software skills, as the seniors perceive them to be important for their learning and success.

But only half of the EET seniors agreed that the faculty publications of technical papers and textbooks, and participation in technical seminar/professional societies activities are important to their learning/success. This low rate of agreement compared to other faculty technical constructs may be due to the fact that most students may not be aware of the role and process of publications and attending technical seminars/conferences and participating in the professional organization activities in the overall professional development of the faculty.

Faculty Teaching Techniques (FTT)

The analyses also revealed that the EET seniors consider that faculty teaching techniques is also important for their learning and success. About 80 percent agreed that a faculty pedagogical approach that incorporates use of a variety of teaching tools, use of a variety of teaching strategies, use of individual lab projects and timely feedback is important to their learning and success.

These results support Guskey's (1988) findings that the teaching behavior of effective teachers incorporates providing regular and specific feedback to students about their learning. The results also agree with the recommendations (use of active learning techniques, providing feedback) made by Chickering and Gasmson (1987) for effective undergraduate education.

More than 90 percent of seniors agreed that professor's lectures, coordinating lab with lecture, and organization and preparation for class and lab activities, are important for their learning and success. These results support the findings reported by Guskey regarding the importance of planning and organization. The majority of EET seniors perceive that coordinating lab with lecture is important for their learning. When a faculty member tries to coordinate lab with class, students see the application of technical theory and develop a clear understating of how to implement lab experiments/projects. This result appears to support one of Knowles (1980) fundamental assumptions about instruction for adults: "Adults learn best when the subject content is clear and of immediate importance."

Only half of the respondents considered the use of group presentations important for their learning/success, and 42 percent disagreed with the importance of the use of PowerPoint for their learning and success. It appears that the majority of students perceive the use of PowerPoint as not important for their learning. This may be due to the fact that many faculty members just read their PowerPoint slides, making the presentation a monotonous and passive rather than an interactive exercise. So faculty members need to learn how to make PowerPoint presentations effective and interesting for students.

Out of 225 respondents, about 80 percent agreed that a faculty teaching approach which incorporates the use of a variety of teaching tools, use of a variety of teaching strategies, use of individual lab projects and timely feed back, is important to their learning and success.

These results support Guskey's (1988) findings where he reported that the teaching behavior of effective teachers incorporates planning and organization, student participation, feedback about learning. The results also support the recommendations made by Caine and Caine (1991) that teachers should incorporate a variety of experimental learning strategies in order to promote learning.

The students perceive that faculty teaching techniques is important for their learning/success. The importance of faculty pedagogy is also highlighted by considering the survey results reported by of Khan et al. (2004). Out of 226 faculty members surveyed, teaching in various technology-based programs all over the country, 47.3 percent said that they did not receive any training in the pedagogy. Therefore, there is a need for improving faculty pedagogy.

Faculty Commitment to Student Success (FCSS)

The study revealed that EET seniors perceive that faculty commitment to student success is important for their learning and success. About 80 percent of seniors agreed that the faculty commitment dimensions of dedication to students, being approachable, providing encouragement towards student accomplishment are important to their success and learning. Further, more than 75 percent of seniors agreed that professor's high expectations and concern for student success are important for their learning/success.

These results support Guskey's (1988) findings about the teaching behavior of effective teachers. Guskey found that effective teachers have a positive regard for students and encourage student participation.

Comparison of the Three Faculty Constructs: Technical Currency, Teaching Techniques, and Commitment to Student Success

Question 2: Are there significant differences between student ratings of their perceptions of the importance of the three constructs of faculty technical currency, faculty teaching techniques, and faculty commitment to student success? (Are there differences among the means of the three constructs?)

Results indicate that there are differences in means of the three constructs of faculty technical currency, faculty teaching techniques, and faculty commitment to student success. Paired sample t-tests revealed that: (a) there was no significant difference between the faculty technical currency (FTC), and faculty teaching techniques (FTT); (b) there was a significant difference between the faculty technical currency (FTC) and faculty commitment to student success (FCSS), but the effect size was small; and (c) there was a significant difference between the faculty teaching techniques (FTT) and faculty commitment to student success (FCSS), but again the effect size was small.

Association Between the Students' Perceptions of the Importance of Faculty Technical Currency (FTC) and Self-reported Learning/Success

Question 3: Are there associations between students' perceptions of the importance of faculty members' technical currency (in terms of up-to-date technical knowledge of subject matter, computer hardware and software skills, knowledge of new and emerging technologies, publication of technical papers and textbooks, and, participation in technical seminars, workshops and conferences, and professional organization activities) and student's self-reported learning/success (expressed in terms of self-reported technical competency and GPA) as perceived by seniors in the EET program?

The results indicate that the EET seniors perceive that there is a direct relationship between the faculty technical currency and the first indicator of student learning/success (students' self-reported technical competency variable, SRTC1 [Critical thinking]); all Pearson coefficient (r) values show small-to-medium effect sizes ($r = .19 - .25$), except for the summated FTC construct, where the correlation coefficient value (.29) reveals a medium effect size.

For the relationship between faculty technical currency and the second indicator of student learning/success (students' self-reported technical competency variable, SRTC2 [Job preparation]), Pearson coefficient values are positive (direct relationship) but mostly indicate small to medium effect sizes (r = .11 – .23).

For the relationship between faculty technical currency and the third indicator of student learning/success (students' self-reported technical competency variable, SRTC3 [Construction of a prototype]), all correlation coefficient values are also positive but fall in the small effect size range, except for computer software skills, and summated faculty technical currency (FTC), where the values (.31 & .29) are in the medium effect size range (r = .3).

For relationships between summated self-reported technical competency (SRTC) and computer software skills, and summated technical currency, the correlation coefficients exhibit a medium effect size.

As for the relationship between faculty technical currency and the fourth indicator of student learning and success, GPA, most Pearson coefficient (r) values are negative (inverse relationship) but are not significant, except for the relationship between faculty publications and student GPA, for which effect size falls in the small-to-medium range (r = - .21). This result indicates that students perceive that faculty technical currency, in terms of publications, is inversely related to their learning/success measured in terms of GPA. The students who rated faculty publications as an important factor for their learning/success had low GPAs and vice versa. Likewise there is an inverse relationship between the summated faculty technical currency (FTC) and GPA.

It is surprising to discover that GPA did not seem to be a viable indicator of student success. This result may be due to the fact that the figures used for GPA were self-reported by the students, so there is possibility of these numbers not being accurate and rather inflated, especially by students with lower actual GPAs. The average GPA reported was 3.2.

As there is little information available in the literature about technical currency and its relationship to student learning/success, no comparisons can be made with the literature. However the results reveal that the EET seniors perceive that each sub-construct of faculty technical currency (in terms of in terms of up-to-date technical knowledge of subject matter, computer hardware and software skills, knowledge of new and emerging technologies, publication of technical papers and textbooks, and, participation in technical seminars, workshops and conferences, and professional organization activities) is important for their learning/success, though effect size varies from small to medium for the sub-constructs. The association between summated faculty technical currency (FTC) and summated student self-reported technical competency is significant and effect size is medium ($r = .30$). This result suggests that students are aware of the pace of technological change and they perceive that faculty who are technically current have more influence on their learning and success.

Association Between the Students' Perceptions of the Importance of Faculty Teaching Techniques (FTT) and Self-reported Learning/Success

Question 4: Ares there associations between students' perceptions of the importance of the faculty teaching techniques (FTT) [in terms of lectures, use of a variety of technological teaching tools, use of PowerPoint, use of a variety of teaching strategies, coordinating lab work with lecture, organization and preparation of class/lab activities, use of group presentations, use of individual lab projects, and providing timely feedback on class/lab projects] and student's self-reported success/learning (expressed in terms of self-reported technical competency, and GPA), as perceived by seniors in the EET program?

The Pearson correlational coefficients for the relationship between faculty teaching techniques and students' perceptions of learning/success expressed in terms of their self-reported technical competency revealed small to medium effect sizes. The following relationships between the FTT sub-constructs and students' self-reported technical competency reveal significant associations of $r \geq .30$, which are medium sized effects according to Cohen (1988).

1. Use of lab projects and summated FTT are related to self-reported technical competency (SRTC1 [Critical thinking]).
2. Summated FTT are related to self-reported technical competency (SRTC2 [Job preparation]).
3. Use of individual lab projects and timely feedback on lab and class projects, and summated FTT are related to self-reported technical competency (SRTC3 [Construction of a prototype]).
4. Use of individual lab projects and summated FTT are related to summated self-reported technical competency (SRTC).

The results suggest that students perceive that the use of individual lab projects, has a significant impact on student learning/success. Designing and implementing a lab project is an example of active learning. This finding supports one of Chickering and Gamson's (1987) principles of effective undergraduate learning, which states, "Effective teaching uses active learning techniques." A lab project is an example of active learning, brain-compatible or constructivist learning, thus involving an application of different levels of Bloom's taxonomy.

The results also indicate that students perceive that professors' timely feedback on lab and class projects is important for their learning/success. This finding supports the results of Guskey's (1988) study that providing feedback to students about their learning promotes learning.

Again it was surprising to note that the fourth predictor of student learning/success, GPA was not a viable predictor of student learning/success. For GPA, the correlation coefficient values are very small for all sub-constructs, except for use of a variety of technological tools and use of group presentations, where the magnitude of the effect size is small and the direction is negative (an inverse relationship). Thus, students perceive that there exists an inverse relationship between faculty's use of a variety of technological tools, and use of group presentations, and, students' learning/success expressed in terms of their GPA. Students in the technology domain rely mainly on professors' lectures and labs as the main modes of learning and any attempt by professors to use computer simulations, internet and videos may be perceived by some students as waste of time rather than learning.

Association Between the Students' Perception of the Importance of Faculty Commitment to Student Success (FCSS) and Self-reported Learning/Success

Question 5: Ares there associations between students' perception of the importance of faculty commitment to student success (FCSS) [in terms of dedication to students, high expectations of students, being approachable by students, encouraging student accomplishment, and concern for student success] and student's self-reported success/learning (expressed in terms of self-reported technical competency and GPA), as perceived by seniors in the EET program?

The Pearson correlation coefficients for the relationship between faculty commitment to student success (FCSS) and students' perceptions of learning/success expressed in terms of their self-reported technical competency (SRTC) revealed small to medium effect sizes. However, the following relationships between the faculty commitment sub-constructs and self-reported technical competency reveal positive significant associations with medium sized effects.

a. High expectations of students, and summated FCSS are related to self-reported technical competency (SRTC1 [Critical thinking]).
b. High expectations of students, encouraging student accomplishment, concern for student success, and summated FCSS are related to self-reported technical competency (SRTC2 [Job preparation]).
c. High expectations of students, encouraging student accomplishment, concern for student success, and summated FCSS are related to self-reported technical competency (SRTC2 [Job preparation]).
d. High expectations of students, encouraging student accomplishment, concern for student success, and summated FCSS are related to self-reported technical competency (SRTC).

These findings indicate that students perceive that faculty member's high expectations of students, encouraging student accomplishment and concern for student success are important for their learning and success. The findings also agree with Chickering and Gamson's (1987) research-based principles of effective undergraduate education. They proposed that good practice in undergraduate education (1) encourages contacts between faculty and students, (2) develops reciprocity and cooperation among students, (3) uses active learning techniques, (4) provides prompt feedback, (5) emphasizes time on task, (6) communicates high expectations, and (7) respects diverse talents and ways of learning. These results also support the findings of Guskey (1988) that effective teachers have positive regard for their students.

Once again, the fourth predictor of student learning/success, GPA, failed to yield any significant relationship with sub-constructs of faculty commitment with student, except for the sub-construct of high expectations of students where the value ($r = .13$) indicates a small effect size. This indicates that students who rate themselves high on technical competency perceive that faculty commitment in terms of high expectations of students is more related to student learning/success in terms of student GPA.

Inter-correlations for Faculty Dimensions of Technical Currency, Teaching Techniques, Commitment to Student Success, an, Students' Self-reported Technical Competency

Question 6: Is there a combination of the factors of faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS), that predict self-reported student learning/success better than one alone, as perceived by seniors in the EET program?

The correlation analyses revealed significant relationships between the faculty technical currency (FTC) and faculty teaching techniques (FTT) [$r = .61$, large effect size], and between faculty technical currency (FTC) and faculty commitment to student success (FCSS) [$r = .51$, large effect size].

Multiple regression analyses revealed that the multiple correlation coefficient (*R*), using all the predictor variables simultaneously, is .42, and the adjusted *R* square is .166, which indicates that 16.6% of the variance in student learning/success can be predicted from the three independent variables [faculty technical currency (FTC), faculty teaching techniques (FTT), and faculty commitment to student success (FCSS)] combined. The *R*-value of .42 indicates a medium to large effect size.

Limitations/Shortcomings

The study has following limitations/shortcomings:

1. Due to the non-availability of any standardized test data (e.g. comprehensive exam before graduation, capstone test score, etc.), the study relied on the student perceptions to investigate the relationship between the importance of faculty dimension of technical currency, teaching techniques, and faculty commitment to student success, to student learning/success.
2. The dependent variables describing the student success were also self-reported by the student. It is possible that students may have inflated their GPA, or exaggerated their self-reported technical competency.
3. All students may not have understood the concept of faculty technical currency properly. (The definition of technical currency may not be as apparent to students as the pedagogy, or commitment). It is difficult to educate students about technical currency and then ask for feedback at the same time regarding the importance of technical currency for their learning/success.
4. It was expected that students' success could also be predicted using the number of job offers, highest salary offered, and membership in honor

societies. But these variables did not prove to be valid indicators of student success, as the results revealed that only 16.4% senior reported that they have job offers, with salary ranging from $ 25,000 to $65,000 (average salary of $34,270), and 62.7% seniors reported that they did not belong to any professional/honor society.

5. It is difficult to assess if the defined procedures of data collection were followed in the same manner at all campuses.
6. Some of the students who completed the surveys may have been enrolled in the CET (computer engineering technology) program, as there are number of courses which are common to EET and CET programs.
7. The present study did not consider the impact of faculty teaching loads on student learning/success.
8. The present study involved students who take classes on-campus; students who take online classes were not included.
9. The results cannot be generalized to the general population of EET seniors because of the use of convenience sampling technique.

Surprises

The study also revealed following surprises:

1. It was expected that Student GPA, a measure of student learning/success, would show some significant relationships with faculty dimensions, but GPA did not reveal many significant relationships with faculty dimensions of technical currency, teaching techniques, and faculty commitment to student success. This could be due to the fact that the GPA numbers were self-

reported, and some students, perhaps less competent, may have inflated the GPA, thus reducing the true variability in the GPA data.

2. Students' self-reported technical competencies, indicators of student learning/success, turned out to be better related to student learning/success than the GPA.

3. It was expected that the faculty technical currency (FTC) would indicate a strong correlation with self-reported student learning/success, but it revealed a medium effect size, whereas the faculty teaching techniques (FTT) showed medium-large effect size with student learning.

Recommendations/Implications for Practice

The exponential rate of technological advances is forcing a paradigm shift in education. Teaching in today's world requires new approaches to instruction. The profound and pervasive changes occurring in education are placing new demands on educators. Educators are expected to be technically current and to learn the mechanics of teaching/learning in order to become effective teachers. These new challenges are forcing teachers to become life-long learners.

The swift pace of technological change is also transforming the global economy into a knowledge-based economy, in which organizations are no longer valued on the basis on their physical assets but rather on the knowledge base of their employees. And in this new knowledge-based economy the wealth of a nation is determined by its intellectual capital.

The study revealed that majority of EET senior (90% or more) perceive that the most important factors that contributed to their learning and success are: coordinating lab with the lecture (FTT), up-to-date technical knowledge (FTC), organization and reparation of class and lab activities (FTT), and professors' lectures (FTT). This author believes that in light of these results, faculty technical currency is of paramount importance. As in the engineering technology discipline, one of the key factors for student learning is the hands-on approach. Therefore, a professor has to be technically current in order to teach/advise students about the design, implementation, and testing of systems composed of state-of-the-art components/sub-systems.

For delivery of online non-technical courses, the design and implementation is relatively less demanding than for the technical courses. For technical courses, the lab component is a pivotal factor in student learning. When offering technical courses online, the use of simulation exercises offers a partial solution. In most simulation experiments, a student can finish a procedure or a process fairly quickly, with lots of "Quick clicking of the mouse button," but learning/retention may not last long. This author recommends that the design of online technical courses should be limited to the lecture part only, and the lab component should be offered via a hybrid approach (for example, 30% simulation based experiments/tutorials, and 70% hands-on experiments, design of projects involving construction and testing of circuits and systems).

In order to optimize teaching/learning, faculty should be provided opportunities to acquire knowledge and skills in the instructional technology (delivery mode of information/knowledge/teaching techniques) and the content technology (technical currency for a given discipline). This author believes that, for both onsite and online delivery of technical courses, faculty technical currency (especially up-to-date technical knowledge and computer hardware/software skills) and faculty teaching techniques (especially coordinating lab with lectures and organization and preparation of class and lab activities) will play the most important role in promoting student learning/success.

In the domains of engineering technology, to narrow the gap between the state-of-curricula and state-of- technology in the industry, faculty are required to revise curricula frequently and maintain their technical currency. To improve student learning/success they are also required to learn the pedagogy. This endeavor is very challenging, and requires institutional vision, planning, and allocation of appropriate resources. The following recommendations need to be implemented at the personal, program/departmental, and institutional levels to improve student learning/success by enhancing faculty technical currency and pedagogy.

1. *At the personal level:* Faculty members should do a yearly self-inventory of their technical currency, teaching techniques, commitment to student success, and should identify areas of improvement and pursue professional development activities to enhance their technical currency and pedagogical skills, and the do a self-assessment of their skills.
2. *At the program/department level:*
   a. Administrators/chairpersons need to realize the importance of technical currency and pedagogy. Moreover, they should provide training opportunities for faculty to enhance their technical currency and strengthen pedagogy in order to improve student learning/ success. Appropriate funds should be allocated.
   b. Curriculum development and revision activities should be synchronized with faculty development and training activities vis a vis technical currency and

pedagogical skills, in order to optimize teaching/learning using continuous quality improvement (CQI) [Figure 5.1].

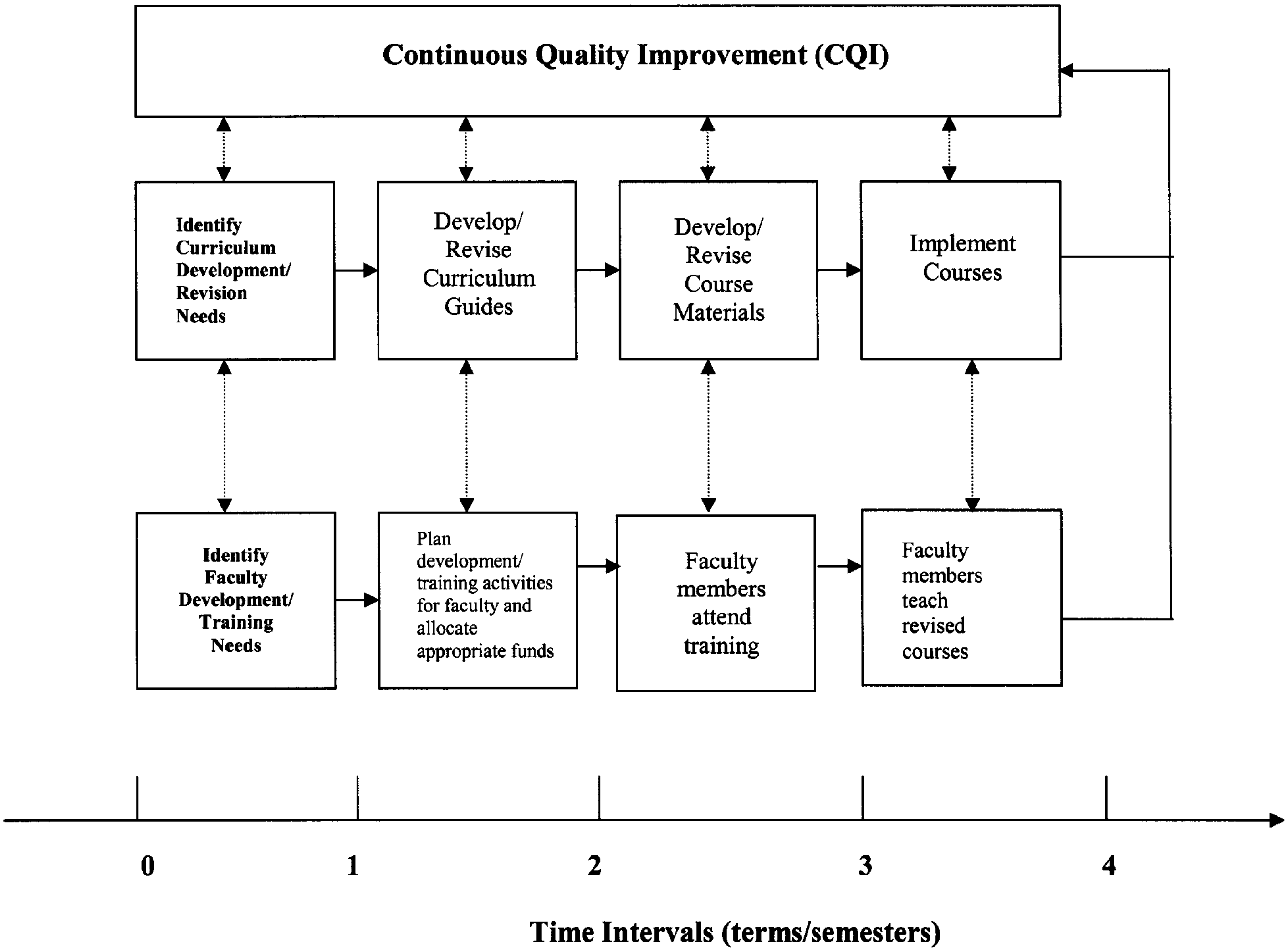

Figure 5.1. Synchronization of curriculum development/revision process and faculty development/training process to optimize teaching/learning with continuous quality improvement (CQI).

3. At the Institutional/Organizational level:

a. Because of the applications orientation of engineering technology programs, faculty technical currency and faculty teaching techniques are essential to make student learning more relevant. Therefore, there is a need to formulate/revise institutional polices to encourage faculty to maintain technical currency and enhance their teaching techniques. Recognizing the need for change, and then changing, is very challenging and requires visionary leadership to formulate goal-oriented short-term and long-term policies, competent educators to implement policies, and the allocation of adequate financial resources that will ensure the success of these policies.

b. Presently accreditation bodies such as ABET emphasize the importance of technical currency in the accreditation handbook, but no specific definition of the construct of technical currency exits. ABET needs to develop a blueprint for defining and assessing faculty technical currency so that program evaluators, school administrators and faculty can have a better understanding of the construct and its assessment.

Recommendations for Future Research

1. The present study was conducted using the EET seniors. Similar studies need to be replicated in other disciplines of engineering technology (e.g. computer, electomechnical, civil, mechanical, manufacturing, environmental, etc.) to investigate the relationship between the faculty dimensions of technical currency, teaching techniques, and commitment to student success, and, student learning/success.
2. The present study used six sub-constructs for technical currency; future studies should incorporate additional sub-constructs, related to professor's technical currency in his or her field of specialization, in the survey instrument.
3. The present study did not consider the impact of faculty teaching loads on predicting student learning/success; therefore, it is recommended that future studies should

investigate the relationship between teaching loads and: (a) faculty technical currency (b) faculty teaching techniques (c) faculty commitment to student success, and, (d) student learning/success.

4. The results of present study were based on students' self-reported learning in terms of self-reported technical competency (SRTC) and GPA, and some students may have inflated these numbers. For future research it is recommended that an achievement test scores or an actual later success indicator be used for student learning/success.
5. While the present study focused on the traditional students (taking classes on-campus), future studies should also investigate students taking online courses, and how the faculty technical currency, faculty teaching techniques, and faculty commitment to student success, of an online faculty member impacts student learning/success.

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APPENDICES

APPENDIX A

Faculty Survey on Technical Currency (Khan et al. 2004)

Faculty Survey on Technical Currency (Khan et al. 2004)

For Questions 1-10, please use the following scale.

1 = I strongly disagree with this statement (SD)
2 = I disagree with this statement (D)
3 = I moderately disagree with this statement (MD)
4 = I neither agree nor disagree with this statement (N)
5 = I moderately agree with this statement (MA)
6 = I agree with this statement (A)
7 = I strongly agree with this statement (SA)

Please circle the appropriate number.

	SD	D	MD	N	MA	A	SA
1. Because of the application orientation of engineering technology programs, technical currency of faculty is essential to make student learning more relevant.	1	2	3	4	5	6	7
2. I believe that there is a strong relationship between the technical currency of the faculty member and student learning/success.	1	2	3	4	5	6	7
3. My institution supports and encourages faculty members to maintain technical currency.	1	2	3	4	5	6	7
4. My chairperson supports and helps me plan professional development activities to maintain technical currency.	1	2	3	4	5	6	7
5. I believe that I have maintained technical currency during the past 5 years, enabling me to teach courses effectively.	1	2	3	4	5	6	7
6. My institution has allocated sufficient funds for the professional development activities of faculty during the past 5 years.	1	2	3	4	5	6	7
7. There is an urgent need in my department/program to improve existing policies in order to allow faculty to enhance their technical currency.	1	2	3	4	5	6	7
8. There is an urgent need in my department/program to increase funding for faculty development activities.	1	2	3	4	5	6	7
9. ABET's new TC2K accreditation criteria will encourage my institution to revise policies in order to promote faculty development activities in order to keep faculty technically current.	1	2	3	4	5	6	7
10. ABET's new TC2K accreditation criteria will encourage my institution to allocate adequate financial resources for faculty development activities.	1	2	3	4	5	6	7

11. How do you stay current (or maintain technical currency) with the pace of technological change? (Check all that apply)
    - □ Active participation in professional organizations
    - □ Presenting papers at conferences/writing papers in peer-reviewed publications
    - □ Attending conferences/technical workshops/seminars
    - □ Reading books, technical magazines, and trade journals
    - □ Keeping up-to-date via the Internet
    - □ Knowledge/skill transfer from senior faculty/colleagues
    - □ Working as a consultant in industry

12. I am affiliated with a:
    - □ State supported 4-year university
    - □ State supported 2-year program/community college
    - □ Private non-profit 4-year university
    - □ Private for profit 4-year university

13. My departmental affiliation:
- □ Electrical and electronics engineering technology
- □ Computer engineering technology
- □ Mechanical/Manufacturing engineering technology
- □ Industrial engineering technology
- □ Civil engineering technology
- □ Chemical engineering technology
- □ Environmental engineering technology
- □ Other___________________________

14. Do you teach in a TAC of ABET accredited program?
- □ Yes
- □ No
- □ We are in process of getting the accreditation

15. Indicate your computer competency/Information Technology (IT) hardware skills (PC & Networks):
- □ Low level (Basic understanding of computer hardware/network systems)
- □ Medium level (have understanding of computer/network systems)
- □ High level (can design hardware/network systems)

16. Indicate your computer competency/Information Technology (IT) software skills (PC & Networks):
- □ Low level (can use application software word, PowerPoint, Internet browsers, etc)
- □ Medium level (can write simple programs)
- □ High level (proficient in programming using high-level languages)

17. Indicate the amount of departmental funds provided to you annually for participation in professional development activities (conferences, workshops, seminars, etc).
- □ None
- □ $1 - $200
- □ $201 - $500
- □ $501 - $ 1000
- □ $1001 - $1500
- □ More than $1500

18. Indicate the amount of personal funds you spent over the last year for participation in professional development activities (conferences, workshops, seminars, etc).
- □ None
- □ $1 - $200
- □ $201 - $500
- □ $501 - $ 1000
- □ $1001 - $1500
- □ More than $1500

19. Years of teaching experience
- □ 0-2
- □ 3-5
- □ 6-10
- □ 11-15
- □ 16-20
- □ More than 20

20. Number of years of recent industrial experience/consulting □ 0 □ 1-2 years □ 2-4 years □ 5 + years
21. Highest educational degree completed □ Industrial experience □ B.S. □ M.S. □ Ph.D. or other doctorate
22. Does your institution expect you to conduct research and do publications? □ Yes □ No
23. Gender □ Male □ Female
24. Professional society membership (check all that apply) □ IEEE □ ASEE □ ASME □ ACS □ ASCE □ ACSM □ AIChE □ Other__________________
25. Did you receive any formal training in pedagogy? □ Yes □ No
26. Do you have any comments regarding the importance of faculty technical currency and faculty development on student learning/success?

APPENDIX B

Cover Letter for Survey Packet for the Deans of EET Program

Cover Letter for Survey Packet for the Deans of EET Program

Date:

Dean of EET Program
DeVry University
XYZ Campus

Dear Dr./Mr. _________:

We would like to request your assistance with a research project. I am a senior professor at DeVry University, Addison campus and also a student in the Education Leadership Doctoral Program at Colorado State University. Gene Gloeckner Ph.D., a professor in the school of education at Colorado State University, is the adviser of this doctoral dissertation, titled "Students' Perceptions of the Importance of Faculty Technical Currency, Teaching Style, and Personal Traits for Student Learning/Success in a Technology-Based Baccalaureate Program." The main objective of this quantitative dissertation is to explore the relationship between faculty dimensions of technical currency, teaching style and personal traits and student learning and success.

We have been approved by DeVry, OBT to conduct this student survey at your campus (please see the attached letter of project approval by Dr. Patrick Mayers, V.P. Academics, DeVry University).

Attached please find a set of survey questionnaires. Could you please have this survey conducted in one of the EET technical class sessions during 10^{th} - 12th week of the Fall 2003 term.

The student participation for this survey is strictly voluntary, and information gathered for this study will remain confidential. And it would take less than 15 minutes for students to complete this survey.

Could you please ask one of the faculty assistants to conduct this survey at the beginning of the class hour. And while students take this survey, the faculty member must leave the classroom for the duration of survey. Before the faculty assistant administers the survey to the students, please ask him/her to read the instructions for administrating the survey.

The students should turn in the completed surveys to the faculty assistant, who should put the surveys in the attached postage paid envelope, seal it and return it to you. And we kindly request you to mail this envelope with all completed surveys back to us.

We hope that the results of this study will help to improve the quality of instruction in the EET program, and lead to enhancing faculty development programs not only at DeVry University but also in the domains of engineering technology all across the country.

We thank you in advance for your cooperation this research project.

Sincerely,

Ahmed S. Khan
Ph.D. Candidate CSU
DeVry University
Addison, IL 60101
(630) 662-8296
khan@dpg.devry.edu

Gene Gloeckner, Ph.D.
Assoc. Professor & Advisor
School of Education
Colorado State University
(970) 491-7661 (office)
ggloeckner@cahs.colostate.edu

APPENDIX C

Letter of Support From DeVry University

December 8, 2003

DeVry University

DeVry Inc.
One Tower Lane
Oakbrook Terrace
Illinois 60181-4624
630-571-7700
800-733-3879
www.devry.com

Dr. Gene W. Gloeckner
School of Education
Colorado State University
Fort Collins, CO 80523

Dear Dr. Gloeckner and CSU Human Research Committee,

This is to convey to you the decision of the DeVry University Doctoral Research Review Committee to approve the data collection plan set forth in the dissertation proposal of Ahmed Khan. Since DeVry University is exclusively a teaching university, we do not have an Institutional Review Board, but have instead substituted the Doctoral Research Review Committee to perform some of the same functions, albeit on a more limited basis. The Committee consists of Marilynn Cason, Senior Vice President and General Counsel, Jerry Murphy, Vice President for Operations, and me, as Vice President for Academic Affairs. DeVry University has a matrix organizational structure under which all of our campus operations report to campus presidents and they to regional vice presidents, all of whom report to Jerry Murphy. On each campus are program deans and deans of academic affairs, who have direct line responsibility for supporting and managing the faculty and academic programs, and all of these academic administrators have dotted line relationships to the program directors and the dean of curriculum, who reports to me.

In supporting Ahmed Khan's dissertation research, we understand that the questionnaire is to be administered voluntarily, with all responses to be anonymous, to seniors in the Electronics Engineering Technology (EET) program at thirteen DeVry campuses, including: Addison, Chicago, Tinley Park, Long Beach, Pomona, West Hills, New York, Dallas, Phoenix, Kansas City, Fremont, Atlanta, and Columbus. The survey will be mailed to the Dean of the EET program at each campus, and administered by a student support person who will collect the instruments in individually sealed envelopes. The individual envelopes will then be placed in a large envelope and returned to the researchers. In conclusion, Ahmed Khan is a highly regarded professor at DeVry; we believe his project will help us continue to improve as an institution; and that it will be supportive of our upcoming TAC of ABET accreditation visit in 2004. If you have any questions, please contact me.

Sincerely,

Patrick Mayers

Patrick Mayers
Vice President, Academic Affairs

CC: Marilynn Cason
Jerry Murphy

APPENDIX D

Instructions for the Faculty Assistant (FA) for Administrating the Student Survey

Instructions for the Faculty Assistant (FA) for Administrating the Student Survey

1. Please take the survey packet to the 9th term EET class designated, by the dean of EET program, to conduct the survey.

2. The survey should be administered at the beginning of the class hour.

3. Please inform the professor teaching the class that this survey will take approximately15 minutes to complete. So please ask the professor to return to class in about 15 minutes.

4. During the administration of this survey no faculty members should be present in the class.

5. Please inform students that their participation in this survey is **strictly voluntary**. And all the information they provide will remain **confidential** and will not be shared with any faculty members at DeVry University.

6. Ask students **not to write** their names or their professors names on the survey.

7. Please use an overhead projector and read the highlighted parts of the attached transparency to the students (transparency is the cover letter of the student survey).

8. Distribute the survey to students.

9. Ask the students to place the surveys in the individual envelopes and seal them.

10. Collect the envelopes with survey forms and place them in the large envelope and seal it.

11. Please take the sealed envelope with completed surveys to the EET dean.

12. Thank you for participating in this research project, your help is very much appreciated.

APPENDIX E

Cover Letter for Student Survey

Requesting Participation and Assuring Confidentiality

Colorado State University
Knowledge to Go Places

School of Education
1588 Campus Delivery
Fort Collins, Colorado 80523-1588

We would like to request your assistance with a research project. Mr. Khan is a senior professor at DeVry University, Addison and also a student in the Education Leadership Doctoral Program at Colorado State University. Dr. Gene Gloeckner, a professor in the school of education at Colorado State University, is the adviser of this doctoral dissertation, titled "Students' Perceptions of the Importance of Faculty Technical Currency, Teaching Style, and Personal Traits for Student Learning/Success in a Technology-Based Baccalaureate Program." The main objective of this quantitative dissertation is to explore the relationship between faculty dimensions of technical currency (Up-to-date technical knowledge of new and emerging technologies), teaching style and personal traits and student learning and success.

In this regard, we invite you to express your opinion, by completing the attached survey, about the importance of various aspects of your technical professors' influence on your learning and success. Your input is needed regarding these professors' technical currency, teaching style, and personal traits, and how these factors influenced your learning and success.

To ensure confidentiality, you should complete the survey **anonymously** (you should not write your name or professor' names on the attached survey questionnaire). Your participation in this project is strictly **voluntary**, and information gathered for this study will remain **confidential**. There are no known risks to taking this survey. Answering the questionnaire will not take more than 10 minutes.

We hope that the results of this study will help to improve the quality of instruction and lead to enhancing faculty development programs. Questions about participants' rights may be directed to Celia S. Walker at (970) 491-1563.

Thank you for your willingness to participate in this research study.

Sincerely;

ASKhan
Ahmed S. Khan
Ph.D. Candidate CSU
DeVry University
Addison, IL 60101
(630) 662-8296
khan@dpg.devry.edu

Gene Gloeckner, Ph.D.
Assoc. Professor & Advisor
School of Education , Colorado State University
(970) 491-7661 (office)
ggloeckner@cahs.colostate.edu

APPENDIX F

Student Survey Instrument

Student Survey

Consider your **technical professors'** influence on your learning and success. Your input is needed regarding various aspects of these **professors' technical currency, teaching style**, and **personal traits**, and how these factors influenced **your learning** and **success.** Please indicate the extent to which you agree or disagree with the following statements (Questions 1-23) about your professors' influence on your learning and success using the following rating scale.

1 = This was not at all important for my learning/success, I strongly disagree (SD)
2 = I disagree with this statement (D)
3 = I moderately disagree with this statement (MD)
4 = I neither agree nor disagree with this statement (N)
5 = I moderately agree with this statement (MA)
6 = I agree with this statement (A)
7 = This was very important for my learning/success, I strongly agree (SA)

Please circle the appropriate number.

	SD	D	MD	N	MA	A	SA
1. My learning/success is due to my professors being current in terms of subject matter (up-to-date technical knowledge).	1	2	3	4	5	6	7
2. My learning/success is due to my professors being current in terms of computer hardware skills.	1	2	3	4	5	6	7
3. My learning/success is due to my professors being current in terms of computer software skills.	1	2	3	4	5	6	7
4. My learning/success is due to my professors being current in new and emerging technologies.	1	2	3	4	5	6	7
5. My success/learning is due to my professors being current in terms of publishing technical papers and textbooks.	1	2	3	4	5	6	7
6. My learning/success is due to my professors being current in terms of participating in technical seminars, workshops, conferences, and professional organization activities.	1	2	3	4	5	6	7
	SD	D	MD	N	MA	A	SA
7. My learning/success is due to my professors' lectures.	1	2	3	4	5	6	7
8. My learning/success is due to my professors' use of a <u>variety</u> of technological teaching tools (e.g. computer simulation, internet, and videos).	1	2	3	4	5	6	7
9. My learning/success is due to my professors' use of powerpoint to deliver lectures.	1	2	3	4	5	6	7
10. My learning/success is due to my professors' use of a <u>variety</u> of teaching strategies (e.g. individual work, discussions as well as lecture).	1	2	3	4	5	6	7
11. My learning/success is due to my professors' use of group presentations.	1	2	3	4	5	6	7
12. My learning/success is due to my professors' <u>coordinating</u> lab work (experiments and projects) with theoretical concepts covered in lecture.	1	2	3	4	5	6	7
13. My learning/success is due to my professors' organization and preparation of class and lab activities.	1	2	3	4	5	6	7
14. My learning/success is due to my professors' use of individual lab projects.	1	2	3	4	5	6	7

15. My learning/success is due my professors' timely feedback on class and lab projects.	1	2	3	4	5	6	7
	SD	D	MD	N	MA	A	SA
16. My learning/success is due to my professors' dedication to their students.	1	2	3	4	5	6	7
17. My learning/success is due to my professors' high expectations.	1	2	3	4	5	6	7
18. My learning/success is due to my professors being approachable.	1	2	3	4	5	6	7
19. My learning/success is due to my professors' encouragement towards my accomplishments in class and lab.	1	2	3	4	5	6	7
20. My learning/success is due to my professors' concern for my success.	1	2	3	4	5	6	7
Students self-perception of competency	SD	D	MD	N	MA	A	SA
21. Given a technical challenge, I can analyze a problem by thinking critically.	1	2	3	4	5	6	7
22. I have confidence in my knowledge of electronics engineering technology (EET).	1	2	3	4	5	6	7
23. Given a technical problem or specifications for a system design, I can propose a solution by designing the necessary sub-system/circuits and by constructing a prototype of the system.	1	2	3	4	5	6	7

24. What is your GPA? My GPA = __________ out of 4.00

25. Do you have any job offers presently? ☐ Yes ☐ No
If you answered yes, how many job offers do you have? # of job offers = __________

26. If you have a job offer, what is the highest salary offered to you?

Highest salary offered = $__________

27. Are you working presently? ☐ Yes ☐ No
If you answered yes, how many hours a week do you work? # of hours/Week = __________

28. Gender ☐ Male ☐ Female

29. Age Age = __________ years

30. Ethnicity/Race ☐ Hispanic ☐ Asian / Pacific Islander ☐ African American ☐ Caucasian
☐ American Indian / Alaskan Native ☐ I do not want to provide this information

31. Are you a student member of any national professional/honor societies? ☐ Yes ☐ No
If you answered yes, which societies do you belong to? (Check all that apply)

☐ IEEE ☐ ISA ☐ Alpha Sigma Lambda ☐ Chi Epsilon Delta ☐ Epsilon Delta Phi ☐ Phi Theta Kappa ☐ Other

APPENDIX G

Human Subjects Approval Letter

Colorado State University

Office of Regulatory Compliance
Office of Vice President for Research
and Information Technology
Fort Collins, CO 80523-2011
(970) 491-1553
FAX: (970) 491-2293

MEMORANDUM

TO: Gene Gloeckner, School of Education, 1588

FROM: Janell A. Meldrem, Administrator for the Human Research Committee

SUBJECT: **PROJECT APPROVAL**

Title: Students' Perceptions of the Relationship between Faculty Technical Currency, Teaching Style and Personal Traits and Student Learning/Success in a Technology-Based Baccalaureate Program

Protocol No.: 03-377H

Funding Agency: N/A

DATE: February 2, 2004

I am pleased to inform you that the above-referenced project was approved by the Human Research Committee on January 23, 2004 for the period January 23, 2004 to January 6, 2005. Because of the nature of this research, it will not be necessary to obtain a signed consent form. However, all subjects must receive a copy of the approved cover letter printed on department letterhead. The requirement of documentation of a consent form is waived under § _ _.117 (c) (2) with the return of the approved survey. **Approval is for 585 seniors.**

A status report of this project will be required within a 12-month period from the date of approval. Renewal is the Principal Investigator's responsibility, but as a courtesy you will be sent a reminder approximately two months before the protocol expires. The Principal Investigator will report on the number of subjects who have participated this year and project-to-date, about problems encountered, and provide a verifying copy of the consent form or cover letter used. The necessary form (H-101) is available from the Regulatory Compliance web page (see below). Should the protocol not be renewed before expiration, all activities must cease until the protocol has been re-reviewed.

It is the responsibility of the investigator to immediately inform the Committee of any serious complications, unexpected risks, or injuries resulting from this research. It is also the investigator's responsibility to notify the Committee of any changes in experimental design, participant population, or consent procedures or documents. This can be done with a memo which completely describes the changes and their consequences (new consent form or cover letter, or altered survey instrument, for example). Students serving as Co-Principal Investigators may not alter projects without first obtaining PI approval. The PI is ultimately responsible for the conduct of the project. Upon completion of the project, an H-101 form should be submitted as a close-out report.

This approval is issued under Colorado State University's OHRP Federal Wide Assurance 00000647 issued July 1, 2001. If approval did not accompany a proposal when it was submitted to a sponsor, it is the researcher's responsibility to provide the sponsor with the approval notice.

Please direct any questions about the Committee's action on this project to me for routing to the Committee. Additional information is available from the Regulatory Compliance web site at www.research.colostate.edu/regulatory/

Attachment

xc: Ahmed S. Khan w/attachment

Animal Care & Use • Drug Review • Human Research • Institutional Biosafety • Misconduct in Science • Radiation Safety
410 University Services Center www.colostate.edu/rcoweb