An Exploratory Study on Visionary Leadership Development in an Electrical Engineering Program at the Undergraduate Level.

by

James P. Froh

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James P. Froh
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APPROVED:

Robert Hockin, PhD., Faculty Mentor and Chair

Susan Saxton, Ph.D., Committee Member

Carolyn Hoch, Ph.D., Committee Member

Glen Wrate, Ph.D., Committee Member

Zig Hancyk, Committee Member

ACCEPTED AND SIGNED:

Robert Hockin, PhD.

Shelley Robbins, Ph.D.
Executive Director, School of Business

Abstract

How well the do electrical engineering programs provide the skills needed for graduates to be the leaders of today's businesses? Engineers comprise over 30% of the senior executives of businesses in today's global economy. Research on leadership has mainly focused on the business school side of leadership and little has been done on the engineering schools' development of the visionary leader. Dr. Marshall Sashkin describes the visionary leader and this research utilizes a survey tool designed by him to ascertain if the electrical engineering program at a private university is indeed preparing its students to be the leaders of tomorrow. The lack of research in this specific field has lead to an exploratory study to establish a base line of understanding on how well the electrical engineering program succeeds in preparing its students to be visionary leaders. The results showed positive outcomes in respect to the survey but just the opposite in analyzing the content of the course descriptions and syllabi in relationship to leadership.

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Acknowledgements

I wish to thank my family. Without their constant support this would not have been accomplished. I also wish to thank my committee for the guidance and wisdom that guided me through the rough times.

CHAPTER 1

Introduction to the Problem

The twenty-first century business environment is dynamic, chaotic, and global. It is transforming the way businesses operate and how executives lead their companies (Bennis, 1994; Drucker, 1995 & 2001A; Galbraith, Lawler III & Associates, 1993; Kotter 1999; Mumford, Zaccaro, Connelly & Marks, 2000; Pinchot & Pinchot, 1993; Porter & McKibbin, 1998). This paradigm shift has been increasing exponentially, demanding greater speed and flexibility by those in the front line (Drucker, 2001A; Hahs, 1999; Hitt & Keats & DeMarie, 1998). Employers need individuals who can thrive in this constantly changing, chaotic, and global environment.

Businesses have recognized this shift in the environment and are seeking graduates who can meet new challenges head on, and be the leaders of tomorrow. The new challenges require students who can communicate effectively, work in teams, analyze and solve problems, be leaders, and use the technical skills from their major field (Holter & Kopka, 2001; Lanier, Tanner, Zhu, & Heady, 1997; Linder & Smith, 1992).

Engineering education at the undergraduate level has failed to prepare graduates for 21st century environment (Emery, 1997; Fettig, 1992; Porter & McKibbin, 1988; Waddock, 1991). Even more dramatic than the failure to prepare graduates is the inability

of the higher education system to prepare its students to be leaders. Linder and Smith (1992) describe how students fail to understand the dynamics within an organization. They quote Harvard Business School Professor J. Sterling Livingston "managers are not taught in formal education programs what they need to know to build successful careers in management" (1992, p. 2).

The engineering and technical schools receive a similar disapproval from businesses (Bjorklund & Colbeck, 2001; Koen & Kohli, 1997; Pudlowski, 1995; Waks & Frank, 2000; Trick, 1994; Wulf & George, 2002).

> The engineering schools, which are increasingly out of touch with the practice of engineering. . . . Moreover, many of the students who make it to graduation enter the workforce ill-equipped for the complex interactions, across many disciplines, of real world engineered systems. Although there are isolated "points of light" (Quote marks by Wulf) in engineering schools, it is only a slight exaggeration to say that students are being prepared to practice engineering for their parents' era, not for the 21st century. (Wulf & George, 2002, p. 1)

In a survey of 50 CEOs of the 100 best companies by Industry Week, Miller (1997) noted that their educational

background consisted of the following: sixteen with business degrees and 15 with engineering degrees, with other fields making up the rest. Approximately 33% of the CEOs came from an engineering background. Other studies have shown similar findings for engineering/technical CEOs (Bassiry, 1991; Bassiry and Dekmefian, 1990; Neff and Citrin, 1999). These studies show the need for engineering programs not only to improve their educational support to the field but also to broaden curricula to include the leadership development skills that businesses call for. This qualitative research focuses on leadership within engineering undergraduate programs.

Background of the Study

Leadership education has been driven by the needs of business throughout history. From its beginnings, leadership study has been focused primarily on management and the organization, with only peripheral attention given to leadership as a skill unto itself. The term "leader" has undergone much scrutiny, and has been defined many different ways over time, reacting to the evolution of management and to organizational research. The concept of leadership has progressed through many stages and continues to evolve with the needs of organizations in today's global economy.

As early as the period from 3000 to 1000 B.C., the Sumerians organized and managed goals and missions for the government to pursue. The Egyptians utilized strong management and organizational skills to build the pyramids (Wagner, III, & Hollenbeck, 1992).

The Industrial Revolution is also significant in the development of management theories. This era gave rise to the bureaucratic form, was followed by the principles of scientific management, and later those of administrative management (Hellriegel, Jackson, & Slocum, 1999).

In the last century, the focus on leadership has evolved to the point that the first leadership major was started at the University of Richmond's Jepson School of Leadership in the 1990s (Jepson, 2002). The significance of leadership within management is the relationship among leader, followers, and the situation. Leadership is not just about the leader but is about the interaction among all three pieces of the puzzle (Bass, 1990; Bennis, 1994; Burns, 1978; Drucker, 2001A; Hughes, Ginnett & Curphy, 1999).

The understanding of leadership continued in the early years of business development with the study of organizations. Organizational studies focused on behavioral aspects of the business and were broken down into six main categories: Scientific Management, 1890-1940; Administrative Management,

1915-1970; Human Relations, 1930 to late 1980; Management Science, 1940-1990; Open System 1950-1990; and finally, Competitive Advantage 1990-present (Daft & Noe, 2001).

Leadership research began with the "Great Man Theory," also known as the "traits" theory, in the early 1900s (Bass & Stodgill, 1990; House & Aditya, 1997; Gibb, 1947; Jago, 1982; Jenkins, 1947; Northouse, 2001; Stodgill, 1948). Research in the mid-1900s led to "styles studies." These built on traits theory and looked at the behavior of the leader (Blake & McCanse, 1991; Blake & Mouton, 1964, 1978, 1985; Northouse, 2001). Research centered on contingency studies followed the traits and behavior theories. Even later, studies looked at the situation and how the leader would react (Fiedler, & Chemers, 1984; House, 1996; Van Fleet, & Yukl, 1986). Finally, studies have moved into the area of transformational leadership. This area includes the idea of motivational drivers of the followers (Bass, 1985, 1997; Burns, 1978; House, 1996; Mumford, Zaccaro, Connelly & Marks, 2000).

Transformational and transactional theories are researched the most at present, and encompass the prior traits, styles, path-goal, and contingency theories to create an understanding of what constitutes leadership in the areas of skills, motivation, behavior, and situation (Bass, 1985, 1997; Fiedler, & Chemers, 1984; House, 1996; Mumford, Zaccaro, Connelly &

Marks, 2000; Sashkin, 2003). The advancements in understanding management history and research of organizations have moved parallel with leadership studies. This growth in knowledge from all three areas allowed leadership education to blossom into an undergraduate major at the Jepson School.

In the beginning, educational goals at the undergraduate level focused on delivering graduates that could function in the disciplines in which they graduated. The focus was on application at both the business and engineering schools (Boyatzis, Cowen, & Kolb, 1995; Lynton & Elman, 1987; Muller & Porter, 1997; Reynolds & Seely, 1993; Trick, 1994; Waks & Frank, 2000; Wulf & George, 2002).

In the 1950s, the focus changed in both business and engineering schools to a scientific approach with little regard to the needs of the business world. The period immediately after World War II had coincided with the government infusing money into the educational system for more scientific research (Trick, 1994; Wulf & Fisher, 2002). The government's needs were the most important requirement at this point, and served the country well for the next 30 to 40 years (Reynolds & Seely, 1993; Waks & Frank, 2000; Wulf & Fisher, 2002; Trick, 1994). This government research focus led to engineering students having very narrow fields of study and little understanding of

the broader world (Reynolds & Seely, 1993; Waks & Frank, 2000; Wulf & Fisher, 2002; Trick, 1994).

Engineering schools evolved over time with the help of several organizations such as Electrical Engineering Association, Architectural Engineering Association, Mechanical Engineering Association, to and so forth. The key to the schools' future was their commitment to improve engineering education (Reynolds & Seely, 1993; Waks & Frank, 2000).

Over the last 90 years, several significant studies were completed by the engineering organizations. Five of these studies are the Mann Report in 1916, the Wickerman Report in 1922, the Hammond Report in 1940, the GOALS report in 1963; and a study by the Accreditation Board for Engineering and Technology (ABET) in the early 1990s. The reoccurring theme throughout all these reports was the need for the engineering schools to broaden the students' background to include Liberal Arts subjects within the curriculum. (Reynolds & Seely, 1993) "After a survey of practicing engineers found that most believed the key to success was character, not mastery of technical material . . ." (1993, p. 138). The need to broaden the engineer's background originally came from the Mann report in 1916 and has not changed much since.

Recently ABET, the recognized body for engineering schools' accreditation, has revised its curriculum requirements to

incorporate the needs of businesses (1993; ABET, 2002). ABET began a program called Engineer Criteria 2000. The purpose of this program is to open up the curriculum to liberal arts study and to ensure outcome-based assessments (ABET, 2002; Huband, 1998). All engineering schools will be required to incorporate these new requirements to be accredited.

Statement of the Problem

The problem investigated herein is that the engineering degree fails to develop the skills needed by graduates to be a leader in today's business world.

> By the 1960s, engineering educators in the leading schools paid little attention to industry. Driven by federal research contracts, especially in the military arena, they had developed a culture and values more akin to the pursuit of knowledge for its own sake than to practical engineering, seriously weakening the links between industry and academia on American engineering campuses. (Reynolds & Seely, 1993, p. 144)

The paradigm shift in the business world driven by globalization and technology, in the late 20th century, further separated the academic and business worlds. This chasm has resulted in an inability of engineering graduates to meet the needs of prospective employers.

Purpose of the Study

The purpose of this study is to examine the undergraduate degree program in the Electrical Engineering and Computer Science Department (EECS) at the Milwaukee School of Engineering (MSOE), and how well the program provides the skills needed for graduates to be the leaders of today's businesses.

Significance of the Study

This exploratory study can have significant impact on engineering programs in developing the leaders of tomorrow. It seeks to establish a base line of understanding on the importance of leadership in engineering schools' curricula. This study also seeks to create a better understanding of the problems which engineering schools are facing in balancing the needs of the discipline with those of business. Most research studies on leadership to date have focused on the premise that the students who graduate with a business or management degree will be the leaders of companies. Very little research has been done on engineers as potential leaders, and how well the engineering schools are providing the skills needed to be those leaders. This research on engineering and leadership is

qualitative in nature. No hypothesis is offered because there is very little research data to date.

Research Questions

The following are the research questions (RQs) driving this project:

RQ1: To what extent do the seniors in the studied department emulate Transformational Leadership Characteristics?

RQ2: To what extent do the seniors in the studied department emulate Transformational Leadership Behavioral skills?

RQ3: To what extent do the seniors in the studied department emulate the Transactional Leadership Characteristics?

RQ4: To what extent do the faculty in the studied department exemplify Transformational Leadership Characteristics?

RQ5: To what extent do the faculty in the studied department exemplify Transformational Leadership Behavior?

RQ6: To what extent do the faculty in the studied department exemplify Transactional Leadership Characteristics?

RQ7: To what extent does the studied department develop the Visionary Leader needed for today's businesses?

Definition of Terms

Accreditation: A process by which an organization attains certification of program quality by compliance with criteria

established by an oversight group that sets standards for all to follow.

Business Skills: The skills required of recent BS graduates by businesses. They include communication, technical, teamwork, listening, analytical, and problem solving skills, as well as leadership, drive, and ethics.

Effective Leader: The visionary and wise exercise of power over others to achieve a common goal Cleveland, 1997).

Leadership: The theories most prevalent in describing the leader needed to run a business in today's global environment. The leader who can motivate followers to pursue new goals and who knows how to build trust and respect through ethics, listening, values, and drive.

Management: The group of people who plan, organize, direct, and control a business to accomplish its goals. It also includes the acts of planning, organizing, directing, and controlling.

Assumptions and Limitations

The term leadership and its definition are dynamic with a continuous flow of new research adding to the knowledge base. The assumption herein is that effective leadership is based on a best practice concept for the long run of the business. The assumption is also made that MSOE/EECS is representative of

electrical engineering programs and compares satisfactorily with the engineering schools discussed later in this manuscript. Truthful answers to the questionnaire are one of the limitations of the research. The risk is that respondents will answer a question as they think it should be, and not on what they know it to be.

Biases among the faculty within the MSOE/EECS program, as they perceive effective leadership to be is another concern. The faculty might also view the questionnaire as a direct reflection of their abilities.

Another limitation includes faculty prejudgments about the outcome of the questionnaire. Careful administration of the questionnaire is required. MSOE is a private university and the impact on the research will be limited to this environment.

The self-portrayal required of the participants is another concern for accuracy of the responses. Many studies have used observers (those who work with, or report to a supervisor of the participant) to balance the accuracy of the findings. This study does not include the use of any observers directly. The students may indirectly reflect the faculty, however.

The final limitation or concern is a potential bias of the researcher due to his prior relationships with the school. The researcher received his Master's degree in Management from MSOE's Business school, and was an adjunct faculty member in

that school for three years. The extensive research will help to buffer the biases of the researcher, along with the use of the research tool to equalize the bias of the researcher.

CHAPTER 2

Literature Review

A review of the literature reveals meager research on development of engineers as leaders at the undergraduate level. The following will establish an understanding of the evolving concepts and ideas centered on the research available concerning engineers and their leadership development. The first section reviews the literature addressing leadership in general with particular attention to its definition and history, and relates leadership within the context of management and organizational history. The second section reviews the literature on business schools and their relationship to the educational system by developing a "Best Practices School." The third section analyzes and reviews engineering schools, available material on engineers as leaders, and compares engineering schools to the "Best Practices" School developed earlier. The final section concentrates on business and what it expects of the graduates.

Leadership

Definition of Leadership

The transformation in how a leader is defined and acts is reflected in studies that have taken place over approximately the last hundred years. It is during this period that the search for a definition of a leader began in earnest.

Each study has led to a new level of understanding and created greater insights. The concept of leader is comprised of more than just the individual; it also includes the leader's interaction with followers, and the situation that the leader and followers both exist in. Over time, leadership and its definition have evolved to reflect the current thinking of the business world and the changes in the concept of management. Early leadership definitions reflected a results orientation. Leadership meant directing and commanding, and was the focus of research in the early 1900s.

Today's business environment requires a different leadership emphasis; it combines the principles of "showing the way" and being a "guiding force." Roach and Behling define leadership (1984) as "the process of influencing an organized group toward accomplishing its goals" (Hughes, Ginnett & Curphy. 1999, p. 9). A simpler version is one by Manz and Neck in their book *Mastering Self-Leadership: "*Empowering yourself for personal excellence*"* (1999, p.2). James Clawson added to this basic phrase in his book *Level Three Leadership*: "Getting below the surface": "Leadership is the ability and the willingness to influence others so that they respond willingly" (1999, p. 27). In Max DePeree's book *Leadership is an Art*, the softer side expressed by focusing on the "servant side" leadership: "The art of leadership requires us to think about the leader-as-steward

in terms of relationships: of assets and legacy, of momentum and effectiveness, of civility and values" (1996, p. 12).

Leadership has been defined in the terms stated above, and also in terms of the leader's relationship with followers and the given situation the group faces. Clawson's definition that the group responds willingly had its roots in DePeree's focus on the servant concept. They both are limited in scope, however, especially in relationship to today's rapidly changing international market. Their concept of leadership did not take into consideration the need to be visionary and efficient in serving the customer as well. In the Afsaneh Nahavandi book *The Art and Science of Leadership 2nd edition*,

> A leader is defined as any person who influences individuals and groups within an organization, helps then in the establishment of goals, and guides them toward achievement of those goals, thereby allowing them to be effective. (2000, p. 4)

The interesting point of this definition is how closely it resembles several of the definitions above.

The above definitions create a vivid, all encompassing picture of a leader. The combination of these ideas brings out the following leader definition: A leader has followers, guides the group by compelling idea(s), establishes norms to meet objectives, understands the situation (past, present and

future), provides a learning environment, and continues to focus on serving the customer. This definition better meets the constantly changing environment in today's world markets. The process of leadership is not an inclusive club that one is born into; leaders come from many diverse backgrounds.

Leadership in a global organization requires delegating decision making, dispersing key functions geographically across units in different countries, removing layers of organization, eliminating formal bureaucratic procedures, and differentiating work responsibilities and authority across networked subsidiaries (Collins, 2001).

When leadership is aligned, successful leaders share their vision, engage followers in that vision, and entrust followers with responsibility and authority to choose, decide, and act. Such a workplace permits failure without penalty, and it creates learning from failure. That is an uplifting environment. When vision and strategy are clearly communicated and effectively shared, the context is established for team, micro- and self-leadership--and for additional macro-leadership--throughout the entire organization (Kur, 1997).

> To be an effective leader in the twenty-first century one will need to possess eight key attributes: (1) an ability to develop and convey a shared vision; (2) a service/servant orientation; (3) commitment to risk-

> taking and continuous innovation; (4) a global mindset; (5) comfort and confidence with technology; (6) competence in systems thinking; (7) recognition of the importance of ethics and spirituality in the workplace; (8) a model for lifelong learning. (Marquardt & Berger, 2000, p. 1)

Steven Covey describes what it takes to be an effective leader in the *Seven Habits of Highly Successful People*: be proactive, begin with the end in mind, put first things first, think win/win, seek first to understand - then to be understood, synergize, and sharpen the saw (Covey, 1989).

> Here then are the 10 traits that our list of the best business leaders in America share in common: passion, intelligence and clarity of thinking, great communication skills, high energy level, egos in check, inner peace, capitalizing on formative early life experiences, strong family lives, positive attitude, focus on doing the right things right. (Neff, Citrin, & Brown, 1999, p. 380-387)

> Since the function of leadership is to produce change, setting the direction of that change is fundamental to leadership. . . . Aligning people versus organizing and staffing . . . motivating people vs. controlling and problem solving . . . creates a

culture of leadership. . . . (Kotter, 1999, p. 51 - 63)

Warren Bennis cites the following characteristics: guiding vision, passion, integrity, trust curiosity, daring (Bennis, 1994).

Burt Nanus suggests the following: farsightedness, mastery of change, organization design, anticipatory learning, initiative, mastery of interdependence, and high standards of integrity (Nanus, 1989).

James O'Toole believes the following: integrity, trust listening and respect for followers (O'Toole, 1996).

Sam Walton focused on these characteristics: commit, share, motivate, communicate, appreciate, celebrate, listen, exceed, control, and swim (Walton, 1992).

Thomas Peters & Robert Waterman, Jr. preferred: managing ambiguity and paradox, a bias for action, close to customer, autonomy and entrepreneurship, productivity through people, hands-on, value driven, stick to the knitting, simple form, lean stuff, simultaneous loose-tight properties (Peters & Waterman, 1982).

In an article written by Warren Bennis, he discusses leadership with Herman Miller chairman Max DePree, Motorola chairman Bob Galvin, and Levi Strauss chairman Bob Haas. The article summarizes many of the same prior definitions but takes

them a step further and creates a human side to being the leader, that of being a servant to the followers. These three leaders focus on people and establishing values for the long term. They allow themselves to show their human side, and recognize the need for humility, strong ethics, listening, and observing. It is interesting that the four all talk the same language of building for the future through values and allowing the people to carry the ball. At the same time, being a leader requires listening, observing, and keeping the team focused on the task at hand. The three CEOs stress that within each of their companies, people are the focus, and organizational strength comes from building trust and allowing it to flow in all directions. The leader must keep learning in order to be intuitive while taking the risks to ensure the company's future (American Society for Training Development, 1998).

The environment and the chaos that companies and their people face at ever-increasing pace drive the concept of what the leader needs to be. Over the years much has been written about leadership from the "traits" to the combination, charismatic, transformational, and transactional leader. Each previously defined study focused on what the authors believed was needed to face the world economy and diverse workplaces. One of the better overall leadership definitions is by Dr. Abdul

Jamali. He stated the following at the June 1997 conference of the International Academy of Arts and Science.

> Leadership is by its nature both a science and an art: A science because it consists of identifiable skills which can be developed and acquired. An art because it is an *etat d'esprit* given to articulating visions, taking risks, and pursuing goals undeterred by obstacles. Effective leadership is neither the bureaucratic exercise of routine administrative prerogatives, not the wielding of power for its own sake. It is the visionary and wise exercise of power, and achievement of common goals, in the service of others. (Cleveland, 1997)

The different studies on leadership point to matching the leader to the situation, to adapting to the environment, and to serving the followers by guiding them down the path of the vision articulated by the leader. The leader is building the team and developing the learning corporation that will meet the challenges of the 21st century. This visionary, transformational leader encompasses all of the characteristics cited above, and balances them with the needs of the organization and the followers. Sashkin and Sashkin (2003) put the idea of the visionary leader into context by the establishing three major groups, Visionary Leadership Behavior, Visionary Leadership

Characteristics, and Visionary Culture Building. The basic premise is that leaders are determined by their characteristics, their behavior, and the situation in which they exist. In defining each of the three categories, specific words and ideas have been generated. In the category of Visionary Leadership Behavior, the typical terms used are as follows: "Intelligent, persistent, patient, confident, analytical, friendly, energetic, sincere, independent, creative, honest, forceful" (Sashkin & Sashkin, p. 1-6).

The second group, Visionary Leadership Characteristics, includes these: "Listens well, supports us, takes risks, communicates, mentors others, gives others credit, shares feelings, acts consistently, gives feedback, coaches, explains, delegates" (Sashkin & Sashkin, p. 1-6).

Finally, the third area, Visionary Culture Building, consists of the following:

> involves the team, grabs my attention, committed to aims, has a vision, politically astute, looks for info, sees the "big picture"(Quote marks by Sashkin & Sashkin), understands the system, understands our environment. (Sashkin & Sashkin, p. 1-7)

The definition of leadership leads us to the question of where did the concept of leadership come. In order to understand the evolution of leadership thoroughly, one needs to understand

the history of management and the development of the organization. Leadership is about the leader, the situation, and the followers. A strong correlation exists between leadership and the history of management and the history of organizations. The growth and development of management and organizations relates to the growth of people, one of the key ingredients of leadership.

History of Management

"As early as 3000 B.C., the Sumerians formulated missions and goals for government and commercial enterprises. Between 3000 and 1000 B.C., the Egyptians successfully organized the efforts of thousands of workers to build the Pyramids" (Wagner et al., 1992, p. 28).

The theories of management began to take shape at the time of the Industrial Revolution and have adapted since to the changing times. Management's constant self-evaluation as an organization strives to determine the best way to serve present and future customers.

> The oldest and perhaps most widely accepted view of management is the *traditional* (or classical) *viewpoint.* It is split into three main braches: bureaucratic management, scientific management, and

> administrative management. (Hellriegel, Jackson, & Slocum, 1999, p. 44)
>
> Bureaucratic management relies on rules, a set hierarchy, a clear division of labor, and detailed procedures. . . . Bureaucratic management provides a blueprint of how an entire organization should operate. It prescribes seven characteristics: a formal system of rules, impersonality, division of labor, hierarchical structure, a detailed authority structure, lifelong career commitment and rationality. Together these characteristics represent a formal, somewhat rigid method of managing. (1999, p. 44-45)

The bureaucratic form of management was used in many businesses from the earliest times. Even today, there are many organizations still following this form. Max Weber is generally recognized for identifying many of the basic concepts that describe this form of management. He based most of his theories on studies of Germany's governmental bureaucracy (1999).

The next form is scientific management. This style was brought about during the Industrial Age and emanated from the need for management to move away from a hands-on authoritarian approach. The scientific management era required management specialists to facilitate the advancement of the organization to compete in this era.

> scientific management focuses on individuals and their machines or tools. Its philosophy is that management practices should be based on proven fact and observation, not hearsay or guesswork. (Hellriegel, Jackson, & Slocum, 1999, p. 49)

Fredrick Taylor was one of the leading researchers of scientific management and used objective scientific techniques of observation for process improvement. Others like Frank and Lillian Gilbreth used time and motion studies to improve efficiencies, and Henry Gantt developed the Gantt chart and focused on timelines (1999).

Administrative management evolved and continues to evolve today, as do the other forms of management. In this theory, the focus moves to the organization of the management team itself. Henri Fayol is recognized as the leader in this era. "He felt strongly that, to be successful, managers had only to understand the basic managerial functions—planning, organizing, leading, and controlling—and apply certain management principles to them" (Hellriegel, Jackson, & Slocum, 1999, p. 52).

These fundamentals are the foundation of many of today's theories and basic management principles in any organization. (See Appendix 2A for details on the four management functions)

These four functions are the basis for understanding management and how managers keep the organization on track. The

four functions led into other leading theorist's concepts, like Fayol's view of how management should direct the company. Fayol developed 14 management principles (See Appendix 2B for full description of the 14 points) and suggested that managers receive formal training in their application as leaders. From Fayol and other leading theorists the concept of the organization continued to evolve. Modern theories on management have evolved rapidly over the last 20 years and continue to do so.

> But the modern organization is a destabilizer. It must be organized for innovation, and innovation, as the great Austrian-American economist Joseph Schumpeter said, is "creative destruction." [Quote marks by Drucker] And it must be organized for the systematic abandonment of whatever is established, customary, familiar and comfortable, whether that is a product, a service, or a process; a set of skills; human and social relationships; or the organization itself. In short it must be organized for constant change. The organization's function is to put knowledge to work--on tools, products, and processes; on the design of work; on knowledge itself. It is the nature of knowledge that it changes fast and that

> today's certainties always become tomorrow's absurdities. (Drucker, 1995, p. 77)

Understanding management history provides a base line from which to build an understanding of where leadership came from and of the forces that shape leaders. The interaction within the organization also has an impact on the development of the leader.

History of Organization

Beginning in the 1900s, the study of organizations and improving the efficiencies of the company began in earnest. In Daft's & Noe's book on organizational behavior, organizational history is broken down into six eras: Scientific Management, 1890-1940; Administrative Management, 1915-1970; Human Relations, 1930-late 1980; Management Science, 1940-1990; Open System 1950-1990; and the Competitive Advantage 1990 to present (2001, p. 7). In Judith Gordon's book, the timeline of major development in the growth of organizational behavior is broken down into several theories that correspond to a larger part of the six categories of Daft and Noe (1999, p. 15).

Scientific management began the understanding of the organization from a scientific point of view. Fredrick Taylor is known as the father of the scientific movement in the early 1900s, ". . . Taylors scientific management approach was unique

in its focus on the role of employees as individuals" (Greenberg, 1999, p. 9). His focus and later his book, *Scientific Management*, provided the groundwork to improve operations through analyzing the best way to do a job and have the best person do it. What was unique to his approach, even in his time frame, was the idea of sharing profits or increased earnings from the improvements in efficiencies. (Greenberg, p. 8) Taylor's results also led to others studying the details of work, including Frank and Lillian Gilbreth and their time and motion studies (Greenberg, p. 9). Until this time, it was generally felt that whatever the boss said had to be done. The education of the general worker had been limited and supervisors did not require the workers to think.

In the early 1920s, the next form of organization evolved. The administrative management organization is primarily focused on structure, concentrating on the type of management and the structure required to increase efficiencies. Chester Bernard and Max Weber identified the need to organize the company structure properly in relation to the type of business (Daft & Noe, p. 8). Henri Fayol also contributed with his five functions of management, planning, organizing, command, coordination, and control (Champoux, 2000, p. 9). His five concepts lead to his four functions of management that appear in every management book published, and are planning, organizing, controlling, and

leading (Dessler, 2002, p. 3). The objective of policies and procedures for organizing a company is to better serve the customer and the company's employees.

The next era in the study of organizations is the Human Relations School. This era focused on the concept of motivating employees through positive relationships between management and employees. During this era, the education of employees had experienced a steady growth, which also coincided with the growth of better treatment of employees. One such scientist was Abraham Maslow, who focused on the idea of a needs hierarchy. His theory considered what motivates individuals to reach higher levels in their relationships after fulfilling prior levels. His five levels included physiological, safety, social, ego, and self-actualization. The focus was to relate to the needs of the employees; what will give them the greatest satisfaction will depend on their level (Bateman & Snell, 2002, p. 418).

Also during this era came the Hawthorne studies. This particular study showed how lighting affected productivity, and the implications on how to treat employees led to further studies in human relations (Daft & Noe, p. 8).

The Management Science era began around the start of World War II and proceeded into the 1990s. During this era, much of the emphasis came from the use of computers and application of quantitative analysis tools, which allowed use of statistics and

performance measurements (Daft & Noe, p. 8). Along with this surge in a numbers approach was the ability to evaluate the performance of the whole organization.

In Daft and Noe's book, the concept of Open Systems was the next major step in organization studies. Management continued its focus on performance and efficiencies by recognizing the impact the external environment had, and investigated how the company could best utilize all its resources to get its products and services to the customer through improvements in utilization of employees, raw materials, distribution systems, and community awareness programs, both locally and globally (2001, p. 11).

The last era described by Daft and Noe is that of Competitive Advantage. The concept of continuous improvement and the taking of a longer-term view of the company's operations identify this era. This era required re-engineering the organization to be more of a learning company that is constantly trying to reinvent itself to exceed customer expectations while leaving the competition far behind (2001, p. 12).

Historically, organizational design usually meant organizational structure. Today, it means an alignment of structure, management processes, information systems, reward systems, people, and other features of the organization with the business strategy (Galbraith, 1987). The "fit" model of organization discussed by Galbraith is well known and widely

used (Waterman, 1982; Nadler, Gerstein, and Shaw, 1992). Organizational design decisions increasingly must be seen as complex trade-offs and contingency decisions, rather than as adoptions of fashion (Galbraith, Lawler III, & Associates, 1993, p. 2).

Comparing the history and the theories that changed management's thinking provides the necessary insight into the organizational reactions to sustain growth. Each writer discussed above focused on some of the leading theorists. Daft and Noe struck a balance between the theories and the time frames of their preeminence, and thereby provided added insight to how the organizational behavior and structure had evolved. By coordinating theory with time, the societal events of the time could be taken into consideration to reinforce the understanding and importance of each new major development. For example, the Management Science School began around the time of World War II, when the government needed to utilize computers to facilitate war analyses and to strategize on alternatives. It was a natural extension for the private sector to use computers to advance the practice of management.

Leadership's role in organizational studies is complex and constantly evolving. Understanding the history of organizations and the impact they have had on businesses help to frame the environment leadership affects.

The need for change and adaptation in an organization is being driven both internally and externally. The customization, flexibility, speed, technology and communications, and global pressures are not driven just from external forces on the organization, but from the relationship between the internal and the external forces that affect the organization. Current organizations differ greatly from the hierarchical structures of the 19th century. Identifying the different management concepts as they evolved and comparing them to the various management ideologies and theories helps to define how the corporation or the organization has evolved. Issue areas such as humanity, knowledge, conflict, and division of labor and power show how the focus has moved over the years away from a mechanical survival mode to one of empowered employees. Summarizing the shifts over the last three centuries is best appreciated through a chart. (See Appendix 2C for full chart of organizational changes)

In Thaddeus Wawro's book, *Radicals & Visionaries - Entrepreneurs Who Revolutionized the 20th Century*, homage is paid to those who have led companies, which have grown greater than the leader by creating an organization similar to those in *Built to Last* by Collins and Porras. The models and theories presented in the literature provide a basis for companies to evaluate where they stand and how they will approach the future on a

continuing basis. In Collins and Porras book *Built to Last*, for example, key insights can be gained by the examples and the thorough study the authors did on visionary companies.

> Visionary companies are primer institutions—the crown jewels—in their industries, widely admired by their peers and having a long track record of making a significant impact on the world around them. The key point is that a visionary company is an organization—an institution. (1997, p. 1)

Ten basic tenets came out of the study that delineates the best of the best from the rest of those within the industry. The ten basic tenets follow the same pattern as Fitz-enz's 8 Practices. (See Appendix 2D for the 10 tenets and their details.)

Other theorists also have examined what is critical for organizations not only to survive but also to thrive in the new economy. Jac Fitz-enz in his book *The 8 Practices of Exceptional Companies* describes eight main themes or characteristics, which the best companies consistently have as part of their tools.

> 'The 8 Practices of Exceptional Companies'
>
> **Value.** [Bold in original] There is a constant focus on adding value to everything rather than on simply doing something. In addition, there is a conscious, ongoing attempt to balance human and financial values. This

is not just a good intention; it is the common practice.

Commitment. Management is dedicated to a long-term core strategy. It seeks to build an enduring institution. It is more than open to change; in fact, it seeks it. Conversely, in these BHAMs there is a noticeable avoidance of the temptation to chase after every management fad that comes along.

Culture. One of the more distinguishing features of the BHAMs is the proactive application of the corporate culture. Management is aware of how culture and systems can be linked together for consistency and efficiency. That interface is consciously and actively managed.

Communication. There is an extraordinary concern for communication with all the stakeholders. Within these organizations, constant and extensive two-way communication is the rule. They use all available media and share all types of vital information with employees and other stakeholders.

Partnering with Stakeholders. New market conditions and customer requirements demand new forms of operation. Partnering is the most prominent new form. The BHAMs involve partners both within and outside the

company in many decisions. This includes the design and implementation of new programs.

Collaboration. There is a high level of collaboration among, and involvement of, all sections *within* [italics in original] functions. The BHAMs study, redesign launch, and follow up new programs in a collective manner. This includes collective support across sections enhancing cohesiveness and providing a solid from against attacks from outside.

Innovation and Risk. Radical change is not frightening here. There is a willingness to shake up the organization to the extent of shutting down the old structure and rebuilding it in a totally different form. Risk and innovation are recognized as necessities in a volatile marketplace.

Competitive Passion. The BHAMs are never satisfied. They constantly search for improvements. They set up systems and processed to actively seek out and incorporate ideas from all sources. In every case their motto is, "Wait till see what we do next." [Quote marks in original] But I do have evidence that companies featuring the following characteristics consistently outperform others over the long term in both human and financial indices. There are eight

> driving forces that make up the context from which the best human asset management systems and processes are derived. (Fitz-enz, 1997, p. 14-15)

In comparing and contrasting the leading theorists on how the best organizations perform, a consistent model becomes obvious and can be gleaned from the works of Collins & Porras (1997) and Fitz-enz (1997). Companies must structure their organization to serve the customers and reap the benefits to the best they can, while separating themselves from the competition. Theorists seem to agree that this formula leads to the high performance organization. In the same vein, synthesizing the history of management principles and organization theories establishes key insights to the evolution of leadership.

Leadership History

The concepts and theories of leadership have gone through several phases. Over time scientific research has developed a substantial base from which to build a credible leadership education program. Many theorists in psychology, organizational behavior, human resources, and other areas have studied leadership. Contributors to scientific research have included leading "traits" theorists such as Stodgill, Bass, and Lord, and transformational/transactional theorists such as House, Bass,

Burns, and others. Authors like De Pree, Bennis, and Covey examined the business side of leadership, while Drucker and Kotter authored books that contributed to the understanding of leadership in business and opened new doors for questioning and research.

Patterns in Leadership Theories

This study isolated the main themes of leadership by cross-referencing the many articles, and evaluating the major contributors to the study of leadership. These themes are consistent across traits theory, styles theory, contingency theory, and transformational theory.

Traits Theory

The traits theory was essentially the first attempt to analyze and compare what makes a great leader. Profiling the great leaders of the time produced the "great man" theory in which the leaders from the social, political, and military were analyzed to identify their qualities and characteristics (Bass & Stodgill, 1990; Gibb, 1947; House & Aditya, 1997; Jago, 1982; Jenkins, 1947; Northouse, 2001; Stodgill, 1948). Traits theory research focused on the leader as an individual and his leadership effectiveness. By the middle of the 20th century, traits studies could not be duplicated, and subsequently

stagnated. Stodgill (1948) called for the evaluation of traits in relationship to a certain situation (House & Aditya, 1997). This did not reenergize the research until much later when Lord, DeVader, and Alliger (1986) revamped the traits studies that had been done earlier and found some traits to be persistent among the effective leaders. These traits were intelligence, dominance, masculinity, and adjustment. These early studies created a basis for more research to come.

> What, then, can be said about trait research? What has a century of research on the trait approach given us that is useful? The answer is an extended list of traits that 'would-be' leaders might hope to possess or wish to cultivate if they want to be perceived by others as leaders. Some of the traits that are central to this list include the following: intelligence, self-confidence, determination, integrity and sociability. (Northouse, 2001 p. 18)

Comparing the traits identified earlier and what Northouse found reveals a consistency. Leaders need to possess certain traits to carry out their vision and the mission of the organization.

Leadership Styles

Advancements beyond the traits approach led to the styles approach. In analyzing the styles of leaders, one examines the

behavior of the leader, what they do and how they act as opposed to their personality traits (Northouse, 2001). Three of the many studies that were significant in this area of leadership were the Ohio State Studies, the Michigan Studies, and the studies by Blake and Mouton (Northouse, 2001). The Leadership Grid (Blake & McCanse, 1991; Blake & Mouton, 1964, 1978, 1985) has been revised several times over the years from this research on styles (2001). The Leadership Grid is used currently to determine the style of leadership.

The Managerial Leadership Grid focuses on concern for people and concern for production (Hughes, Ginnett, & Curphy, 1999). The style of the leader in the Grid is categorized as a relationship between task orientation and people orientation. This is done through scoring the answers from a test. The scoring determines their style of leadership in relationship to the different managerial environments such as country club management, team management, middle-of-the-road management, impoverished management, and authority-compliance management. (See Appendix 2E for the specific descriptions of the grid) This approach to styles classified the leader according to his or her way of doing things and how comfortable he or she was. The styles of a leader range from Impoverished Management on the grid (1,1) to the Team Management (9,9). Ideally, the 9,9 area is what is suppose to indicate the great leader, balancing the

style of the leader between the tasks required and the needs of the people, but this has not been proven. (Northouse, 2001) The styles approach had broadened the research of leadership beyond focusing on personality and tried to identify how an individual would respond to a situation, given their leadership style.

The research on behavior analysis has continued until today alongside the growth of research in other areas of leadership. Earlier theorists contrasted the traits and styles approaches to isolate the different focuses of each theory. Today, what is relevant is not the contrast but what researchers can build on from these initial studies to understand better the multidimensional aspects of leadership and the meaning of what a leader is.

A bridge between the styles approach and the contingency approach in leadership was the work done by Hersey and Blanchard (1969) called the situational approach (Northouse, 2001). They were the leading theorists in this area and provided the foundation for continued work into the situational and future theories. The work by Blanchard on the model of Situational Leadership II (2001) focused on the situation and the ability of the people to deal with that situation at that time. Working from delegation, supporting, coaching, and directing, the leader would determine the amount of directive or supportive behavior needed (Blanchard, 1985; Blanchard, Zigarmi, and Zigarmi,

1985). It is in this approach in which the theorists move further away from the "great man" theory and toward the people within the situation. The key is the ability of the leader to recognize the correct amount of directive or supportive reaction to the needs of the employees. Leadership research is no longer just a focus on the leader, but an expansion into the environment in which the leader operates, and with the other individuals who are involved.

Contingency Theory

The contingency theory includes the situation and the relationship between the leader and the effectiveness of his or her actions (Fiedler, & Chemers, 1984; Van Fleet & Yukl, 1986). The work of Fiedler on Least Preferred Coworker Measurement (LPC) and the work of House on Path-Goal Theory are a couple of the leading efforts in this field.

Fiedler focused on different styles and how effective they were in a leadership context.

> After analyzing the styles of hundreds of leaders who were both good and bad, Fiedler and his colleagues were able to make empirically grounded generalizations about which styles of leadership were best and which styles were worst for a given organizational context. (Fiedler, & Chemers, 1984; Northouse, 2001, p. 75)

Fiedler integrated styles with the situation and created the LPC. His objective was to determine the style of the leader and then assess the situation in which the leader was engaged. He concluded that the best match between the two would help to have a successful outcome.

The LPC determines the personality of the test taker. (Fiedler & Chemers, 1984) It helps to separate task motivated, independent, and relationship motivated leaders, and then measures the situation in which they will be required to lead (Northouse, 2001). Analyzing Fiedler's contribution to the leadership study illustrates how both the style and the situation combine to determine the effectiveness of an individual. Fiedler's work adds to the traits and style research and to the complexity of the topic by addressing the combination of person and situation.

Robert House (1996), developed the path-goal theory which, analyzed leader effectiveness in relation to leader task orientation, and to the subordinate's satisfaction and performance. House built his theory from prior studies on leadership and specifically from the Ohio State studies. (1996) "path-goal theory emphasizes the relationship between the leader's style and the characteristics of the subordinates and the work setting" (Northouse, 2001, p. 89). The complexity of leadership research had increased significantly with his work

because motivation was introduced into the mix. In fact, one of the problems with leadership research in general is the difficulty in recognizing all of the relevant variables and then analyzing them adequately (House, 1996). House's theory has been researched extensively over the years by House himself as well as others, and was reformulated by its originator in 1996. This reformulated path-goal theory includes "ten classes of leader behavior, individual differences of subordinates, and task moderator variables, which are related to each other in 26 propositions" (House, 1996, p.344). House's contribution to the understanding of leadership is still being debated; more studies and critiquing of the theory are needed. What is important in the path-goal theory is the contribution of motivation to the list of variables, and that it again builds from prior research.

Transformational Theory

Burns (1978) and later Bass (1985) proposed the concepts of transformational and transactional leadership. The basic premise of this theory is that the leader focuses on the motivation of the employees to achieve his objectives (Burns, 1978). The transactional leader will attempt to determine what motivates followers with the objective of the overall betterment of the business. The transformational leader focuses on the

needs of the followers to bring them to their full potential and possibly to a higher level of performance (Mumford, Zaccaro, Connelly, & Marks, 2000). This contrasts with prior theories because it focuses on the needs of the followers and on the ability of the leader to tap into the goals of the group. Interestingly, about that same time, House (1976) introduced the concept of charismatic leadership, which is very similar to the basic elements of the transformational and transactional leadership. Within these groups of theories were the elements of trust and respect that brought leader and followers together in pursuing the vision of the company.

The important point to recognize in charismatic leadership theory is that it is not just about the leader. The connection between the leader and the followers is fundamental to charismatic leadership theory as it is in transformational and transactional theory. This emotional connection drives the followers to new levels of performance. The requirement is for the leader not only to have this charismatic personality but to also have the vision, ethics, and drive to reach to new heights. They (leader and followers) should be continually striving to improve, building off of one another (Bass, 1997; House, 1996; House and Shamir, 1993). Many other authors have contributed to these theories, but these three; Fiedler, House and Burns have

made significant inroads into conceptualizing the leadership model and developing it complexity further.

The theories have laid the groundwork for the leader to develop. The changes in the environment, the organization and the people have placed even greater demands on the leaders of today's businesses.

> In the crucible of leadership today, the CEO stands stressed and squeezed between the need 'to be' and the imperative to do it; in fact, overnight. . . . a leader must be unrelentingly poised and vigilant, ready to redraw the landscape and reinvent a strategy. (Bernhut, 2001, p. 4)

In order to face the challenges in the 21st century a leader must be able to adapt, be an effective communicator, create the vision, have a servant attitude, listen, be humble, be a team developer, be technologically savvy, have international experience, have high integrity, be a people person, and have fun doing it all. The leader must be challenging, questioning, raising the bar of expectancy, learning, and setting the values from which the company can grow into the future. His or her style is not that of the autocrat but of the nurturer and guiding hand, ensuring the right path is being taken while scanning the horizon for new challenges and opportunities. This is why the transformational/transactional leader style is so

prevalent in the leadership research of today (Bass, 1997; Burns, 1978; House, & Shamir, 1993; Yukl, 1999; House, 1996).

The transformational/transactional leader is required to deal with the chaotic, technology driven, and fast-paced globalized world economy. Colwill (1999) takes the position that a woman is better equipped in many circumstances to handle the chaotic evolving world markets wherein a learning organization is best equipped to handle the future. Women leaders have the empathy and the natural tendency to be team players. They allow decisions to be turned over to teams as a key to their successful running of a learning corporation (Colwill & Townsend, 1999). Higher education schools must help develop these skills for the students to become the future leaders of businesses.

Higher Education & Leadership

Higher education's role in developing future business leaders has expanded from the first business school, the Wharton School of Commerce at the University of Pennsylvania, (Muller & Porter, 1997) to a point where there are now thousands of business schools. They all embrace the latest trends and focus curricula on leadership. Engineering schools are just beginning to recognize the broader roles the engineering students will have in business. Business schools focus on management,

organization, and leadership. The business school can serve as a standard for the engineering schools to emulate.

Business Schools

The basic premise of the early business school was to enlighten, develop, and create the fundamental knowledge that applied directly to running a business. The early business schools began by focusing strictly on education at the undergraduate level and sought to develop the leaders needed for that time (Goldberg, 1996; Muller & Porter, 1997). The higher education system has continually pushed for academic excellence and pursued a "Best Practices" approach in their courses. The current leadership degree at the undergraduate level had as its genesis the early business school programs.

Early business school programs focused on the applied-practical approach of a hands-on leader.

> As might be expected, in its early years collegiate business education had an applied emphasis and the quality of its programs varied considerably. It was not until 1959 that studies sponsored by the Ford Foundation and the Carnegie Corporation precipitated substantial changes in the academic nature of business education [Gordon & Howell, 1959; Pierson, 1959] (Mueller & Porter, 1997).

During the years that followed, the emphasis championed by the business schools was the scientific model, focusing on quantitative analysis and a scientific approach to the field. The intention was to legitimize the study of business (1997). Changes and pressures of the time caused business schools to redesign programs to include theoretical approaches.

Today's world is significantly different than 1959, and the schools have been slow in adapting to the expectations that the business world is demanding of the new graduates. Scientific reasoning fit well in the mid-20th century, providing leaders with hierarchical viewpoints with the leader coming up with the answers. The environment was fairly stable, and positions were well defined to allow followers to know what each was to do. Followers were expected to carry out their duties systematically and without question (Waddock, 1991). Porter & McKibbin (1988), Leavitt, (1989), Main (1989), Tanyel & Mitchell, (1999), and Fiedler (1996) report that the changing world has created a need for new type of leader for tomorrow, and that the old system that has existed since the 1950's will not suffice. Businesses are demanding graduates who know the basics of business and they are insisting that the business schools step up to the plate. The higher education business programs must recognize the environmental changes to management, organizations, and businesses in the 21st century, and their

focus on leadership. In order to accomplish what businesses wanted, the schools must evaluate themselves against what the best schools are doing, such that businesses consider them to be the "Best." Many of the concepts and principles taught by the "Best" in class correlate directly to the transformational/transactional theories of leaders.

Best Business Schools

The Wall Street Journal (2001) ranked the top MBA International Business Schools through a Harris Interactive Business Survey of the corporate recruiters. The intent of the survey was to make it relevant to the people doing the hiring of new recruits (Alsop & Sever, 2001). The overall analysis of the schools shows the top ten to be doing better in several key attributes:

1. Teaching analytical and problem-solving skills
2. Past success with the quality of graduates
3. The school's preparation of students for the new economy
4. Graduates' strategic thinking
5. Chemistry between the school and recruiter; and
6. Communication and interpersonal skills.

Out of 50 finalists from around the world the top-rated school in this survey was Dartmouth's Amos Tuck School.

Following close behind Tuck were Carnegie Mellon University and Yale University's School of Management. The University of Michigan and Northwestern's Kellogg Graduate School of Management rounded out the top five. Tuck's uniqueness and ability to produce solid general managers with strong interpersonal and communication skills, plus excellent team skills is what set it apart from the rest (2001).

In the undergraduate business degree in Management, the top five in 2002 per *US News and World Report* (2002) are University of Pennsylvania, University of Michigan, Massachusetts Institute of Technology (MIT), Carnegie Mellon University, and the University of California, Berkeley. In *Business Week* the top five in 2000 were: the University of Pennsylvania, Northwestern University, Harvard University, MIT, and Duke University (2000; Best colleges, 2002). The subtle differences among these schools are difficult to separate. In the three surveys listed here, The University of Pennsylvania Wharton School was ranked first by two of them. The Wharton School of Business will therefore be analyzed to establish the standard of "Best Practices."

Wharton School

The first degreed studies in management/business began in 1881 at the Wharton School of Commerce, University of

Pennsylvania (Linder & Smith, 1992; Mueller & Porter, 1997). Through the years Wharton has had many cycles of prestige and letdown, but during the last five years it has been recognized for its outstanding students in undergraduate business and management degrees (2000; Best colleges, 2002).

The faculty of the Wharton School has designed the undergraduate curriculum to accomplish three objectives:

1. Combining the study of business with the study of the liberal arts and sciences,
2. Giving students an international perspective, and
3. Improving students' leadership and communications skills. (Curriculum overview, 2002)

Recently the curriculum has undergone a major overhaul to incorporate cross-functional and diversity subjects, a global and leadership focus, and an orientation of service to the community and environment (Rifkin, 1996; Curriculum overview, 2002). The Wharton School incorporates a balance of theoretical and practical subjects to meet the needs of the future leaders.

The business emphasis can be focused in four areas: Entrepreneurial Management, Human Resource/Organization Management, Multinational Management, and Strategic Management (Curriculum overview, 2002). The inclusion of the Liberal Arts and their relationship to the students' roles in the business world provide the students with the practicality, diversity,

interpersonal relationships, and communications to be an asset to any company that hires them. The student-centered approach has allowed Wharton to revamp its program and incorporate interdisciplinary programs within the school. Businesses are doing the same thing (Kedia & Harveston, 1998). This compares favorably to the *Wall Street Journal* analysis of the best MBA schools. Another school to be analyzed is the Jepson School of Leadership because this is the first school in the United States to have a major in leadership at the undergraduate level.

Jepson School of Leadership

The Jepson School of Leadership began in earnest in 1989 and had its first class start in the fall of 1992. Under the guidance of Dr. Howard T. Prince II and Dr. James MacGregor Burns, the school has grown in popularity and has become one of the fastest growing programs at University of Richmond (Morrill & Roush, 1991; About the Jepson School of Leadership Studies, 2002). A gift of $20 million from Mr. and Mrs. Robert S. Jepson, Jr. was accompanied by a challenge to the university to move forward on a school of leadership. Morrill and Roush (1991) wrote:

> The school's goal is to combine education about and for leadership into an exacting and exciting whole. Knowledge and theories from all relevant fields will

> be combined with experiences and programs to foster leadership capacities. This continual effort to relate theory and practice, reflection and action, information and personal development will characterize the educational philosophy of the Jepson School. (p.3)

Key to this program has been a belief in the development and ongoing education of leaders, and not in the specific end product (1991).

The curriculum is designed around a Liberal Arts focus with emphasis on active and experiential learning. Included is a requirement for leadership majors to perform service learning and complete an internship within a real-world setting. The program places an emphasis on testing and analyzing the theories and principles of leadership in real-world settings as the students learn about themselves, and their attitudes on ethics, morality, and responsibility (About the Jepson School of Leadership Studies, 2002). The multidisciplinary program of leadership starts with a focus on morals, with intent to develop honest, caring, and socially responsible leaders. The next area of focus is the developing of leadership skills through theory and action-based settings. The faculty reinforces the action-based learning themselves by being leaders in their field and incorporating innovative pedagogical techniques through

experiential learning (About the Jepson School of Leadership Studies, 2002).

The Leadership Major includes prerequisite classes of foundation of leadership studies and service to society, followed by seven required courses:

1. History and theories of leadership
2. Critical thinking and methods of inquiry
3. Ethics and leadership
4. Leading groups
5. Research methods in leadership studies
6. Internship and
7. Senior seminar

Four classes of elective studies are required from a vast array of topics related to leadership, including independent studies with approvals of topic by faculty advisors. The Leadership Major must also complete an internship and a period of service learning. The internship consists of a minimum of 240 hours working outside of the university system in a real-world setting.

The Service Learning requires a minimum of 45 hours outside of the university in a community program. The Leadership Major must also complete an approved concentration in another field from the School of Arts and Sciences or the E. Claiborne Robins School of Business (About the Jepson School of leadership

studies, 2002). Jepson's philosophy is to develop a process by which the undergraduates form a deep understanding of and about leadership. The process is ongoing and prepares the multicultural, diverse, interpersonal growth, and morally, and socially responsible leader for the 21st Century.

Leadership in the Real World

The growth of the leadership schools is based on applications approach or hands-on-approach from the businesses reaction to the ill prepared students. The curriculum is designed to prepare the students to begin their journey into a leadership role. It is a process and a continuous learning experience. The environment in which the real world has to operate drives the shift in school's curriculum. According to Dr. James MacGregor Burns, a paradigm shift in leadership is evolving due to the environment in which businesses need to operate today and in the future (Burns, 1978). In turn, a paradigm shift in the skills and characteristics of the leaders in today's businesses is required. Leaders of today are those who will consult and listen, who have respect for human possibilities, who foster growth, who are enablers, who help remove obstacles to effective functioning, and who help others see and pursue shared purposes. The practical side of learning

about leading comes from the minds of leaders who are or have been in business, men like Max DePree or Sam Walton.

The many models of leadership theory are moving from the "Great Man Theory" and traits to one of transformational-morally-socially-responsible servant leader (Bass, 1990). Maxwell DePree (1989) states, "liberating people to do what is required of them in the most effective and humane way possible" (p. xx) DePree focuses on the concept of leadership as an art and the leader should be a servant to the followers (1989). Sam Walton describes leadership in relation to developing partners through communications, appreciation, sharing, motivating, listening, questioning and the willingness to take risks while creating the vision of a great place to work as partners (Walton & Huey, 1993). It is important to recognize that leadership does not only come from theories but also from the minds of those who have lead companies. Many models on leadership from theoretical to the practical exist in today's world and will continue to expand. "Nevertheless, a full account of leader-outcome results will require the use of multiple methods in the same situation. Nonetheless, both approaches will be needed for comprehensive explanations" (Bass, 1990, p. 897).

In comparing the models of leadership and the two schools, one sees the strong relationship among interpersonal growth, morals, social mindedness, diversity, a globalized world, and

relying on others to accomplish the goal of the organization. The two schools strive on meeting the needs of the employers while integrating theoretical concepts to further the knowledge of leadership and management. The course curriculum, faculty, vision, and philosophy are all in alignment to meet the chaotic, globalized competitive world in which the graduates will enter. The two schools recognized that the key to leadership is the process of developing morally and socially responsible leaders who are lifelong learners and who can influence future through their vision, while serving the followers to reach that goal.

Engineering schools have a similar history but are more focused on the scientific approach to learning. The following will review the engineering development and how it relates to leadership. The engineering literature research review on leadership and engineering is very limited.

Engineering's Paradigm Shift

Traditional engineering schools have focused on the science of engineering with a narrow focus on a specific field of study, such as Mechanical, Electrical, to and so forth. Overall, however, they are not meeting the needs of the students nor the employers for the 21st Century (Bjorklund & Colbeck, 2001; Huband, 1998; Lynton & Elman, 1987; Reynolds & Seely, 1993; Trick, 1994; Yamada & Todd, 1997). The driving force behind

this shift of practicality to scientific approach is the advancement of technology.

> Since World War II a number of fundamental societal changes have had a profound impact on higher education in general and on universities in particular. And the rate of innovation is accelerating. Scientific and technological developments lead more rapidly to new products, to new modes of communication, and to new economic conditions. Global interdependence is growing, and even on a local scale many problems and issues are becoming complex. These developments have affected both the nature and the importance of knowledge and have thereby significantly changed the role and functions of the American university. (Lynton & Elman, 1987, p. xi)

The concept of universities is to transfer the knowledge to the next generation, therefore fostering intellectual development for society while advancing, interpreting, and disseminating knowledge (Lynton & Elman, 1987). Traditional business universities were established to encourage a humanistic liberal arts focus while broadening the minds of the graduates to become the leaders of the future. This utilitarian focus had its roots in research and the dissemination of new ideas to the specific fields. This continued focus of research began to

separate the different disciplines and also separated the faculty, which created walls that proved to be part of the decline in the broad based learning. The continued focus on research into one single field of expertise propagated the continued educational process late into the 20th century (1987). This selectivity within the university system is apparent in the engineering field.

Engineering Background

The paradigm shift in higher education of moving from the scientific focus to the practical approach is especially significant in the engineering field. Engineering education continues to focus on the traditional model. This model has changed little and focuses on the research and scientific process (Wulf & George, 2002; Pudlowski, 1995; Reynolds & Seely, 1993; Trick, 1994; Wirasinghe, 2002; Waks and Frank, 2000).

> Engineering and technology education often lags behind the requirements of employers, who currently demand more broadly educated people, able to satisfy modern job requirements and challenging new on-the-job situations. (Pudlowski, 1995, p. 403)

Wulf and Fisher (2002) reinforce this concept in describing the inability of the students to work in the real world of

engineering upon graduation. In order for this to change, an understanding of engineering is needed.

> Engineering is not science or even just "applied science." Whereas science is analytic in that it strives to understand nature, or what is, engineering is synthetic in that it strives to create. Our own favorite description of what engineers do is "design under constraint." Engineering is creativity constrained by nature, by cost, by concerns of safety, environmental impact, ergonomics, reliability, manufacturability, maintainability—the whole long list of such "ilities" (2002, p. 1).

The traditional approach to the education of an engineer focused on the science, math, and research of engineering. It allowed the in-depth education and training of the engineer to create something new and different while engrossed in his/her research with little interruption from other fields.

> Critics see both undergraduate and graduate programs as having curricula that are too narrowly confined to technical skills, with too much of a gap between theory and practice, too much emphasis on purely cognitive and analytical material, too much abstract classroom work and too little hands-on experience. (Lynton & Elman, 1987, p. 73)

Engineering Education History

The history of engineering education had its initial roots at West Point in 1802 (Reynolds & Seely, 1993). During the 1800s the development of the engineer was strictly focused on industrial needs. The beginnings of organizations such as the American Society of Civil Engineers (ASCE) and the American Institute of Mining Engineers (AIME) led to the first meetings on engineering education in 1876 (1993). The education process was haphazardly designed and related directly to those needs of the institution, which served the interest of the local industries. The recurring theme has purportedly been the betterment of the engineering education in the United States.

In 1893, the Society for the Promotion of Engineering Education (SPEE) was formed to be the leading voice of all engineers. This organization was fragmented at best but continued to meet and bring together the different factions of engineering organizations. Its main goal continued to be the promotion of the engineering educational system as a whole, with talk of accreditation as a future objective. Throughout the years several in-depth studies were done to evaluate the conditions of engineering education.

The Mann Report.

The first such report for SPEE was the Mann report in 1916-1918.

> After a survey of practicing engineers found that most believed the key to success was character, not mastery of technical material, Mann urged more attention to values and culture. He also urged dropping foreign language requirements, making shop courses more meaningful, teaching theory and its application to practice simultaneously, and promoting cooperative education programs. (Reynolds & Seely, 1993, p. 138)

This first study, with more to come, provided the initial talks of some form of accreditation on a national level.

The Wickerman Report.

In 1922, the SPEE president commissioned another study. This arose from the belief that engineering schools were not meeting their duties in delivering the educated engineer to meet society's needs of the time. The Wickerman report responded with two main outcomes: The engineering schools' move to incorporate summer schools to allow room for more liberal arts curriculum, and the need for accreditation of the engineering schools. Schools like Cornell University and the University of Wisconsin were the first to incorporate the summer sessions

(1993). Several organizations brought together the idea of accreditation and out of these the Engineers' Council for Professional Development (ECPD) was formed in 1930s (1993). In 1936 the first list of accredited programs was issued.

The Hammond Report

In 1940, the SPEE report by Hammond, *The Aims and Scope of Engineering Education* recommended that a preprofessional training in liberal arts program be a requirement for a licensed engineering degree.

> It argued that engineering careers frequently involved management and responsibilities beyond narrowly technical arenas, so exposure to the liberal arts ought not be confined to a separate pre-professional program. (1993, p. 140)

The world wars and the period around the wars drastically altered the engineering organizations and placed tremendous emphasis on research and development at the university level driven by the federal government. This was a crucial turning point for the engineering schools; they moved to a scientific research focus and away from the needs of industry.
From the mid-1940s to the early 1950s, the SPEE was reorganized and the American Society for Engineering Education (ASEE) was formed. This organization continues to play a major role even

today. The ASEE contributed significantly in the shift of engineering education to a scientific focus and asserted itself as the voice of engineers.

GOALS Report.

The GOALS report was commissioned in 1963 and, as other reports before it, its recommendation was to:

> . . . strengthen the liberal arts education; base engineering curricula on engineering science; improve work in analysis, synthesis, and design; diversify the educational experience; encourage cooperation between industry, government, and universities; increase funding for research; and improve continuing education. (Reynolds & Seely, 1993, p. 143)

This report was lost in political fallout within the engineering organizations. The different organizations created internal turf wars and split the commission (Reynolds & Seely, 1993).

> By the 1960s engineering educators in the leading schools paid little attention to industry. Driven by federal research contracts, especially in the military arena, they had developed a culture and values more akin to the pursuit of knowledge for its own sake than to practical engineering, seriously weakening the

> links between industry and academia on American engineering campuses. (1993, p. 144)

The next 50 years reinforced the scientific research focus for engineering education with more recent trends beginning to reopen the door for a renewed voice for Liberal Arts based education. One of the leading proponents of this resurgence is the Accreditation Board for Engineering and Technology (ABET), which is the former Engineers' Council for Professional Development.

Accreditation Board for Engineering and Technology (ABET)

"ABET will provide world leadership to assure quality and stimulate innovation in engineering, technology and applied science education" (ABET, 2002). ABET is currently recognized as the only agency that is responsible for the accreditation of engineering degrees in the United States (Huband, 1998). The vision of ABET is as follows:

> ABET serves the public through the promotion and advancement of engineering, technology and applied science education. ABET will: Accredit engineering, technology and applied science programs. Promote quality and innovation in engineering, technology and applied science education. Consult and assist in the development and advancement of education in engineering, technology and applied science.

> Inform the public of activities and accomplishments. Manage operations and resources to be responsive and relevant to the needs of the organization and its stakeholders. (ABET, 2002)

The accreditation process took many different forms and required years of coordination among the different engineering groups. The goals and visions of these groups were the glue that kept them pursuing agreement. The standards proposed were the beginnings of accreditation.

> In the United States, accreditation is used to assure quality in educational institutions and programs. Accreditation is a voluntary, nongovernmental process of peer review. It requires an educational institution or program to meet certain defined standards or criteria. . . . There are two types of accreditation - institutional and specialized. Institutional accreditors, such as those referred to as "regional" accreditors, examine the college or university as a whole educational institution. Specialized accreditors evaluate specific educational programs. Professional accreditors, such as those for medicine, law, architecture and engineering, fall into this category. (ABET, 2002)

During its early years, ABET functioned as a sounding board for many different institutions and constantly fought off turf wars among the different fields of study. The objective of improving education of all the engineering groups consistently brought them back together. Their focus was to continue improvements in educational programs and to provide systematically the guidance needed to improve the engineers graduating from the member universities.

The years after the World War II saw a dramatic change in the vision of ABET. The scientific focus became apparent in how ABET's "criteria grew from a few short paragraphs to 30 pages of detailed course descriptions, credit-hour requirements, mandated numbers of faculty members, and so on" (Huband, 1998, p. 6). This scientific focus seemed to ignore the needs of the industry as globalization took effect in the late 20th century. Focus seemed more directed toward the needs of the members with more criteria geared to validate their existence. The last 10 to 20 years have forced ABET to reexamine their role, and recently they have come up with the Engineering Criteria 2000 Program. (See Appendix 2F for the Strategic plan) See prior notes about appendixes.

This program was developed with contributions from ABET, academe, and the industry working together to reexamine the accreditation process and to bring it back into a balance

between technical knowledge and new skills in teamwork, leadership, and the effects of globalization and the environment. The core of the new program was outcome-based assessment, which included ABET-approved measuring tools (Huband, 1998). There are eight basic criteria (See Appendix 2G for the full details of the eight criteria) from which the accreditation follows:

1. Students.
2. Program Educational Objectives.
3. Program Outcomes and Assessment.
4. Professional Component.
5. Faculty.
6. Facilities.
7. Institutional Support and Financial Resources.
8. Program criteria (Huband, 1998).

The goal of the program is to graduate engineers who have acquired the following attributes:

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design and conduct experiments as well as to analyze and interpret data.
3. An ability to design a system, components or process to meet desired needs.
4. An ability to function on multidisciplinary teams.

5. An ability to identify, formulate, and solve engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global/societal context.
9. A recognition of the need for and an ability to engage in lifelong learning.
10. A knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. (Huband, 1998, p. 20)

To achieve these graduation outcomes requires students be exposed to certain aspects of liberal education (Huband, 1998).

The primary force driving these outcomes is industry. Industries want the technical experts, but they also desire individuals with a broader based background.

> Engineers who can work in teams, perhaps with team members in other countries, and who are familiar with quality improvement and customer focus concepts. They want engineers who are aware of and can work in engineering's new social and environmental context.

> Finally industry knows that the engineers of the next century must be able to handle a rapidly evolving workplace where lifelong learning is essential to keeping up with the field's evolution. (p. 11)

ABET 2000 is the driving force to meet these needs. The engineering schools are just beginning to adapt these new criteria. The following will analyze a couple of the top engineering schools.

Top Engineering Schools

Massachusetts Institute of Technology (MIT)

MIT and Rose-Hulman Institute of Technology are two top engineering schools ranked by *US News and World Report* (2002) for the year 2001. MIT is ranked number one in engineering programs with the highest degreed program a doctorate, while Rose-Hulman Institute of Technology is ranked number one in engineering schools with the highest degreed program a master's degree. Both schools have been consistently ranked high over the years by several different ranking firms. MIT's school started in the 1860s with a primary focus on research and education. "Education and related research—with relevance to the practical world as a guiding principle—continue to be MIT's primary purpose" (*US NEWS*, 2002). Through the years, its focus

on research and engineering concepts has led to the school being ranked so high as an engineering program.

The primary objectives of the School of Engineering at MIT are to educate and prepare men and women for leadership in industry, government, and educational institutions; to advance the knowledge base of the engineering professions; and to influence the future directions of engineering education and practice. MIT's engineering educational programs emphasize the understanding of fundamental principles:

> facility with experimental, computational, and analytical methods; development of skill in the creative processes of engineering such as design; and the development of a self-confidence and versatility of mind that prepare the individual for a lifetime of learning and professional growth (MIT, 2002).

MIT's mission has remained essentially unchanged since its founding and focuses on the student and being able to deliver competent graduates. The focus of the undergraduate curriculum is to prepare the whole student through a holistic approach to his or her education, and by combining the liberal arts with the technical focus for the major field at the beginning of the program. (See Appendix 2H for MIT undergraduate curriculum requirements.)

Rose-Hulman Institute of Technology

Rose-Hulman Institute of Technology was founded in the late 1800s, with the objective of fostering the ideals of business and technical fields to create new ventures, and preparing students to deal with the industrialization movement.

> Rose-Hulman Institute of Technology was created as the result of visionary academic, civic and business leadership, which recognized the power of combining technical and academic excellence, capital resources, and an entrepreneurial spirit to accomplish community and economic development objectives. (Rose-Hulman Institute of Technology, 2002)

The focus on leading-edge technology for creation of new venture start-ups has consistently placed it ahead of other engineering programs. The institute delivers outcome-based programs that enable graduates to contribute both technically and as team members. (See Appendix 2I for undergraduate degree requirements.) The mission of the school is:

> To foster creation and growth of innovation-based businesses by providing easier access to infrastructure, technical support, business support, and capital, thereby providing uniquely valuable educational experiences for students and faculty along with new sources of economic vitality for the

community and state. (Rose-Hulman Institute of Technology, 2002)

MIT and Rose-Hulman Institute of Technology have similar missions as those of ABET. ABET's 2000 program shows the focus on outcome-based learning with a commitment to teaching the needed technical skills alongside a broader understanding of the world of business. Both of these schools are excellent benchmarks for other schools to emulate. Benchmarking against the best provides other schools the means to see how they measure up.

An example of this would be to assess the Milwaukee School of Engineering (MSOE) compared to these other two schools. MSOE is used in this study because of its proximity to the researcher and the ability of the researcher to connect to the inside workings of the university. This researcher received his master's degree from MSOE. Another reason is the deep tradition of the Milwaukee area and central United States for being the industrial center of the country (Haynes & Dinc, 1997). This area requires many engineers and MSOE has a deep tradition with the businesses within this region of producing top-notch engineers (Milwaukee School of Engineering, 2002).

Milwaukee School of Engineering

Oscar Werwath started Milwaukee School of Engineering (MSOE) in 1903 as the School of Engineering of Milwaukee.

Werwath had come over from Europe as a practicing engineer. The school was designed around meeting the growing needs of the Midwest's expansion into the industrial era, and the consequent requirement for more engineers. MSOE's mission statement is:

> MSOE will always be at the forefront of professional education with emphasis on both theory and technology, coupled with intensive laboratories and career practice. MSOE provides a sustained interactive educational climate for students to become well-rounded, technologically experienced graduates and highly productive professionals and leaders. The mission will be accomplished through an organized environment that places carefully recruited students among highly qualified faculty, a dedicated support staff and strategic partners in business and industry. All committed to meeting the ultimate objective of a graduate fully prepared for immediate productivity and advanced study. (Milwaukee School of Engineering, 2002)

MSOE's curriculum for the four-year program is intensive and has an application based focus. (See Appendix 2J for the four-year plan) The school has grown and consistently been recognized as a solid engineering program with students that can go right to work upon graduation (MSOE, 2002). In 1999 they

adapted specific electrical engineering goals and incorporated them into their vision.

MSOE'S ELECTRICAL ENGINEERING PROGRAM GOALS

The Electrical Engineering program at MSOE implements the mission of the university by fostering the professional and personal development of its students, resulting in graduates who are competent and effective contributors to both the engineering profession and society as a whole. To that end the goals of the Electrical Engineering program are:

1. Graduates will have demonstrated knowledge of mathematics, the basic sciences, and the engineering sciences.
2. Graduates will have demonstrated their theoretical and practical understanding of open-ended design problems as applied to complex electrical engineering systems and circuits using analytical and simulation skills.
3. Graduates will have demonstrated the laboratory implementation of their engineering designs and the ability to relate experimental results to a theoretical understanding.

4. Graduates will have demonstrated proficiency in oral and written communication skills and effective teamwork skills.
5. Graduates will have an understanding of their personal, professional and ethical responsibilities as applied to both the engineering profession and society as a whole.
6. Graduates will have an understanding for the necessity of lifelong learning to maintain professional viability and be prepared to continue their formal education for advanced degrees. (November 5, 1999)

The goals have been adapted to conform to the ABET 2000 criteria and focus on a stronger outcome basis. In the *US NEWS and World Report*, (2002) MSOE was ranked 13th in engineering (See Appendix 2K for comparison of schools) for schools with the highest degreed program a master's for the year 2001 (2002). Both the engineering and business schools have used the scientific approach as a general guide to their educational programs. This paradigm shift from the scientific to the practical focus in thinking is now forcing the educational field to reevaluate their programs and deliver a product, which is needed by businesses in the 21st Century.

Business

Business Environment

Businesses today are faced with the reality of a chaotic global economy. This economy has turned business on its head and required its very essence to be reevaluated (Drucker, 2001B; Senge, Kleiner, Roberts, Ross, Roth, & Smith, 1999). The challenges require an intense focus on and an immediate response to customers' needs. Kotter (1999) explained that the opportunities and hazards due to globalization are demanding that businesses change or they will not survive. Waddock (1991) described it as four basic areas of change within the business environment: information-bases, alliances, globalization, and competitiveness. This change in the environment has only increased exponentially, demanding greater speed in dealing with day-to-day issues by those in the front line of the business (Drucker, 2001A; Hahs, 1999; Hitt & Keats & DeMarie, 1998). The companies need employees who can thrive in this constantly changing, chaotic, and global environment.

Business Higher Education World

The academic world is facing a paradigm shift that has been brought about by the environment in which the graduates are entering as the 21st Century begins. There has been a shift from the practical to the scientific and now a further shift bringing the business schools back to some parts of the application

focus. Business programs in the early days were designed specifically to graduate students to be the leaders of the companies they worked for. Currently, business education programs are generally focusing on research, political correctness, rankings, jobs, and other areas, but not on learning (Boyatzis, Cowen, & Kolb, 1995; Muller & Porter, 1997). The skills that the business schools need to develop for today's global market are:

1. Intellectual and personal (Thompson, 1999);
2. Oral and written communication skills;
3. Presentation skills;
4. Multimedia presentation skills;
5. Global awareness; decision making skills;
6. Teamwork;
7. Initiative;
8. Honesty and integrity;
9. Reliability;
10. Technical report writing;
11. Research/library skills;
12. Computer skills;
13. Leadership;
14. Problem analysis and project management abilities; and
15. Multicultural appreciation (Levenburg, 1996; O'Reilly and Michels, 1994; Tanyel & Mitchell, 1999).

The American Assembly of Collegiate Schools of Business (AACSB), now called the International Association for Management Education, is trying to determine the needs of the employers and establish guidelines for the business schools to incorporate (Tanyel & Mitchell, 1999).

A study by Tanyel and Mitchell (1999), surveyed both faculty and employers. The employers sought these characteristics (in order of importance) in new graduates at the undergraduate level:

> responsibility and accountability, ethical values, interpersonal skills, oral communications, time management and punctuality, the ability to work in teams and decision-making and analytical skills. (1999, p. 3)

It is interesting to note the lack of globalization, presentation skills, persuasive ability, and computerization. The faculty had these elements in order of importance:

> responsibility and accountability, oral communication, interpersonal skills, written communications, creativity and critical thinking, time management and punctuality, and decision making and analytical ability. (1999, p. 3)

Less important to the faculty were persuasive ability, global awareness, project management, and computer skills. (Tanyel & Mitchell, 1999) The priorities of each group were

similar in the first few items but changed going down the list. It is important to recognize that the requirements of the employer are to hire new employees with the ability to think, analyze, and work well with others. From this beginning, the employer takes the next step and trains the employee in the specific job and the responsibilities they will be given. This might be why globalization and leadership are not that important for the new recruits because these areas of responsibilities will not be required at the entry levels (1999).

Business Needs

The business leaders and employers are finding that graduates lack the basic tools needed in this changing environment.

> Articles in the business press (e.g., Main, 1989) as well as those in the more academic literature point out that the business schools' strong emphasis on quantitative aspects of management has resulted in the inability of management-educated managers to do their jobs effectively because they lack the ability to think broadly and instead think in narrow analytic frames (See, for example, Leavitt, 1989). The result is a paucity of managers capable of the type of integrative thinking and broad perspective necessary

> to manage in a rapidly changing, internationally focused, and information-based society. (Waddock, 1991, p. 70)

The emphasis on developing the right student for today's work is felt at the MBA level also. Emery (1997) and Porter & McKibbin (1988) stated that the MBA graduate does not understand the dynamics of the business functions and how they are integrated throughout the business.

> In HBR's "Myth of the Well-Educated Manger" (January-February 1971), Harvard Business School Professor J. Sterling Livingston made many of the same points when he concluded that "managers are not taught in formal education programs what they need to know to build successful careers in management." (Quote marks by Linder & Smith) In our rapid-response world, perhaps there is small comfort in the fact that the criticisms of MBA programs are constant" (Linder & Smith, 1992, p. 2).

Fettig (1992) reviews the output of the schools and states that graduating students are not learning the right things and, in addition, are not able to compete against students from other countries. The barrage of criticism from employers relates directly to the change in the real-world environment that forces leaders to respond quickly. The key, then, is having employees

better prepared to take on those challenges. Employers are stressing the importance of some basic skills needed in order to cope with the realities of today's business.

Business Skills Needed of the Graduates

The literature is quick to criticize the business and engineering schools over their inability to deliver prepared employees. The employers are looking for students to become an immediately contributing team member and "hit the ground running." The skills required by business are as follows:

1. Communications (Lanier, Tanner, Zhu, & Heady, 1997),
2. Teamwork,
3. Leadership, and
4. Thinking and problem-solving skills (Holter & Kopka, 2001; Linder & Smith, 1992).

The expectations of both employer and employee have to be taken into consideration. The business students of recent years have been taught to use scientific analysis, but the real world does not allow the luxury of time for detailed analysis. The new hires have to think on their feet and have the knowledge needed to make the best decision. What is interesting from the business perspective is that the focus of in-house training programs is on leadership, ethics, team development, and communications with strong emphasis on the human capital

enhancement (Day, 2000; Fiedler, 1996; Friedman, 2001; Huey & Sookdeo, 1994). This list correlates strongly with what employers are requesting of the business schools.

Supervisors of recent engineering graduates have sought the same skills as those of the business school graduates (Bjorklund & Colbeck, 2001: Koen and Kohli, 1997; Wulf & Fisher, 2002). The problem is the inability of the engineering educational system to deliver the skills needed in the new economy (Yamada & Todd, 1997). Industries need to have engineers that have the characteristics to be team players, to communicate well, to have engineering skills, to be lifelong learners, and to be creative. (Bjorklund & Colbeck, 2001; Koen & Kohli, 1997; Trick, 1994; Wulf & Fisher, 2002) Trick (1994) explains that the faculties in engineering programs have failed to keep up with the times and continue to segment the departments to focus on their specific field. Waks and Frank (2000) examined a case study of industry needs and the engineering curriculum of the engineering schools.

> In an article that summarizes the findings of a study that assesses which skills will be required of future engineers, Koska and Romano [6] advise that college curricula substantively change to emphasize skills that require a systems approach and to create a wide

theoretical base and skills that are required by the industry. (p. 349)

Drucker (1995) has stated the changing global economy needs graduates to analyze, manipulate, and work together to embrace the chaotic environment in which businesses operate in the 21st Century. The engineering educational programs must recognize the new skills needed and adapt to them.

CHAPTER 3

Introduction

The purpose of this research was to examine the undergraduate degree program in the Electrical Engineering and Computer Science (EECS) Department at the Milwaukee School of Engineering and to determine to what extent the program provides graduates the skills needed by today's businesses. This is articulated in question seven of the research questions and derived from answering the first six research questions.

Research Questions Restated

The following are the questions with the first three questions analyzing the students. The next three questions are used to evaluate the faculty. Question seven is analyzing the results from the first six questions along with the word content analysis to qualitatively determine the outcome.

RQ1: To what extent do the seniors in the studied department emulate Transformational Leadership Characteristics?

RQ2: To what extent do the seniors in the studied department emulate Transformational Leadership Behavioral skills?

RQ3: To what extent do the seniors in the studied department emulate the Transactional Leadership Characteristics?

RQ4: To what extent do the faculty in the studied department exemplify Transformational Leadership Characteristics?

RQ5: To what extent do the faculty in the studied department exemplify Transformational Leadership Behavior?

RQ6: To what extent do the faculty in the studied department exemplify Transactional Leadership Characteristics?

RQ7: To what extent does the studied department develop the Visionary Leader needed for today's businesses?

Methodology

In order to answer the ultimate question, number seven, the research was broken into three parts: an analysis of the curriculum, an evaluation of the senior students in the EECS program, and an evaluation of the faculty. The curriculum analysis consisted of a review of both the course descriptions and the syllabi. This was followed by an evaluation of the senior students who had completed most, if not the entire program, and an evaluation of the faculty as to their level of leadership understanding.

The exploratory study focused on ways the university communicates and delivers ideas/concepts of the Visionary Leader. The three parts combine to provide a base line of understanding of the department's ability to develop the Visionary Leader.

The first part, curriculum analysis, began with the way the engineering department might educate students on leadership.

It provided a review and analysis of the published material on course content and syllabi. These documents are indicative of the ideas, goals, objectives, and images conveyed to the student.

The second part gathered data from the seniors in the program and sought answers to research questions one, two and three. The seniors were used to establish the level of student understanding of leadership through the use of The Leadership Profile (TLP) questionnaire.

The third part gathered data from the faculty using the same questionnaire to establish their knowledge of leadership. Answers to research questions four, five and six were sought to determine the faculty level of understanding of visionary leadership.

Ethical

The questionnaire was administered in strict confidence and the data collected to assure anonymous compliance. (See Appendix 3A for the IRB) The approval of the vice-chairman of the department was obtained along with the program heads' approvals. Respondents were told the questionnaire was voluntary, and that their confidentiality and that of their responses would be protected. No MSOE personnel would see the information. The researcher controlled all the data.

Questionnaires did not have a place for names, only a number. A list of the names from the department was used to verify the tool was sent to each individual and that each individual returned it. The numbers on the individual questionnaires were correlated to the list in order to keep track of the responders. Once the study was complete, list was destroyed. Data was analyzed via a third party, Dr. Marshall Sashkin who is the author of the TLP, and returned directly to the researcher.

Research Focus

The Milwaukee School of Engineering's (MSOE) EECS department, which offers the following Bachelor of Science degrees: Biomedical Engineering, Computer Engineering, Electrical Engineering, Electrical Engineering Technology, and Software Engineering. MSOE was used in this study because it typifies an engineering school from the area and the upper-central United States. This area requires many engineers (Haynes & Dinc, 1997). MSOE has a long history with the businesses within this region of producing top-notch engineers (Milwaukee School of Engineering, 2002). MSOE's mission statement is:

> MSOE will always be at the forefront of professional education with emphasis on both theory and technology,

> coupled with intensive laboratories and career practice. MSOE provides a sustained interactive educational climate for students to become well-rounded, technologically experienced graduates and highly productive professionals and leaders . . . (Milwaukee School of Engineering, 2002).

In the *US NEWS and World Report*, MSOE was ranked 13th in engineering (See Appendix 2K for comparison of schools) for schools with the highest degreed program being a master's degree for the year 2001 (*US NEWS*, 2002).

Word Analysis

The first part was the examination of the course description and syllabus for each course in the four-year electrical engineering program. This word content analysis would identify the presence of key indicators of understanding the needs of business with respect to leadership. The implication is the written documentation shows the engineering department is promoting and developing leadership among its students as demonstrated by their course descriptions and course syllabi. The analysis started with establishing the key leadership words needed to evaluate each course.

Sashkin and Sashkin (2003) put into context the idea of the visionary leader by establishing three major sets of measures:

Visionary Leadership Behavior, Visionary Leadership Characteristics, and Visionary Culture Building. The basic premise is to include the traits, behavior, and the situation to describe the leader. In defining each of the three categories for this study, specific words and ideas were generated, which were based on the works of Bass (1981), Bennis and Nanus (1985), Burns (1978), Stodgill (1948), and others that contributed to the following list and are summarized below:

The first category, Visionary Leadership Behavior, includes terms like leadership, ethics, intelligent, and leader's behavior. The second group, Visionary Leadership Characteristics, includes terms like communications skills, leader as risk taker, and leader/mentor. The third area, Visionary Culture Building, consists of terms like teamwork, visionary, global leader, and diversity. These were the terms used to review each course syllabus and description.

Four levels were established to signify what level the above words associated with a visionary leader has in relationship to the individual course. The following are the levels used in this research:

Level 1 - No leadership words are found within the course description or the syllabus relating to visionary leader.

Level 2 - Some leadership words are contained in the course description or the course syllabus relating to visionary leader.

Level 3 - Some leadership words are contained in the course description and the course syllabus. Also a part of the specific course outline related to visionary leader.

Level 4 - Some leadership words are contained in the course description and the course syllabus and are a major part of the specific course outline and curriculum.

The analysis of the syllabi and course description was done to determine if the idea of the visionary leader was conveyed. In analyzing the course description and syllabus, the number of words associated with the word leader will infer the strength by which the course covers the subject. The research required that each course within a four-year curriculum of an electrical engineering student be evaluated and charted. The overall analysis of the chart will be the next step in the word content analysis.

The last step in the process is to establish whether the combined courses through out the student's program would indicate the pedagogical strength of visionary leadership. Each university establishes their requirements to convey a minor and

major in a subject. The Jepson School of Leadership requires a core course curriculum followed by 11 courses on leadership and an internship to obtain a major in leadership. The minor entails 5 courses on leadership. (About the Jepson School of Leadership Studies, 2002) The top engineering school, MIT, requires a core curriculum to be completed, then for the Bachelor of Science Electrical Engineering major it requires approximately 18 courses. There is no minor for the Electrical Engineering Degree but minors at the university average around 6 courses (MIT, 2002). These two schools represent the best in the land and as such are being used as the criteria for establishing a measurement of a minor or a major.

For the purposes of this study, if two or three courses were solely dedicated to leadership, then the minimum requirement of knowledge as called for by research question seven on leadership will have been met. Below two or three will indicate limited or no knowledge of leadership is being transferred. A finding of four to six courses will convey achieving a minor, and above ten courses will convey the concept of achieving a major in said subject.

Individual course results were tallied to see how many courses at the level four might produce a minor in leadership. This would need a minimum of 4-5 courses as in use by the best

business universities. A major in leadership would require at least 6 - 8 courses at the level four as defined herein. ABET 2000 accreditation requires all engineering schools define goals and objectives clearly within their course description and syllabi. These goals and objectives must align with the program's and the university's goals and objectives. MSOE is ABET accredited and has been in compliance with ABET 2000 accreditation standards for the last two years. The standards are based on the need to be an outcome-based institution, while keeping an alignment of goals and objectives from school through department to individual course. This reinforces the significance of word content in answering research question seven.

Questionnaire

The next part included a questionnaire to be filled out by the approximately 120 seniors in the Electrical Engineering & Computer Science (EECS) department and its 35-core faculty. The questionnaire is called The Leadership Profile (TLP) (Sashkin 2001). The TLP has another form, which is used for students called the Leadership Competency Assessment (LCA). This format is the same as the original only reworded to facilitate the students' understanding. (For this study, the term "TLP" is used to describe both.) The focus of the TLP questionnaire is

centered on the Visionary Leader and the three categories, which make up the Visionary Leader and also its ability to measure culture building within the organization.

Leslie and Fleenor (1998) analyze 24 different survey tools regarding leadership measurement. Other survey tools such as the Multifactor Leadership Questionnaire, (MLQ) and Campbell Leadership Index were also considered, but the TLP provided a stronger measurement tool with respect to the research of this project and related well to the global environment in which leaders have to work in. The reason the TLP was picked is because of its more encompassing approach to defining leadership in transactional leadership, visionary culture building, transformational leadership behavior, and transformational leadership characteristics: "the Visionary Leader." The other survey tools did not include the organizational aspect (culture building) of leadership.

The TLP questionnaire consists of 50 questions (See TLP questionnaire in Appendix 3B) with the respondent answering each on a 5-point Likert scale. The 5-point scale uses this terminology: "To a very great extent," "To a great extent," "To a moderate extent," "To a slight extent," and "To little or no extent." Respondents were instructed to fill in the computerized form in answer to how each particular question

related to him or her. The questionnaire took about 15 minutes to fill out. (Sashkin 2001)

The TLP's three main categories are divided into 10 scales that are each made up of five items. The three main categories are transactional leadership, transformational leadership behavior, and transformational leadership characteristics. The tenth scale measures the culture building. These relate to the research questions in the following way: The transactional leadership scales (research questions three and six):

1) Capable Management. This scale measures how well the leader accomplishes the day-to-day basic administrative or managerial tasks that are necessary for any group or organization to function well in the short term.
2) Reward Equity. Effective managers find out what followers want. They promise followers what they want in exchange for good performance, and deliver on their promises.

The next four scales measured the transformational leadership behavior, which relate to research questions two and five. These are:

3) Communications Leadership. This scale assesses the ability to manage and direct the attention of others through especially clear and focused

interpersonal communication. Transformational leaders listen and pay especially close attention to those with whom they are communicating.

4) Credible Leadership. This scale deals with a leader's perceived integrity. Is the leader reliable, keeping commitments and promises? Are the leader's words consistent with her or his actions? Effective leaders "walk the talk." (Quote marks by Sashkin) That is, they establish trust by taking actions that are consistent both over time and with what they say.

5) Caring Leadership. This scale measures the degree in which a leader demonstrates respect and concern for others. Transformational leaders consistently and constantly express concern for others.

6) Creative Leadership. Some would say that effective leadership involves a willingness to take risks. Transformational leaders, however, do not take undue risks--they create opportunities.

The next three of the ten scales measured the transformational leadership characteristics, which are in research questions one and four:

7) Confident Leadership. Transformational leaders have a basic sense of self-assurance. They believe

that they can personally make a difference and have an impact on people, events, and group achievements. . . . Effective leaders believe they control their own fate.

8) Follower-Centered Leadership. Transformational leaders don't seek power and influence because they enjoy exercising power over others. Rather, they realize it is through the positive use of power and influence that they can achieve group and organizational goals. Transformational leaders use power by sharing it with followers. They empower followers to take an active role in achieving group goals.

9) Visionary Leadership. This scale measures a leader's ability to define and express clearly a future for the group or organization, both in concept and in action. Such long-term goals are based on shared values and beliefs. Transformational leaders derive these values, as well as organizational goals, from followers, at least in part.

The last scale is used to identify the cultural building ability of the respondent. It is used in conjunction with the transformational leadership characteristics. Scale ten focuses

on the organizational context and the ability of the leader to build the culture:

> 10) Principled Leadership. An effective transformational leader helps develop and support certain shared values and beliefs among group members; that is what this scale measures. These values and beliefs reflect the important and fundamental issues faced by people in groups and organizations. (Sashkin & Sashkin, 2003, pps. AII2-6)

The data collected from the use of the TLP questionnaire will be compared to the data that has been previously collected by Dr. Sashkin. This data establishes competency and knowledge of leadership in relationship to each of the categories. The data is compiled from several research studies covering thousands of people (Sashkin, 2002); most of the studies are focused on managers in business or some form of government.

In the analysis of Dr. Sashkin's data, the last scale, ten, is used only to determine if the individual has an ability to develop cultural building. The data collected in past research by Dr. Sashkin and others provide the base line by which the students and faculty were compared. The TLP questionnaire developed by Dr. Sashkin includes within the questions the ability to test if the individual is capable of

culture building. This aspect of the questionnaire provides another aspect of the research not only to include the three main categories but also to take into context the organizational aspect of visionary leadership.

Process Collection

The process in collecting the data was started by having a meeting with the program heads within the EECS department. The research project was explained, and the ethical concerns were addressed to ensure anonymity and to begin building trust. The faculty list was used to hand out to the faculty with written instructions (See Appendix 3C for the faculty instructions and Appendix 3D for the students instructions), which did detail the process to the faculty. The seniors within the department all have a senior design class, and the survey was administered at that time. The research was explained to the seniors, and they were told the survey was strictly voluntary on their part. A written format was used to explain the questionnaire to ensure no bias was introduced to the students. The process of working with the faculty and students hopefully established a trust and desire by them to fill out the questionnaire honestly. This is important because the total population of the students in the EECS department is about 120 and the total population for the faculty is about 35. The population was relatively homogeneous,

and, therefore, the returns of the survey tool should represent a normal distribution even if the response rate was 30%. The expectation was for at least a 40% return and follow-up procedures were establish to ensure this goal were obtained.

Tool Reliability and Validity

The TLP has evolved over the years from its original beginning as the Leadership Behavior Questionnaire (LBQ) in the mid-1980s by Sashkin, "Between 1984 and 1999 more than 30 independent studies were conducted investigating and testing Visionary Leadership Theory. (Sashkin, 1984; Sashkin & Rosenbach, 2001) Many of these studies were done as doctoral dissertation research projects" (Sashkin, 2002, p. 1). Many editions of the leadership questionnaire have evolved from the research criticisms. Over time, fine-tuning them has ensured their validity and reliability as a basic tool. The LBQ has evolved into the TLP and continues to be made available as an excellent, reliable, and valid questionnaire.

> The LBQ has undergone extensive testing for validity and reliability (Sashkin & Burke, 1990; Sashkin & Fulmer, 1985; Sashkin, Rosenbach, Deal & Peterson, 1992), including studies that relate its results to independent measures of performance. Sashkin, Rosenbach & Mueller (1994) demonstrated a significant

> relationship between LBQ scores and independently rated performance of district managers in a large national bank. Colyer (1997) also showed significant relationships between LBQ scores of retail store managers and several independent performance measures (dollar sales per square foot, losses due to theft). . . . Lafferty (1997), however, has demonstrated significant test-retest reliability as well as acceptable Cronbach alpha levels (greater than 0.60) for the scales of the next-generation instrument, now called The Leadership Profile. (Axelrod and Sashkin, 2001, p. 16)

In reliability, the Cronbach's alpha tests for seven studies (See Appendix 3E for total Cronbach results) for the ten scales utilized in the TLP show a high correlation of above 0.70. Item number eight shows a relatively low number and after further review showed it was actually measuring two subscales and when divided out the alphas for scale eight jumps to over 0.70. Item number nine also showed a low score and found one of the questions needed to be revised, which was done, and now shows a score of above .70 (Sashkin, 2002). The Cronbach test is generally considered a good reliability if the results are in the .70 and above range. In fact high scores indicate that the scale may have more items than necessary (Leslie, 1998). "An

alpha of .7 is generally considered acceptably high" (Leslie, 1998, p. 15).

Another measurement of the reliability is the test-retest, where the test gives the same results each time it is used as a measurement. This scale is measured in a -1.00 to +1.00 range, with a strong showing here considered in the +.4 range and above. In three different studies of hundreds of Air Force officers who participated in a ten-month leadership training program, a positive result on the test-retest shows a strong correlation in reliability of .400 or above in the relationship to the three major categories of Visionary Leadership by Sashkin (Sashkin & Sashkin, 2003).

Test - Retest Reliability Correlations

	A	B	C
Group 1: One year to two years after training program(N = 189)	.485**	.379**	.402**
Group IIa: Pre-training to post-training (N=505)	.533**	.502**	.519**
Group IIb: Post-training to one year after training	.460**	.217*	.615**
Group III: Pre-training to post-training (N=341)	.532**	.231**	.490**

A: Transactional Leadership(Sum of Scales 1 and 2)
B: Transformational Leadership Behavior (Sum of Scales 3-6)
C: Transformational Leadership Characteristics (Sum of Scales 7-10)**p<.01, *p<.05 (Sashkin & Sashkin, 2003)

This again shows the strength of the overall reliability to the TLP with the Transformational Leadership Behavior having the

lowest scores but still averaging over .332. The total average for the overall of the three groups is .447.

The validity of a questionnaire is the ability of that test to measure what one actually wishes to measure.

> Factor analyses have been conducted on three large TLP data sets (Sashkin, Rosenbach, & Sashkin, 1997). As anticipated, none of these analyses yielded a clear 10-factor solution. A detailed discussion of the rationale for this can be found in Sashkin, Rosenbach, and Sashkin (1997). In essence, the argument is simply that, in fact and in reality, the TLP behavior scales are necessarily interrelated (Sashkin, 2002).

Along with this, are the studies by Adkins (1990), McElreath (1999), Hall (1999), Coyler (1996), Higgins (1998), Stoner (1988), Sashkin, Rosenbach and Mueller (1994) and others who have tested the realm of the TLP's ability to examine the three major areas of Leadership Behavior, Leadership Characteristics and Leadership Culture as defined by the performance outcomes. The validity is called criterion validity, therefore building from the works of others to strengthen its validity. (Sashkin & Sashkin, 2003) In addition, three large tests were evaluated with a combined number of 951 observations. Sashkin and Sashkin (2003) performed a factor analysis to determine the construct validity. The results

showed significant correlation in the two transactional scales, three of the four transformational scales and the three transformational characteristics scales (2003).

The data analysis used SPSS with primary attention to correlational analysis and analysis of variance. Descriptive statistics were also generated.

CHAPTER 4

Presentation and Analysis of the Data

Overview

This chapter presents and analyzes the data collected. This study examined the Milwaukee School of Engineering's Electrical Engineering and Computer Science Department (EECS) undergraduate degree program. Its purpose was to determine how well the program provides the skills needed by graduates to be the leaders of today's businesses.

The study collected data and analyzed the results in three main areas: a word analysis of the course descriptions and syllabi in one four-year curriculum, a survey of seniors using Sashkin's TLP Leadership profile, and a similar survey administered to the faculty.

Course Syllabus and Description Results

The word analysis began with identifying key words that reflected the concept of visionary leader in three categories. The first category of Visionary Leadership Behavior included terms like leadership, ethics, intelligence, and leader's behavior. The second category of Visionary Leadership Characteristics included terms like communications skills, leader as risk taker, and leader/mentor. The third category is Visionary Culture Building and consists of terms like teamwork,

visionary, global leader, and diversity. The descriptions and syllabi of courses in the Electrical Engineering degree were analyzed to see if they contained any of the above words. Four levels were established to reflect the level that each course demonstrated leadership content. They following are the levels:

Level 1 - No words are found in the course description and syllabus.

Level 2 - Some words found.

Level 3 - Some words found and course outline revealed content specific to visionary leadership.

Level 4 - Some words found and a major part of the course contained content specific to visionary leadership.

The following table summarizes the data analyzed.

Table A - Summary

Bachelor of Science Electrical Engineering						
Model track for four years: 2001-2005						
FRESHMAN YEAR						
Course#	**Course Title**		**Level 1**	**Level 2**	**Level 3**	**Level 4**
EE-100	Intro. to Electrical Engineering			X -Team work		
MA-136	Calculus for Engineers I		X			
CS-150	Intro to Computer Programming		X			
EN-131	Composition		X			
HU-100	Contemporary Issues		X			
OR-100	Freshman Orientation				X-Time Management, Leadership	
EG-122	Eng. Graphics & Visualization		X			

MA-137	Calculus for Engineers II		X			
CH-200	Chemistry I		X			
EN-132	Technical Composition			X-Cultural Differences, Communication Skills		
MS-221	Microeconomics			X-World Economy		
MA-231	Calculus for Engineers II		X			
PH-110	Physics of Mechanics		X			
ChH-201	Chemistry II		X			
EN-241	Speech			X-Communication Skills		
HU/SS**	HU/SS Elective ** (3 Credits)					
	SOPHOMORE YEAR					
EE-201	Linear Networks: Steady State Analysis		X			
ME-255	Engineering Statistics		X			
MA-235	Differential Equations for Engineers		X			
CS-250	Intro. to Object Oriented Programming		X			
PH-230	Physics of Electricity & Magnetism		X			
EE-230	Special Network Applications		X			
EE-290	Combinational & Sequential Logic		X			
ME-256	Engineering Dynamics		X			
MA-232	Calculus for Engineers IV		X			
PH-220	Physics of Heat, Wave Motion & Optics		X			
EE-202	Linear Networks: Transient Analysis		X			
EE-291	Microprocessor Systems		X			
MS-262	Probability and Statistics		X			
PH-250	Modern Physics		X			
	JUNIOR YEAR					
EE-310	Electronic Devices & Circuits		X			
EE-392	Digital System Design		X			
MA-330	Vector Analysis		X			
ME-354	Thermodynamics and Heat Transfer		X			
Ph-360	Physics of Electronics		X			
EE-303	Signal Analysis		X			
EE-311	Electronic Networks		X			
EE-320	Electric & Magnetic Fields		X			
EE-340	Electromechanical Energy Conversion		X			
EE-300	Career & Professional Guidance			X-Team work		
EE-370	Control Systems		X			
EE-383	Computer-Aided Design		X			
EE-393	VLSI Design		X			
MS-331	Business Law			X-Ethics		
	SENIOR YEAR					
EE-401	Principles of Communications			X-Communications Skills		
EE-407	Senior Design Project I			X-Team work		
EE-412	Electronic Systems Design		X			

HU/SS**	One HU/SS Elective					
EE-?***	One EE elective					
EE-408	Senior Design II			X-Team work		
IE-423	Engineering Economy		X			
SS-461	Organizational Psychology				X-Motivation, Communication, Leadership	
HU/SS**	One HU/SS Elective					
EE-?***	One EE elective					
Elective**	One Elective from any Course					
EE-409	Senior Design Project III			X-Team work		
HU-432	Ethics for Professional Mgrs. & Engs.			X-Ethics		
HU/SS**	One HU/SS Elective					
EE-?***	One EE Elective					
Elective**	One Elective from any Course					
**The HU/SS electives are generally classes taken in the Humanities and Social Science areas.						
***The EE Electives are courses taken to strengthen the students' knowledge in Electrical Eng.						
http://www.msoe.edu/eecs/cese/courses/courselist.php						

These results do not consider the actual electives a student might take. The elective requirements include ten courses of three credits each. Electives are broken down into five required courses in the humanities and social sciences, three courses of electrical engineering from the approved program list, and two courses of free electives. The list of the humanities and social science electives for the 2001-2002 year includes areas of history, art, philosophy, government, psychology, literature cultures, and language. (See Appendix 4A for full list of courses.) The electrical engineering electives are specific to the discipline and did not show any specific leadership word association. (See Appendix 4B for list of the EE electives.) There are two free electives, and in discussions

with the students and faculty, the courses are generally used to enhance their knowledge of the discipline.

The 21 credits of electives outside the field could have been used to increase the students' exposure to leadership-related subjects. In discussions with some of the students, however, these were classes where students took basic art, history or language classes, which did not provide exposure to leadership subjects. This input from the students led to a conclusion that the electives were not used to enhance their knowledge of leadership.

Summarizing the above tables:

1) Thirty-eight courses yielded a Level 1 rating.

2) Eleven courses yielded a Level 2 rating.

3) Two courses were analyzed at Level 3, and.

4) No courses yielded a Level 4 rating.

The 11 courses at Level 2 usually had a single phrase such as "teamwork" within its description or syllabus but did not show any specific allocation of time for the subject.

The two courses at level 3 included specific words such as "time management," "leadership," "teamwork," "communication," and "teamwork." In addition, specific days in the syllabus were allocated to leadership topics.

There were no courses at Level 4, and even reviewing the electives showed that none of them could be considered at Level

4. Most of the general electives fell into the Level 1 or 2 categories, while the electrical engineering electives were in Level 1.

Overall, the number of courses that might expose the students to leadership over the entire Electrical Engineering Degree Program is limited. The word association did not produce anything close to a minor in leadership. This seems to contradict the stated goals and mission statement of the University to be developing leaders for tomorrow (MSOE, 2002). Therefore, the word association and word content analysis showed minimal exposure to leadership.

Survey Process

The TLP survey instrument was administered to both the faculty and the seniors in the department. The 35 faculty members of the department were surveyed by enclosing the questionnaire in an envelope, to be placed in the individual faculty mailboxes at the department office. Instructions were also included. (See Appendix 3C for the faculty instructions.) The Vice Chair of the department also requested the faculty and program heads respond to the survey, since the department was looking to use the results for accreditation. A total of 28 faculty filled out the questionnaire and three returned them

blank, a 90% return rate. The uncompleted surveys were destroyed.

The students were approached in their senior design classes. On hundred twenty-one seniors represented the total possible sample. There was a 70% return with 86 completed questionnaires. Three were not completed correctly, and those remaining were blank or not returned. The surveys and those not completed correctly were destroyed.

TLP Reliability

The data collected showed consistency with past reliability tests done using the Cronbach's alpha including scale 1, 3, 8, and 10 (Sashkin, 2002; Sashkin & Rosenbach, 2001). Those items showed lower then the normal ratings of .7 as an acceptable reading but consistent with the past research and the fact this was not a business but a school culture. The data for the faculty are in the following table B.

Table B: Faculty results.

FACULTY RESULTS		
Name	**SCALE**	**ALPHA**
Capable Management	**1**	**0.530**
Reward Equity	**2**	**0.821**
Communication Leadership	**3**	**0.629**
Credible Leadership	**4**	**0.805**
Caring Leadership	**5**	**0.796**

Creative Leadership	**6**	**0.743**
Confident Leadership	**7**	**0.727**
Follower-Centered Leadership	**8**	**0.521**
Visionary Leadership	**9**	**0.768**
Principled Leadership	**10**	**0.621**

The lowest Cronbach's number is still above .500 levels for the reliability for the faculty with the majority of the scales being above .600. Dr. Sashkin concluded that the above numbers fell within acceptable range given that they are not in an actual business setting. Further discussion with Dr. Sashkin indicated that the scale one might be low due to the culture being that of a school.

The students' results, shown in table C, in reliability show similar alpha scores with only scale six dropping below the .500 levels for reliability. The scale six for students produced results of .373 in Cronbach's alpha. This seems to contradict the reliability of the survey, but the faculty had a score of .743 taking the same survey. The sixth scale measures creative leadership. In effect, the person taking the survey knows that he/she is able to empower people. This indicates the faculty seemed to show they understood the questions and the students might have had problems in understanding it. The scale eight for the students showed a low number but when

divided into two subcategories as Sashkin and others have suggested (2002), the results show consistent reliability. The subcategories produced results of .594 and .545.

Table C - Students Results

STUDENT RESULTS		
Name	SCALE	ALPHA
Capable Management	1	0.571
Reward Equity	2	0.708
Communications Leadership	3	0.704
Credible Leadership	4	0.655
Caring Leadership	5	0.655
Creative Leadership	6	0.373
Confident Leadership	7	0.693
Follower-Centered Leadership** **two sub scales scores in ( )	8	0.183 (.594 & .545)
Visionary Leadership	9	0.634
Principled Leadership	10	0.543

Student& Faculty Questions

The purpose of this study was to examine the Milwaukee School of Engineering's Electrical Engineering and Computer Science Department (EECS) undergraduate degree program and how well the program provides the skills needed by the graduates to be the leaders of today's businesses. The ideal visionary leader is described as the self-actualizing leader:

> This ideal profile is unusual; very few people have extremely high scores across the board. Such scores

> are strong evidence that one is currently acting as an effective leader. Research shows that individuals in responsible positions, who score quite high in all three areas, have followers who report a high level of satisfaction as well as high productivity. . . . (Rosenbach & Sashkin, 2003)

Their scores for all three areas determine the leadership categories in which the student might arrive at. The underdeveloped manager is one who scores low in all three areas and is truly in need of development in the three areas. Scores in the 40 - 50 per cent range of the visionary leader for each of the areas is not unusual. The aspiring leader is a category in which the respondents of the survey show signs of being a visionary or self-actualizing leader but have not reached their full potential, scores in the 70 - 80 per cent range of the visionary leader are not uncommon for this classification. (Rosenbach & Sashkin, 2003)

The following shows the results specific to each research question. All of the means reported have a normal distribution curve with one standard deviation from the mean. The scoring will be compared to the self-actualizing leader profile described earlier. This comparison is only to establish at what level do the faculty and students have knowledge of the Visionary Leader as profiled by Dr. Sashkin's evaluation tool

(2002). The first three questions dealt with the students and the next three with the faculty and the seventh question will be analyzed last.

RQ1: To what extent do the seniors in the studied department emulate Transformational Leadership Characteristics?

The transformational leadership characteristics, table D, show the mean scores of the 86 students for each of the questions in scale seven: Confident Leadership; scale eight: Follower - Centered Leadership; and scale nine: Visionary Leadership. The total for the students is 54.77 out of possible 75 total points.

Table D - Transformational Leadership Characteristics

Question Numbers	Students: N=86
7	3.59
8	4.08
9	3.38
17	3.53
18	3.85
19	3.22
27	3.67
28	3.45
29	3.8
37	4.02
38	3.08
39	3.6
47	3.87
48	3.51
49	4.12
Totals	54.77

The score for the self-actualizing leader in the transformational leadership characteristics category is considered positive if above 64, meaning that the students do show signs of the transformational leadership characteristics (Rosenbach & Sashkin, 2003).

RQ2: To what extent do the seniors in the studied department emulate Transformational Leadership Behavioral skills?

The transformational leadership behavior, table E, show the mean scores of the 86 students for each of the questions in scale 3: Communication Leadership; scale four: Credible Leadership; scale five: Caring Leadership; and scale six: Creative Leadership. The total for the students is 75.34 out of possible 100 total points.

Table E - Transformational Leadership Behavior

Question Numbers	Students: N=86
3	3.79
4	4.3
5	4.26
6	2.79
13	3.57
14	4.03
15	3.81
16	3.45
23	3.57
24	4.16
25	3.75
26	3.69
33	3.28
34	3.69
35	4.33

36	**4.26**
43	**3.58**
44	**3.5**
45	**3.73**
46	**3.8**
Totals	**75.34**

The score for the self-actualizing leader in the transformational leadership behavior category is considered positive if above 85, the score for the students' means that the students do exhibit the building blocks of transformational leadership behavior (Rosenbach & Sashkin, 2003).

RQ3: To what extent do the seniors in the studied department emulate the Transactional Leadership Characteristics?

The transactional leadership characteristics, table F, show the mean scores of the 86 students for each of the questions in scale one: Capable Management; and scale two: Reward Equity. The total for the students is 38.39 out of possible 50 total points.

Table F - Transactional Leadership

Question Numbers	**Students: N=86**
1	**3.8**
2	**4.3**
11	**3.71**
12	**4.12**
21	**3.65**
22	**4.08**
31	**3.84**
32	**3.61**
41	**3.8**
42	**3.48**

Totals	38.39

The score for the self-actualizing leader in the transactional leadership characteristics is considered positive if above 43, meaning that the students do show signs of the transactional leadership (Rosenbach & Sashkin, 2003).

RQ4: To what extent do the faculty in the studied department exemplify Transformational Leadership Characteristics?

The transformational leadership characteristics, table G, show the mean scores of the 28 faculty members for each of the questions in scale 7: Confident Leadership; scale eight: Follower - Centered Leadership; and scale nine: Visionary Leadership. The total for the faculty is 57.43 out of possible 75 total points.

Table G - Transformational Leadership Characteristics Faculty

Question Numbers	Faculty: N=28
7	4
8	4.5
9	3.68
17	3.79
18	4.25
19	3.5
27	3.86
28	3.61
29	4
37	4.21
38	2.65
39	3.5

47	**3.88**
48	**3.89**
49	**4.11**
Totals	**57.43**

The score for the self-actualizing leader in the transformational leadership characteristics is considered positive if above 64, meaning that the faculty does show signs of the transformational leadership characteristics (Rosenbach & Sashkin, 2003).

RQ5: To what extent do the faculty in the studied department exemplify Transformational Leadership Behavior? The transformational leadership behavior, table H, show the mean scores of the 28 faculty members for each of the questions in scale three: Communication Leadership; scale four: Credible Leadership, scale five: Caring Leadership; and scale six: Creative Leadership. The total for the faculty is 78.49 out of possible 100 total points.

Table H - Transformational Leadership Behavior

Question Numbers	**Faculty: N=28**
3	**3.93**
4	**4.37**
5	**4.25**
6	**3.22**
13	**3.71**
14	**4.36**
15	**4.11**
16	**3.46**
23	**3.62**
24	**4.46**
25	**3.96**

26	**3.75**
33	**3.25**
34	**4.14**
35	**4.5**
36	**4.19**
43	**3.93**
44	**3.79**
45	**3.85**
46	**3.64**
Totals	**78.49**

The score for the self-actualizing leader in the transformational leadership behavior category is considered positive if above 85, meaning that the faculty does show signs of the transformational leadership behavior (Rosenbach & Sashkin, 2003).

RQ6: To what extent do the faculty in the studied department exemplify Transactional Leadership Characteristics?

The transactional leadership characteristics, table I, show the mean scores of the 28 faculty members for each of the questions in scale one: Capable Management; and scale two: Reward Equity. The total for the faculty is 40.73 out of possible 50 total points.

Table I - Transactional Leadership Faculty

Question Numbers	**Faculty: N=28**
1	**4.25**
2	**4.43**
11	**4**
12	**4.14**
21	**4.3**
22	**4.04**

31	**4.25**
32	**3.54**
41	**3.89**
42	**3.89**
Totals	**40.73**

The score for the self-actualizing leader in the transactional leadership characteristics category is considered positive if above 43, meaning that the faculty does show signs of transactional leadership (Rosenbach & Sashkin, 2003).

RQ7: To what extent does the studied department develop the Visionary Leader needed for today's businesses?

The survey shows a strong indication that the faculty and the senior students show a strong relationship to developing leadership as a visionary leader. The results show the building blocks are in position by which the students can grow into the visionary leader. The summary table J shows the similarities between the two groups, with the faculty showing a stronger indication toward visionary leadership. According to Dr. Sashkin's results the students and the faculty would fall into the aspiring leader category. This level shows consistent signs of the self-actualizing leader but has not reached the 100% level in each of the three categories.

Table J - Summary

Leadership Defined	**LCA scores**	**Faculty**	**Students**
Transformational Leadership Characteristics	**64**	**57.43**	**54.77**

Transformational Leadership Behavior	**85**	**78.49**	**75.34**
Transactional Leadership	**43**	**40.73**	**38.39**

The faculty is consistently higher in all areas and understandably should be. The important fact here is the mirror image, in which the students shadow the faculty in each of the categories to reach for the visionary leader of tomorrow. This score indicates that the faculty and the students would be in the "The Aspiring Leader" category. They didn't meet the standard for the visionary leaders but they fell into the aspiring leader category.

> The person with a profile that is average in each of the three areas of leadership is in an excellent position for growth and development. Like the underdeveloped manager, this person is not overly focused on any one area. The aspiring leader has sound (if basic) managerial capabilities and may already look toward the challenge of transformational leadership. This person may feel a degree of frustration, too, having some idea of what he or she is reaching for but not seeing a clear path to that goal. A common strategy is to try even harder as a manager; but this only creates more frustration. What is effective in a managerial role is not necessarily relevant for successful leadership. An initial action

step might be to continue to build management skills while assessing one's abilities and development needs as a transformational leader. (Rosenbach & Sashkin, 2003, p. 13)

The culture building was analyzed using scale ten of the survey. This criterion is centered on the idea of sharing of values and or beliefs. Scale ten is the ability of the leader to create consensus and teamwork to guide the group toward their goals and objectives. Table K shows the results from this survey, and both the faculty and students show promise with scoring 20.12 and 19.27 respectively out of 25 total points.

Table K

Culture Building		
Question Numbers	**Faculty**	**Students**
10	**4.33**	**4.21**
20	**3.44**	**3.4**
30	**4.14**	**3.88**
40	**4**	**3.98**
50	**4.21**	**3.8**
Total	**20.12**	**19.27**

The word association and word analysis do not indicate the development of visionary leadership within the four-year course work. The curriculum fails to develop the leadership qualities of the students. This fact contradicts the summary report and the culture building question, but the survey indicates that the development of visionary leadership is taking place. The

building blocks for the students to be the visionary leader are in place according to the survey results. In fact the survey results indicate the faculty and the students to be Aspiring Leaders.

Chapter 5

Summary, Conclusions, and Recommendations

Overview

The objective of this chapter is to summarize the research with respect to the question: "Is Visionary Leadership developed in an electrical engineering program at the undergraduate level?" The research of this topic was analyzed through the seven questions:

RQ1: To what extent do the seniors in the studied department emulate Transformational Leadership Characteristics?

RQ2: To what extent do the seniors in the studied department emulate Transformational Leadership Behavioral skills?

RQ3: To what extent do the seniors in the studied department emulate the Transactional Leadership Characteristics?

RQ4: To what extent do the faculty in the studied department exemplify Transformational Leadership Characteristics?

RQ5: To what extent do the faculty in the studied department exemplify Transformational Leadership Behavior?

RQ6: To what extent do the faculty in the studied department exemplify Transactional Leadership Characteristics?

RQ7: To what extent does the studied department develop the Visionary Leader needed for today's businesses?

Specifically the research focused on Sashkin & Rosenbach's definition of visionary leadership and how the four-year curriculum at a private undergraduate engineering university in the Electrical Engineering and Computer Science Department prepares the visionary leaders needed in today's global economy. The chapter will be presented in three major sections: The first section is the summary of the study, the second section is the conclusions, and the final section is recommendations.

Summary

The purpose of the study was to examine the Milwaukee School of Engineering's Electrical Engineering and Computer Science Department (EECS) undergraduate degree program with respect to visionary leadership. The research focused on how well the programs provide the skills needed for graduates to be the leaders of today's businesses. The literature review analyzed the development and history of leadership, business schools, and engineering schools. Significant in the literature review was the lack of information specifically on leadership

development within an engineering undergraduate program. Few studies analyzed the development of leadership in engineers, despite that many CEOs or other executives come from a technical or engineering background (Bassiry, 1991; Bassiry and Dekmefian, 1990; Neff and Citrin, 1999). As stated earlier, in a survey of 50 CEOs of the 100 best companies by Industry Week, Miller (1997) stated the educational background of the CEOs included 16 with business degrees, 15 with engineering degrees, and other fields made up the rest. This equates to approximately 33% of CEOs coming from an engineering background. Other studies have shown similar findings for engineering/technical degreed CEOs (Bassiry, 1991; Bassiry and Dekmefian, 1990; Neff and Citrin, 1999). These figures show that engineering programs should broaden their curricula to include leadership development skills that businesses need. The Jepson School of Leadership first recognized the emergence of leadership and eventually designed a degree in leadership at the undergraduate level (Jepson, 2002).

The steps toward the knowledge of leadership can trace their roots back to "The Great Man Theory" (Bass & Stodgill, 1990; House & Aditya, 1997; Gibb, 1947; Jago, 1982; Jenkins, 1947; Northouse, 2001; Stodgill, 1948). Over time, researchers continued to add to the knowledge of leadership. Studies separated and combined theories that led to the concept of the Visionary Leader. The theory of a Visionary Leader is both

transformational and transactional while building the culture of the company for the future (Rosenbach & Sashkin, 2003).

Rosenbach and Sashkin (2003) defined a visionary leader in a manner that could be measured by a survey instrument called the "The Leadership Profile." A visionary leader needs to have the correct amount of transformational leadership behavior, transformational leadership characteristics, and transactional leadership along with the ability to build the culture.

Transformational leadership behavior is defined as having the skills in such areas as communication, credibility, caring, and creative leadership. The visionary leader needs more than just the behavior or skills; the leader also needs the transformational characteristics like confidence leadership, follower-centered leadership, and visionary leadership. It is not required that the leader has one or the other, but the individual should have the right amount of both to allow the followers to reach beyond their individual capabilities. This in turn leads to the need for the transactional leadership characteristics such as capable management and reward equity. The transactional leader has the proper mix of ability to manage the day-to-day activities while concurrently recognizing the effective reward for the followers to respond in a positive manner. Included within this survey tool is the ability to measure culture building or organizational context. This adds

the dimension of group and the setting in which they are working in (Rosenbach and Sashkin, 2003). The concept of the Visionary Leader combines the histories of management and leadership with several of the theories to establish the basis upon which to measure the leader effectively.

Conclusions

The methodology used in this study evolved from extensive review of the literature and the establishment and execution of a comprehensive analysis of the EECS department' ability to develop students into leaders. This is significant because very little research has been done on how well engineering schools are providing the skills needed to be that leader, which is research question seven. The research consisted of three parts: The first part analyzed the word content of courses as they reflected Visionary Leadership within a four-year curriculum, an overview of the engineering program as part of research question seven. In the second part, the faculty who delivers the courses were surveyed analyzing this in research questions four, five and six. The third part consisted of surveying the seniors in the department, analyzing this from research question one, two and three.

The data collected from the use of the TLP questionnaire was compared to the data that had been established by Dr.

Sashkin, author of the TLP. This data establishes competency and knowledge of leadership in relationship to each of the categories and culture building. The data is compiled from several research studies covering thousands of people (Sashkin, 2002). Most of the studies were focused on managers in business or in some form of government.

The student data did identify the knowledge the students have of the Visionary Leader in relationship to Dr. Sashkin's data. The faculty data did establish their competency of Visionary Leadership in relationship to Dr. Sashkin's data. The data collected did provide a template by which to profile the group's ability to communicate what a Visionary Leader is. The multifaceted cross-sectional study was enhanced by now having the analysis of the written communication, the evaluation of the products, the students' perception of the visionary leader, and finally the faculty who deliver the communication through their actions and beliefs.

The content analysis part of the study looked for three categories of terminology related to visionary leadership. The first category, visionary leadership behavior, included terms such as leadership, ethics, intelligence, and behavior. The second category, visionary leadership characteristics, included terms such as communications skills, leader as risk taker, and leader/mentor. The third category, visionary culture building,

consisted of terms like teamwork, visionary, global leader, and diversity.

Course descriptions and course syllabi were reviewed to find terms related to these three categories. The analysis showed only a slight presence of the specific word related to visionary leadership. Over 95% of the classes did not address leadership in the written form, leading to the assessment that there is lack of attention given to facilitating visionary leadership development.

Specific results showed 11 courses having minor content associated with leadership and only two courses having a chapter or specific class time related to it. This yielded the conclusion that there is the lack of leadership development in course of study in the program. This takes the assumption that the written documents are a good indicator of the outcomes, developing the leaders of tomorrow. This assumption would need further testing to be proven correct and in reality may prove to not be a good indicator of leadership development.

The faculty and students were surveyed using the instrument Leadership Competency Assessment that is The Leadership Profile for students and those who do not have specific business or organizational background. (Rosenbach and Sashkin, 2003)

RQ1: How well do the seniors in the EECS department emulate the Transformational Leadership Characteristics?

In this question the results produced an ability on the students part to become visionary leaders using Sashkin's Leadership Competency Assessment. Their scores indicated them to be in the Aspiring Leader category. They were in the 75% range and above in reaching the visionary level scores. This shows great promise to be leaders of vision, yielding the possibility that leadership development is occurring within the electrical engineering program.

RQ2: How well do the seniors in the EECS department emulate the Transformational Leadership Behavioral skills?

In this question the results produced an ability on the students part to become visionary leaders using Sashkin's Leadership Competency Assessment. Their scores indicated them to be in the Aspiring Leader category. They were in the 75% range and above in reaching the visionary level scores. This shows great promise to be leaders of vision, yielding the possibility that leadership development is occurring within the electrical engineering program.

RQ3: How well do the seniors in the EECS department emulate the Transactional Leadership Characteristics?

In this question the results produced an ability on the students part to become visionary leaders using Sashkin's Leadership Competency Assessment. Their scores indicated them to be in the Aspiring Leader category. They were in the 75% range

and above in reaching the visionary level scores. This shows great promise to be leaders of vision, yielding the possibility that leadership development is occurring within the electrical engineering program.

RQ4: How well do the faculty in the EECS department exemplify the skills of the Transformational Leadership Characteristics?

In this question the results produced an ability of the faculty to become visionary leaders using Sashkin's Leadership Competency Assessment. Their scores indicated them to be in the Aspiring Leader category. They were in the 75% range and above in respect to reaching the visionary level scores. This shows great promise to be leaders of vision resulting in the possibility that leadership development is occurring with in the electrical engineering program.

RQ5: How well do the faculty in the EECS department exemplify the skills of the Transformational Leadership Behavior?

In this question the results produced an ability of the faculty to become visionary leaders using Sashkin's Leadership Competency Assessment. Their scores indicated them to be in the Aspiring Leader category. They were in the 75% range and above in respect to reaching the visionary level scores. This shows great promise to be leaders of vision yielding the possibility

that leadership development is occurring with in the electrical engineering program.

RQ6: How well do the faculty in the EECS department exemplify the skills of the Transactional Leadership Characteristics?

In this question the results produced an ability of the faculty to become visionary leaders using Sashkin's Leadership Competency Assessment. Their scores indicated them to be in the Aspiring Leader category. They were in the 75% range and above in respect to reaching the visionary level scores. This shows great promise to be leaders of vision, resulting in the possibility that leadership development is occurring with in the electrical engineering program.

The summary table, L, shows very positive results with the students and faculty, both groups establishing a positive score in all areas. The LCA scores indicate what a visionary leader might have scored in taking the survey. Both the students and the faculty are with in the 85% of the visionary leader scores, concluding that the faculty and the students are on their way to developing the characteristics/behaviors of the visionary leader. The faculty had a slightly stronger showing than the students in all of the areas.

Table L Summary

Leadership Defined	LCA scores	Faculty	Students
Transformational Leadership Characteristics	64	57.43	54.77
Transformational Leadership Behavior	85	78.49	75.34
Transactional Leadership	43	40.73	38.39

The conclusion from the results of the survey indicates a strong development of visionary leadership. The students and faculty scored below the data established by Sashkin and others, but were within 10% of the target score of a visionary leader. Dr. Sashkin and Dr. Rosenbach confirmed that the data they have collected thus far shows the 10% to be well within the norms of the other studies. (Sashkin, M., Rosenbach, W. E., & Mueller, R. 1994). In effect, both the students and the faculty have strong potential in becoming Visionary Leaders per the outcome of the surveys.

One point to note: creative leadership in scale six results showed the reliability was low for the students. This showed a large range of 2.79 to 4.26, creating the concern about reliability. These numbers are the actual range of scores for the individual students and when using the Cronbach test a score of .373 was obtained.

This scale focuses on the empowerment and the ability of the leader to create opportunities for others to succeed. The faculty taking this same survey scored high in this area, .743. The conclusion or inference from this is the students' inability to clearly understand the willingness to take risks through others, and whether they are ready to empower others to accomplish the goals. The results may also emanate from the respondents' being students and, therefore they have not yet had the opportunity to be mentors or establish work requirements that require them to be mentors.

Another concern was the Cronbach scores of less than .7. Further analysis and discussion with Dr. Sashkin showed the results were not far from the scores from past research. Dr. Sashkin indicated that this might also be due to the culture of a school and not a business. The scores of the past have been based mainly on business culture. This research was limited to an exploratory study of an educational institution and more research would be needed in this environment to determine the true reasons for this outcome.

The culture building was analyzed using scale ten of the survey. This criterion is centered on the idea of sharing of values and/or beliefs. Scale ten is the ability of the leader to create consensus and teamwork to guide the group toward their goals and objectives. The conclusion drawn from this survey

question is that the students and faculty indicate they have a strong understanding of the culture building requirements to be a visionary leader of today's business. They scored above the 75 percentile of the visionary leader.

RQ7: How well does MSOE's EECS department develop the Visionary Leader needed for today's businesses?

This exploratory research utilized the word content and the Leadership Competency Profile to establish a base line of information to answer this question. The word content did not show the positive results of the Competency Leadership Profile in the programs ability to develop the leaders of tomorrow. Given the results from the questionnaire the researcher is concluding that the school maybe developing the visionary leaders of tomorrow.

The research questions essentially analyzed each of the three components and culture building of the Visionary Leader described by Sashkin, (2003) in relationship to the faculty and the students. It is interesting to note how close the scores of the two groups came in taking the survey, indicating a strong correlation between the ones who are delivering the messages and those who are receiving them. This also contradicts the content analysis result of their being little offered to learn about leadership. The contradiction shows the students have a strong basis for visionary leadership despite the lack of specific

course content focused on leadership. This ties directly to the purpose of the research: Does the EECS programs develop the skill needed by graduates to be the leaders of tomorrow's businesses? One can only infer that visionary leadership education is being accomplished within the department. The research is a limited study and further investigation is needed in this area, specifically in the dynamics of how it occurs since the course descriptions and syllabi do not show it.

Recommendations

The literature review indicates the need for more research and studies relating to engineering and leadership. The lack of research opens the doors to many opportunities for analysis of leadership within engineering programs in the undergraduate level. The focus of this study showed a positive result within a private university that utilizes engineering professors who have worked in the business world for at least five years before they began teaching. Further research is needed within the engineering schools to address the researcher's findings that seemingly contradict each other.

In this exploratory study the main question was how well does the MSOE engineering program develop the students to be leaders of businesses. There was a clear indication in the results of the surveys that a positive trend existed toward

developing the Visionary Leader. The written documentation of what the programs and faculty do shows there is little if any published focus on leadership development. This raises the question, where did the leadership development come from? Was it in the hands-on approach the school has long been noted for, the application focused professors, the strong relationship with the many businesses and their leaders, the one-to-one relationships between the faculty and students, or some combination of the above? The opportunity for further research in this area would require a longitudinal study, tracking the students from the beginning to the end of their four years. This project sought to develop a basis to begin to probe deeper into the engineering programs and to facilitate their growth into the leadership arena. It was very interesting to see both the faculty and the students' score relatively high in the survey. One might have thought the faculty would score higher than the students perhaps showing a need for more structured class work.

Another important area is the development of creative leadership for the students in scale six. Statistics from this scale clearly indicate a need to identify why there is a loss of understanding or a lack of knowledge with respect to empowerment. More research is needed to identify the reasons for this to develop the students who wish to be leaders of today's dynamic global business world further.

The research project began with trying to see how well engineering programs develop the students to be Visionary Leaders. The conclusion shows that the word analysis indicates a lack of structured class time being devoted to leadership concepts. The research also shows the positive results that the survey indicated in comparing both the faculty and the students to the self-actualizing leader. Therefore, overall the EECS department is providing the groundwork for the leaders of today's business. On the other hand, the research indicates that the knowledge on leadership is not coming from the structure within the institution. Recognizing that the APICS certification requires the school to document what they say and do what they say. Additional research addressing the following questions seems appropriate: (a) Do the students have this knowledge before they enter the school? (b) How is the faculty influencing the outcome? (c) Do the outside business relationships with the department contribute to the leadership development? (d) Does the faculty background in having to work in business prior to teaching at the university influence the students? And, (e) Do the one-on-one relationships between the faculty and students become a contributing factor to leadership development?

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APPENDIX 2

2A.

Management Functions

Planning: The management function of deciding what to do in the future; setting goals and establishing the means to attain them.

Organizing: The management function of developing a structure of interrelated tasks and allocation people and resources within this structure.

Leading: The management function of encouraging and guiding employees' efforts toward the attainment of organizational goals and objectives.

Controlling: The management function of evaluating the performances of an organization or organizational unit to determine whether it is progressing in the desired direction. (Wagner, III, & Hollenbeck, 1992, p. 25-28)

2B

Fayol developed the following fourteen management principles and suggested that managers receive formal training in their application.

1. **Division of labor.** The more people specialize, the more efficiently they can perform their work.
2. **Authority.** Mangers have the right, the authority, to give orders to things done.
3. **Discipline.** Members of an organization need to respect the rules and agreements that govern it.
4. **Unity of command.** Each employee must receive instructions about a particular operation from only one person to avoid conflicting instructions and confusion.
5. **Unity of direction.** Managers should coordinate the efforts of employees working on projects, but only one should be responsible for an employee's behavior.
6. **Subordination of individual interest to the common good.** The interests of individual employees should not take precedence over the interests of the entire organization.
7. **Remuneration.** Pay for work done should be fair to both the employee and employer.
8. **Centralization.** Mangers should retain final responsibility but should also give their subordinates enough authority to do their jobs properly.
9. **Scalar chain.** A single uninterrupted line of authority (often represented by the neat boxes and lines of an organization chart) should run rank to rank from top management to the lowest level position in the company.
10. **Order.** Materials and people should be in the right place at the right time, In particular, people should be in the jobs or positions best suited to them.
11. **Equity.** Managers should be both friendly and fair to their subordinates.
12. **Stability and tenure of staff.** A high rate of employee turnover is not efficient.
13. **Initiative.** Subordinates should be given the freedom to formulate and carry out their own plans.
14. **Esprit di corps.** Promoting team spirit gives the organizations a sense of unity. (Hellriegel, Jackson, & Slocum, 1999, pp. 53-54)

2C
Organizational Changes

Concepts	**19th Century**	**20th Century**	**21st Century**
Theory of person hood	Interchangeable muscle and energy.	A subordinate with a hierarchy of needs	Autonomous and reflexive individual
Information and knowledge	The province of management alone	Management-dominated and shared on a limited basis	Widely diffused
The purpose of work	Survival	Accumulation of wealth and social status	Part of a strategic life plan
Identification	With the firm and/or with working class	Identify with a social group and/or the firm	The disenfranchised self
Conflict	Disruptive and to be avoided	Disruptive but tolerated and can be settled through collective bargaining	A normal part of life
Division of labor	Mangers decide, employees execute	managers decide, employees execute thoughtfully	Employees and managers decide and execute
Power	Concentrated at the top	Limited, functional sharing/empowerment	Diffused and shared

(Bouchikhi & Kimberly, 2000, p. 215)

2D
'Built to Last'
Ten Tenets

1) **Clock Building, Not Time Telling.** The idea is to build something greater than the individuals, something that will pass the test of time. Along with the choice of both and not the 'or' propositions in normal management. The idea to stretch to choose more than one idea.
2) **More Than Profits.** A business cannot continue to exist on the main motive of money. The Best of the Best incorporate greater values to which they embrace, such as people first.
3) **Preserve the Core/Stimulate Progress.** In essence it is imperative for the company to know thyself and stay true to that. This does not mean never change but to keep the core alive and adapting to the future.
4) **Big Hairy Audacious Goals.** Defy the odds and reach for the shinning star. Keep the company stretching for the vision of the big goal.
5) **Cult-Like Cultures.** From day one the new employee is inundated with the philosophy of the company's history practices and vision of the future. In essence a brain-washing to ensure the vision is carried into the future.
6) **Try a Lot of Stuff and Keep What Works.** In the Best of the Best studies, those who kept trying and were not afraid of failures outperformed all others. Encouraging new ideas and not the fear if one fails.
7) **Home Grown Management.** Build from with in through training, education and high expectations to lead the company into the future beyond the needs of those currently in charge.
8) **Good Enough Never Is.** It is not a choice of short term over long-term performances, but both. It is management's requirement to hold themselves up to the high performance and expectations of the now while incorporating plans for the long term. Constantly pushing the envelope of both.
9) **The End of the Beginning.** It is not important as to the present is for but the idea is for the continuous reaching out of new beginnings with in the company. Building not for today but for the constant changing future.
10) **Building the Vision.** Clear and precise articulated vision to show the direction of the company. Creating the core to constantly challenge the company to new heights. (Collins, & Porras, 1997)

2E

Managerial Grid

1,9 Country Club Management: (Bold by author) Thoughtful attention to the needs of the people of satisfying relationships leads to a comfortable, friendly organization atmosphere and work tempo.

9,9 Team Management: Work accomplishment is from committed people; interdependence through a "common stake" (quote marks by Hughes) in organization purpose leads to relationships of trust and respect.

5,5 Middle-of-the-Road Management: Adequate organization performance is possible through balancing the necessity to get work out while maintaining morale of people at a satisfactory level.

1,1 Impoverished Management: Exertion of minimum effort to get required work done is appropriate to sustain organization management.

9,1 Authority-Compliance Management: Efficiency in operations results from arranging conditions of work in such a way that human elements interfere to a minimum degree. (Hughes, Ginnett, & Curphy, 1999)

2F

ABET's Strategic Plan - 12 Goals

Strategic Plan (Bold by author for all of this section)

Goal 1 - Develop and operate accreditation systems of the highest quality

Objectives:

- Develop and provide a model structure and process for accreditation of engineering, technology and applied science programs
- Implement Engineering Criteria 2000
- Develop systems to monitor interim quality assurance Implement performance-based accreditation for engineering technology programs
- Develop comprehensive training and evaluation programs for evaluators and commissioners
- Streamline and simplify accreditation practices

(Bullets by Author for all of this section)

Goal 2 - Increase participation of engineering technology and related programs in ABET accreditation
Objectives:

- Develop an outreach program for two- and four-year-degree granting institutions
- Increase participation of practitioners and two-year-program educators as evaluators and commissioners

Goal 3 - Develop a broader program in international activities
Objectives:

- Increase international accreditation activities
- Expand international consultancy initiatives
- Establish credentialing programs
- Expand mutual recognition agreement initiatives

Goal 4 - Recognize programs that promote educational quality and innovation
Objectives:

- Establish award and recognition programs for institutions, faculty, companies, to and so forth.

2F-Con't.

- Identify and disseminate educational best practices
- Cooperate with other organizations to develop programs that promote educational quality and innovation

Goal 5 - Expand diversity of participation in ABET
Objectives:

- Proactively enhance recruitment of evaluators and commissioners
- Expand industry's knowledge of the value of ABET and its activities
- Enhance the participation of the ABET Industry Advisory Council
- Increase the numbers of those historically under-represented in ABET to reflect the full spectrum of participants in the engineering community

Goal 6 - Encourage and accommodate new educational paradigms
Objectives:

- Examine feasibility of multi-level accreditation
- Assist engineering disciplines in defining the first degree for professional practice
- Develop the capability to evaluate programs that use alternative educational delivery systems
- Determine ABET's role in continuous professional development

Goal 7 - Promote professional recognition
Objectives:

- Establish the ABET/EAC-accredited degree as an acceptable entry into professional practice internship
- Address the apparent disparity between the completion of an ABET accredited engineering program and passage of the Fundamentals of Engineering examination
- Clarify ABET's role in governmental and non-governmental recognition
- Address the relationships among engineering, engineering technology and applied science

Goal 8 - Enhance effectiveness of relationships with Participating Bodies
Objectives:

2F-Con't.

- Improve communication with boards, education departments and membership
- Facilitate and improve training coordination among Participating Bodies

Goal 9 - Strengthen support for and participation in ABET
Objectives:

- More clearly articulate the value of ABET Inform the public of the value of ABET accreditation
- Increase student awareness and understanding of the value of ABET accreditation
- Increase the number of academic institutions, societies and companies actively involved in ABET activities

Goal 10 - Ensure financial resources for future needs
Objectives:
Control accreditation costs Generate appropriate additional revenue sources Utilize cost-effective technologies in ABET's operations
Goal 11 - Establish an ABET internal continuous improvement process
Objectives:

- Incorporate greater use of information technology in operations
- Develop a system of benchmarks to measure performance
- Establish staff development programs

Goal 12 - Examine ABET's governance and structure
Objectives:

- Review and clarify the roles and responsibilities of the organizational elements of ABET
- Create a feedback system for changes, revisions, amendments, improvements and incorporation of new ideas
- Organize headquarters to support the strategic plan. (ABET, 2002)

2G

2000 Criteria

I. Objectives of Accreditation (Bold by author)
The ABET accreditation process is a voluntary system of accreditation that:

1. assures that graduates of an accredited program are adequately prepared to enter and continue the practice of engineering;
2. stimulates the improvement of engineering education;
3. encourages new and innovative approaches to engineering education;
4. identifies these programs to the public.

II. Basic-Level Accreditation Criteria
It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria.

Criterion 1. Students
An important consideration in the evaluation of an engineering program is the quality and performance of the students and graduates. The institution must evaluate, advise, and monitor students to determine its success in meeting program objectives.

Criterion 2. Program Educational Objectives
Each engineering program for which an institution seeks accreditation or reaccreditation must have in place:

a) detailed, published educational objectives that are consistent with the mission of the institution and these criteria;
b) a process based on the needs of the program's various constituencies in which the objectives are determined and periodically evaluated;
c) a curriculum and process that ensures the achievement of these objectives; and
d) a system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program.

Criterion 3. Program Outcomes and Assessment
Each program must have an assessment process with documented results. Evidence must be given that the results are applied to the further development and improvement of the program. The assessment process must

2G con't.

demonstrate that the outcomes important to the mission of the institution and the objectives of the program are being measured. Evidence that may be used includes, but is not limited to, the following: student portfolios, including design projects; nationally normed subject content examinations; alumni surveys that document professional accomplishments and career development activities; employer surveys; and placement data of graduates. Engineering programs must demonstrate that their graduates have:

a) an ability to apply knowledge of mathematics, science, and engineering;
b) an ability to design and conduct experiments as well as to analyze and interpret data;
c) an ability to design a system, component, or process to meet desired needs;
d) an ability to function on multidisciplinary teams;
e) an ability to identify, formulate, and solve engineering problems;
f) an understanding of professional and ethical responsibility;
g) an ability to communicate effectively;
h) the broad education necessary to understand the impact of engineering solutions in a global/societal context;
i) a recognition of the need for and an ability to engage in lifelong learning;
j) a knowledge of contemporary issues; and,
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The institution must have and enforce policies for the acceptance of transfer students and for the validation of credit for courses taken elsewhere. The institution must also have and enforce procedures to assure that all students meet all program requirements.

Criterion 4. Professional Component

The Professional Component requirements specify subject areas appropriate to engineering, but do not prescribe specific courses. The engineering faculty must assure that the curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution. The curriculum must prepare students for engineering practice culminating in a major design experience based on the knowledge and skills acquired in earlier coursework and incorporating engineering standards and realistic constraints that include most of the following considerations: economic, environmental, sustainability, manufacturability, ethical, health and

2G con't.

safety, social, and political. The professional component must include:

a) one year of college-level mathematics and basic sciences (some with experimental experience) appropriate to the discipline;
b) one and one-half years of engineering topics, to include engineering sciences and engineering design appropriate to the student's field of study; and,
c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

Criterion 5. Faculty

The heart of any educational program is the faculty. The faculty must be of sufficient number, and must have the competencies to cover all of the curricular areas of the program. There must be sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners as well as employers of students. The faculty must have sufficient qualifications and must ensure the proper guidance of the program, its evaluation and development. The overall competence may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and registration as professional engineers.

Criterion 6. Facilities

Classrooms, laboratories, and associated equipment must be adequate to accomplish the program objectives and provide an atmosphere conducive to learning. Appropriate facilities must be available to foster faculty-student interaction and to create a climate that encourages professional development and professional activities. Programs must provide opportunities for students to learn the use of modern engineering tools. Computing and information infrastructures must be in place to support the scholarly activities of the students and faculty and the educational objectives of the institution.

2G con't.

Criterion 7. Institutional Support and Financial Resources
Institutional support, financial resources, and constructive leadership must be adequate to assure the quality and continuity of the engineering program. Resources must be sufficient to attract, retain, and provide for the continued professional development of a well-qualified faculty. Resources also must be sufficient to acquire, maintain, and operate facilities and equipment appropriate for the engineering program. In addition, support personnel and institutional services must be adequate to meet program needs.

Criterion 8. Program Criteria
Each program must satisfy applicable program criteria. Program criteria provide the specificity needed for interpretation of the basic level criteria as applicable to a given discipline. Requirements stipulated in the program criteria are limited to the areas of curricular topics and faculty qualifications. If a program, by virtue of its title, becomes subject to two or more sets of program criteria, then that program must satisfy each set of program criteria, understanding that overlapping requirements need to be satisfied only once. (Huband, 1998, pp. 13-16)

2H

MIT's Undergraduate Curriculum

Degree Chart for Course VI (2001-2002)

Bachelor of Science in Electrical Science and Engineering, Course VI-1
Bachelor of Science in Electrical Engineering and Computer Science, Course VI-2
Bachelor of Science in Computer Science and Engineering, Course VI-3
Those receiving simultaneous award of Master of Engineering in Electrical Engineering and Computer Science/Course VI-P: See Course description of VI-P.
The program for freshmen entering in the summer of 2001 or later includes a Communication Requirement of 4 subjects: 2 Humanities, Arts, and Social Sciences (HASS) subjects designated as a Communication Intensive (CI-H) and 2 Communication Intensive Subjects in the major, to be specified in the 2002-2003 *Bulletin*.

General Institute Requirements (GIRs)	**Subjects**
Science Requirement	**6**
Humanities, Arts, and Social Sciences Requirement	**8**
Restricted Electives in Science and Technology (REST) Requirement [can be satisfied by 6.001 or 6.002, and 18.03 in the Departmental Program]	**2**
Laboratory Requirement	**1**
Total GIR Subjects Required for S.B. Degree	**17**
PLUS Departmental Program	**Units**
Subject names below are followed by credit units, Engineering Design (ED) points, and by prerequisites if any (co requisites in italics).	
Required Subjects	**72**
6.001 Structure and Interpretation of Computer Programs, 15 (ED 4), REST	
6.002 Circuits and Electronics, 15 (ED 4), REST; 8.02*, 18.03*	

2H Con't	
6.003 Signals and Systems, 15 (ED 4); 6.002	
6.004 Computation Structures, 15 (ED 4); 6.001, 6.002	
18.03 Differential Equations, 12, REST; *18.02**	
Restricted Electives	**96**

1. Either 6.041 or 18.440 or 6.042J. Students in Course VI-1 must select either 6.041 or 18.440; students in Course VI-3 must select 6.042J.

2. One 12-unit subject selected from the undergraduate laboratory subjects 6.100-6.182. Students in Course VI-3 must select 6.170. Students in Course VI-1 or VI-2 who take both 6.021J and 6.022J are exempted from this requirement. Note that this departmental laboratory requirement is in addition to the General Institute Laboratory Requirement.

3. Five subjects from the list of Engineering Concentration subjects constrained as follows:
   a) Students in Course VI-1 must take the header subjects in each of the three Electrical Engineering Concentrations (Communication, Control, and Signal Processing; Devices, Circuits, and Systems; and Electrodynamics and Energy Systems). They must also take either one additional subject in one of these three Concentrations and one additional subject from any of the seven Concentrations or else the header and one additional subject in the Bioelectrical Engineering Concentration.
   b) Students in Course VI-3 must take the header subjects in each of the three Computer Science Concentrations (Artificial Intelligence and Applications; Computer Systems and Architecture; and Theoretical Computer Science). They must also take either one additional subject in one of these three Concentrations and one additional subject from any of the seven concentrations or else the header and one additional subject in the Bioelectrical Engineering Concentration.
   c) Students in Course VI-2 must take the header subjects from any two of the Electrical Engineering Concentrations and any two of the Computer Science Concentrations. The fifth Engineering Concentration subject may come from any of the seven Concentrations.

2H Con't

Every approved degree program must contain at least 48 Engineering Design (ED) points and must include a major project experience at an advanced level.

Departmental Program units that also satisfy the GIRs	**(27)**
Unrestricted Electives	**48**
Total Units Beyond the GIRs Required for S.B. Degree	**189**

No subject can be counted both as part of the 17-subject GIRs and as part of the 189 units required beyond the GIRs. Every subject in the student's departmental program will count toward one or the other, but not both. Similarly, no single subject may be counted in more than one category of departmental restricted electives.

Notes on Courses VI-1, VI-2, VI-3

*Alternate prerequisites are listed in the subject descriptions.

For an explanation of credit units, or hours, please refer to the Guide to Subject Listings in Chapter VIII of this catalogue.

2I

Rose-Hulman Institute of Technology
Engineering Curriculum Requirements.
EE Curriculum

The Electrical Engineering program provides basic preparation for a career in the broad discipline of Electrical Engineering or for graduate level study. From the design and operation of multi-megawatt power generating stations to the design and application of integrated circuits which operate at microwatt power levels, and from the design of electrical/electronic systems to the processing of information, Electrical Engineering encompasses an extremely broad array of concentration areas. In such a discipline it is imperative that students appreciate its breadth so that they have an understanding of other facets of their chosen profession. Preparation for careers in research and development, design and manufacturing, technical sales and product support, or for graduate study in electrical engineering are embodied in the program. It also prepares students for further study in a variety of other professions such as business administration, medicine, and patent law.

The Electrical Engineering curriculum provides students with a foundation in basic science, mathematics and the humanities. Written and oral communication skills are emphasized and developed throughout the program, as is team project work and an appreciation of the ethical and professional responsibilities of an engineer.

The Electrical Engineering student develops a thorough understanding of the physical and mathematical principles underlying basic electrical processes and devices. The theory and/or application of circuits, electronics, control systems, communications systems, digital components, electromagnetic fields, energy conversion, microcomputers and wave propagation are included. Extensive use of the computer as a tool for mathematical analysis, design, data analysis and instrumentation is emphasized. The iterative nature of the design cycle and the need for concurrent documentation and development are emphasized through team project work. The Electrical Engineering program culminates with a year-long client centered group design project.

2I con't

The program in Electrical Engineering includes many courses that have an integrated laboratory component which is supported by modern laboratories and state-of-the-art equipment and computers. Strong emphasis is placed on "hands-on" experience.

A broader goal of the program is to produce graduates who are lifelong learners. It is imperative in such a broad field that electrical engineers maintain their technical competence. Emphasis is placed on design because it is through innovative approaches to problems that new solutions are found, thereby enabling new products to be brought to market.
(2002, http://www.rose-hulman.edu/)

2J (pps. 175 - 177)

MSOE's Curriculum Requirements

Bachelor of Science in Electrical Engineering

Model Full-Time Track, ver. 14.10

Important: For the most accurate and up-to-date information, consult your academic advisor or the Electrical Engineering Program Director, *Dr. Owe Petersen.*
The notation such as "3-2-4" indicates the number of hours per week in lecture (3), and lab (2), and the number of credits (4).

Freshman Year

Course No.		**Qtr. 1**	**Qtr. 2**	**Qtr. 3**
EE-100	Introduction to Electrical Engineering	1-2-2		
MA-136	Calculus for Engineers I	4-0-4		
CS-150	Intro to Computer Programming	2-2-3		
EN-131	Composition	3-0-3		
HU-100	Contemporary Issues	3-0-3		
OR-100	Freshman Orientation*	1-0-0		
EG-122	Engineering Graphics and Visualization		1-3-2	
MA-137	Calculus for Engineers II		4-0-4	
CH-200	Chemistry I		3-2-4	
EN-132	Technical Composition		3-0-3	
MS-221	Microeconomics		3-0-3	
MA-231	Calculus for Engineers III			4-0-4
PH-110	Physics of Mechanics			3-2-4
CH-201	Chemistry II			3-2-4
EN-241	Speech			2-2-3
HU/SS-???	HU/SS Elective**			3-0-3
Totals		**14-4-15**	**14-5-16**	**15-6-18**

Sophomore Year

Course No.		Qtr. 4	Qtr. 5	Qtr. 6
EE-201	Linear Networks: Steady State Analysis	4-0-4		
ME-255	Engineering Statistics	3-0-3		
MA-235	Differential Equations for Engineers	4-0-4		
CS-250	Intro. To Object Oriented Programming	2-2-3		
PH-230	Physics of Electricity & Magnetism	3-3-4		
EE-230	Special Network Applications		3-0-3	
EE-290	Combinational & Sequential Logic		3-3-4	
ME-256	Engineering Dynamics		3-0-3	
MA-232	Calculus for Engineers IV		3-0-3	
PH-220	Physics of Heat, Wave Motion & Optics		3-3-4	
EE-202	Linear Networks: Transient Analysis			3-3-4
EE-291	Microprocessor Systems			3-3-4
MA-262	Probability and Statistics			3-0-3
PH-250	Modern Physics			3-3-4
Totals		**16-5-18**	**15-6-17**	**12-9-15**

Junior Year

Course No.		Qtr. 7	Qtr. 8	Qtr. 9
EE-310	Electronic Devices & Circuits	3-3-4		
EE-392	Digital System Design	3-3-4		
MA-330	Vector Analysis	3-0-3		
ME-354	Thermodynamics and Heat Transfer	3-0-3		
PH-360	Physics of Electronics	3-3-4		
EE-303	Signal Analysis		4-0-4	
EE-311	Electronic Networks		3-3-4	
EE-320	Electric & Magnetic Fields		4-0-4	
EE-340	Electromechanical Energy		3-3-4	

	Conversion			
GE-300	Career & Professional Guidance		0-2-1	
EE-370	Control Systems			4-0-4
EE-383	Computer-Aided Design			3-3-4
EE-393	VLSI Design			3-3-4
MS-331	Business Law			3-0-3
Totals		**15-9-18**	**14-8-17**	**6-6-18**

Senior Year

Course No.		**Qtr. 10**	**Qtr. 11**	**Qtr. 12**
EE-401	Principles of Communications	3-0-3		
EE-407	Senior Design Project I	3-0-3		
EE-412	Electronic Systems Design	3-3-4		
Electives	Electives (one EE, one HU/SS)**	6-0-6		
EE-408	Senior Design Project II		2-3-3	
IE-423	Engineering Economy		3-0-3	
SS-461	Organizational Psychology		3-0-3	
Electives	Electives (one EE, one HU/SS, one Free)**		9-0-9	
EE-409	Senior Design Project III			2-3-3
HU-432	Ethics for Professional Mgrs. And Engineers			3-0-3
Electives	Electives (one EE, one HU/SS, one Free)**			9-0-9
Totals		**15-3-16**	**17-3-18**	**14-3-15**

2K

Engineering Schools Compared.

School	Milwaukee School of Engineering	Rose-Hulman Institute of Technology (IN)	Massachusetts Institute of Technology	
Public/Private	Private	Private	Private	
Founded	1903	1874	1861	
Religious Affiliation	No affiliation	No affiliation	No affiliation	
Total Undergraduates	2,279	1,581	4,258	
Location				
City/State	Milwaukee/WI	Terre Haute/IN	Cambridge/MA	
Setting	Major City	Suburban	City	
Distance from home (miles)	N/A	N/A	N/A	
Academics				
Student-to-faculty ratio	12/1	15/1	7/1	
Full-time faculty	74%	96%	89%	
Classes taught by TAs	0%	0%	2%	
Cla'es under 20 students	53%	33%	58%	
Classes with 50+ students	0%	1%	16%	
Av'ge six-year grad'tion rate	N/A	N/A	N/A	
Cost				
Private tuition and fees	$20,985	$21,521	$26,960	
Public in-state tuition/fees	N/A	N/A	N/A	
Pu'lic out-of-state tuition/fees	N/A	N/A	N/A	
Room/Board	$4,845	$6,039	$7,500	
Financial Aid*				
Std't recv'ing:N'dbased g'nt	68%	67%	50%	
Need-based self-help aid	67%	68%	53%	
Merit aid	15%	27%	13%	
% of need that was met	11%	15%	95%	
Av'ge financial aid package	$13,713	$14,581	$23,526	
Average need-based grant	$4,496	$4,925	$17,376	
Admissions				
Selectivity	More selective	More selective	Most selective	

Acceptance rate	82%	77%	16%	
Number of applicants	1,994	2,796	10,671	
Average high school GPA	3.24	N/A	N/A	
SAT/ACT (25/75 percentile)	24- 28[3]	1230- 1440[3]	1410- 1560	
Student Satisfaction				
Freshman retention rate	78%	93%	98%	
Alumni giving rate	17%	46%	41%	
Student Body				
Diversity**	no	no	yes	
Fraternity members	9%	45%	44%	
Sorority members	6%	35%	24%	
Students living off campus	N/A	N/A	N/A	

N/A indicates that the school did not provide data to *U.S. News* in a certain area, or that the data is not applicable
to a particular school, such as in-state or out-of-state tuition for private schools.

*The percentages of students receiving financial aid is based on the total number of full-time undergraduates. The percentage of students whose need was fully met is based on those students who applied for financial aid. Average financial aid packages and need-based grants are based on packages and grants awarded.

**A school is considered diverse if the minority population is greater than 17 percent.

N/A for tuition indicates that tuition for the 2000-2001 academic year was provided. To maintain comparability, only 2001-2002 tuition is displayed on this page. The 2000-2001 academic year tuition can be found on the school's Financial Aid directory page.

APPENDIX 3

3A IRB

CAPELLA UNIVERSITY
222 South 9th Street, 20th Floor
Minneapolis, Minnesota 55402

Human Participants in Research Form

(To be completed if human subjects are involved in the research)

Learner Name: __James P. Froh___ **Date:**__December 30, 2002_____
Address:_W 3909 Hull Rd., Horicon, WI 53032 _____
Phone: (Work) 1(262) 472 - 395____ **(Home)** 1(920) 485 - 4265____
Field of Study: Org. and Management_ **Degree Program: MS__PhD__X__**
Mentor: Dr. Robert Hockin_____

1. **Project Title:** (Use same title as Final Proposal)
A cross sectional study on Leadership Development in an Electrical Engineering Program at the Undergraduate Level.
2. **Inclusive dates of project:** November 2002_**through:** May 2003_
3. **Abstract/Lay Summary**

The purpose of this study is to examine the Milwaukee School of Engineering's Electrical Engineering and Computer Science Department (EECS) undergraduate degree program and whether the program provides the skills needed by the graduating students to be the leaders of today's businesses.
The study will encompass a cross sectional analysis. The first part will be an analytical review of the courses required of a graduating student. This will include a review of the course description of all courses in the four years of study followed by an analysis of the course syllabi in relationship to the concepts of a visionary leader.

The next part will include a questionnaire to be filled out by the approximately 120 senior students in the EECS department and the 35-core faculty from this department. The questionnaire is called The Leadership Profile (TLP), Sashkin 2001. The questionnaire is 50 questions, with the respondent filling in a five-point Likert scale. The five-point scale is: 'To a very great extent', 'To a great extent', 'To a moderate extent', 'To a slight extent', and finally 'To little or no extent'. The respondent fills in the computerized form with a number 2 pencil as how each particular question relates to them self. The questionnaire itself has ten scales by which three major categories are defined in relationship to the visionary leader. The three major categories are: 'Visionary Leadership Behavior Score', 'Visionary Leadership Characteristics Score', and the final one is 'Visionary Culture Building Score'. The questionnaire takes about 15 minutes to fill out.

3 A Con't

4. Subject Population
a. Number : Male: 122_ **Female:** 33_ **Total:** 155_
b. Age Range: _21 to 64_
c. Location of Subjects: .
Special Characteristics:
(Check all that apply)
(Check all that apply)

____elementary/secondary schools

___inpatients

____outpatients

___prisons/halfway houses

___patient controls

____hospitals and clinics

___normal volunteers (adults)

_X_ university student

_X_ other Faculty

____other hospitals:

specify_____

d. If research is conducted through community agencies written documentation of approval/cooperation from such an agency (school, etc.) should accompany this application.
See attached signatures and approvals from MSOE University.
e. Describe how subjects will be identified or recruited. Attach recruitment information, i.e., advertisement, bulletin board notices, recruitment letters, etc.

The subjects have been identified by their direct relationship to the EECS Department, either as a student or as the core faculty member of MSOE.

f. If subjects are chosen from records, indicate who gave approval for use of the records. If records and private medical or student records, provide the protocol for securing consent of the subjects of the records and approval from the custodian of the records.

Approval was obtained from the Vice Chair of the EECS, Dr. John Gassert. (See attached letter)

g. Who will make the initial contact with subjects? Describe how contact is made.

The researcher, Jim Froh, in their senior seminar class, will contact the students with the questionnaire being filled out during the class time taking up about ½ hour of instruction and actual filling out of the form. The questionnaire is voluntary and it is important to stress this fact.

The faculty will be contacted by the researcher in person at their convenience followed by a mailing to them of the questionnaire, if needed. The questionnaire is voluntary and it is important to

3A Con't

stress this fact to the faculty along with the importance of the confidentiality.

h. Will subjects receive inducements before, or rewards after the study? (Include this information in your consent documents.)

No inducements will be utilized.

i. If subjects are school children and class time is used to collect data, describe in detail the activity planned for non-participant. Who will supervise those children? (This information must be included in the consent form.)

Not relevant.

5. Confidentiality of Data

a. Describe provisions made to maintain confidentiality of data. Who will have access to data?

The researcher will maintain the confidentiality of the respondents and their responses by ensuring no MSOE superior will see or utilize the information. This will be accomplished by controlling the questionnaire myself so that the superiors of the respondent will have no access to the respondents' direct data. The data will be analyzed via a third party, Dr. Sashkin, and returned directly to the researcher.

b. Where will data be stored and for how long? If tape recordings are created, explain who will have access and how long the tapes will be retained.

No tape recordings will be utilized.

All documents relating to ethical treatment of human subjects which will be used in the course of the research must be attached to this form. These documents include consent forms, cover letters and other relevant material.

The signatures below certify that:

- The information provided in this application form is correct
- The learner (researcher) will seek and obtain prior written approval from the Committee for any substantive modification in the proposal.
- Unexpected or otherwise significant adverse events in the course of this study will be promptly reported.
- Any significant new findings that develop during the course of this study, which may affect the risks and benefits to participation, will be reported in writing to the Committee and to the subjects.
- The research may not be initiated until final written approval is granted.

This research, once approved, is subject to continuing review and approval by the Committee. The learner(researcher) will maintain records of this research according to Committee guidelines.

If these conditions are not met, approval of this research could be suspended.

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Signature of
Learner(Researcher)_____Date_____

As Mentor and Chair of the committee, I assume responsibility for ensuring that the learner complies with University and federal regulations regarding the use of Human Subjects in research

Signature of Faculty Mentor(Chair)_____
Date_____

Completed forms and attachments should be mailed to:

Office of the Executive Director/Chair of the Human Subjects Committee at Capella University
222 South 9th Street, 20th Floor
Minneapolis, MN 55402

As Executive Director, or designee, I acknowledge that this research is in keeping with the standards set by the university and assure that the researcher has met all requirements for review and approval of this research.

Signature of Executive Director: _____
Date_____

3B

The Leadership Profile - Questionnaire

(Will include in final paper, Copyright issues)

3B con't
TLP page 2
(Will include in final paper, Copyright issues)

3 C

Dear Faculty,

My name is Jim Froh and I am currently finishing my PhD in Leadership from Capella University. Dr. John Gassert and the program directors in attendance at a meeting on 03/14/03 have given me approval to ask you to complete a survey on leadership development within the EECS department at MSOE. It is important to understand this is strictly voluntary. The importance of the study is to understand how well the EECS department is in alignment with MSOE's mission statement at the undergraduate level. **"MSOE provides a sustained interactive educational climate for students to become well-rounded technologically experienced graduates and highly productive professionals and leaders"** (MSOE, 2002, Undergraduate Catalog p. 6). MSOE has consistently produced some of the top engineers of the nation. This survey will help determine if the visionary leader is developed with in the seniors of the EECS department. The visionary leader is the type of leader needed of today's graduating seniors to work in the technologically driven, fast-paced, team-based, and ever changing global economy.

Instructions

The front page is needed only to fill out your specific program by filling in the corresponding circle next to your program. **NO NOT FILL IN YOUR NAME.**

1) At the bottom of the front page is a block which says **'Office Use Only'**. In the first column please indicate by filling in the corresponding number with your specific educational background. **A number 2 pencil is needed.**

0 = Chair, Vice Chair or Director of Program
1 = Faculty and students in BE
2 = Faculty and students in CE
3 = Faculty and students in EE
4 = Faculty and students in EET
5 = Faculty and students in SE
6 = Students: Double major/minor in Engineering Programs
7 = Students: Double major/minor in Engineering & Business

The next column has numbers filled in and is being used only as the identifying numbers of student or faculty.

3C con't

2) The survey is 50 questions relating to the visionary leader, which is located on the back page. Answer the questions to **best describe <u>you</u>** using the 5-point Likert scale from a very great extent - to little or no extent. **It only takes about 15 minutes.**

Thank you for your time and helping us make MSOE a better school by ensuring the alignment of the students to MSOE's Mission Statement. **Please place the answer sheet in the envelope, seal it and return to Marilyn at the EECS department office by March 20, 2003. Even if you do not wish to fill it out, *please return it*.**

Jim Froh

3 D

Dear Student,

My name is Jim Froh and I am currently finishing my PhD in Leadership from Capella University. Dr. John Gassert and the program directors in attendance at a meeting on 03/14/03 have given me approval to ask you to complete a survey on leadership development within the EECS department at MSOE. It is important to understand this is strictly voluntary. The importance of the study is to understand how well the EECS department is in alignment with MSOE's mission statement at the undergraduate level. **"MSOE provides a sustained interactive educational climate for students to become well-rounded technologically experienced graduates and highly productive professionals and leaders"** (MSOE, 2002, Undergraduate Catalog p. 6). MSOE has consistently produced some of the top engineers of the nation. This survey will help determine if the visionary leader is developed with in the seniors of the EECS department. The visionary leader is the type of leader needed of today's graduating seniors to work in the technologically driven, fast-paced, team-based, and ever changing global economy.

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Thank you for your time and helping us make MSOE a better school by ensuring the alignment of the students to MSOE's Mission Statement. **Even if you do not wish to fill it out, *please return it*.**

Jim Froh

3 E

Cronbach's Alphas for the Ten *TLP* Scales

***TLP* Scale**	**Group: A**	**B**	**C**	**D**	**E**	**F**	**G**
1: Capable Management	.769	.767	794	.822	.780	.900	.804
2: Reward Equity	.801	.801	.805	.890	.900	.930	.866
3: Communication Leadership	.647	.668	.682	.800	.790	.890	.654
4: Credible Leadership (trust)	.857	.785	.847	.892	.890	.940	.778
5: Caring Leadership (respect)	.764	.771	.790	.900	.900	.940	.822
6: Creative Leadership	.804	.814	.795	.844	.840	.910	.839
7: Confident Leadership	.764	.740	.768	.747	.830	.870	.812
8: Follower-Centered Leadership	.213	.334	.208	.366	.440	.510	.401
9: Visionary Leadership	.562	.589	.419	.568	.640	.520	.592
10: Principle-Centered Leadership	.596	.597	.572	.714	.710	.780	.674

Key: Group A is the same as Group I in Table 2, at time one; N=189.
Group B is the same as Group II in Table 2, at time one; N=505.
Group C is the same as Group III in Table 2, at time one; N=341.
Group D: audit team members in a national "Big 6" accounting firm reporting about their leaders; N=149.
Group E: engineers in several different high-technology firms in Northern Virginia; N=68
Group F: design engineers in a major US high technology organization; N=300 (TLP-other)
Group G: Florida public school teachers and principals (N=1466) (Sashkin, 2002, p. 2)

APPENDIX 4

4 A

HUMANITIES/SOCIAL SCIENCE ELECTIVES
2001-2002 TENTATIVE SCHEDULE

FALL QUARTER
Day College
HU 431A Formal Logic
HU 433 Philosophy
HU 437 Praxiology
HU 440 Global History I
HU 487 Visual Arts
HU 494 Creative Thinking
HU 49506 On Wisconsin
SS 415S Spanish Culture
SS 453 American Government
SS 460 Foundations of Psychology
SS 462 Developmental Psychology

FALL QUARTER
Evening College
HU 410G German I
HU 410S Spanish I
HU 434 Existentialism
HU 494 Creative Thinking
SS 442 Modern European History
SS 453 American Government
SS 456 Public Policy & Urban America

WINTER QUARTER
Day College
HU 425 Contemporary Literature
HU 441 Global History II
HU 485 Fine Arts
HU 494 Creative Thinking
HU 49507 The Search for Home & Place
SS 415G German Culture
SS 455 International Relations
SS 464 Human Factors
SS 466 Abnormal Psychology
SS 471 Sociology
SS 473 World Societies
SS 476 Death & Dying

WINTER QUARTER
Evening College
HU 411G German II
HU 411S Spanish II
HU 426 Survey Third World Literature
HU 430 Epistemology

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HU 494 Creative Thinking
SS 462 Abnormal Psychology
SS 464 Human Factors

SPRING QUARTER

Day College

HU 427 Oriental Literature
HU 428 Classics in Literature
HU 429 Literature of American Minorities
HU 443 Russian History
HU 486 Theater Arts
HU 494 Creative Thinking
HU 49508 The Films of Alfred Hitchcock
SS 415F French Culture
SS 453 American Government
SS 457 Current Affairs
SS 462 Developmental Psychology
SS 464 Human Factors
SS 466 Abnormal Psychology
SS 474 The Family

SPRING QUARTER

Evening College

HU 412G German III
HU 412S Spanish III
HU 435 Philosophy of Religion
HU 494 Creative Thinking
SS 454 Political Science
SS 464 Human Factors
(MSOE, 2002)

4 B

ELECTRICAL ENGINEERING ELECTIVES
2001 - 2002

See Dr. Petersen for current approved EE elective list.

EE-404 ACTIVE FILTERS
EE-420 TRANSMISSION LINE CIRCUITS
EE-421 DIGITAL COMMUNICATION SYSTEMS
EE-422 DIGITAL SIGNAL PROCESSING
EE-423 APPLICATIONS OF DSP
EE-424 DATA COMMUNICATIONS
EE-425 RADIO FREQUENCY CIRCUIT DESIGN
EE-429 MICROWAVE ENGINEERING
EE-444 POWER ELECTRONICS
EE-447 POWER SYSTEM ANALYSIS I
EE-449 POWER SYSTEM ANALYSIS II
EE-460 QUALITY IN ELECTRONIC SYSTEMS
EE-462 COMMUNICATION SYSTEMS
EE-464 FIBER OPTIC COMMUNICATIONS
EE-474 PROGRAMMABLE CONTROLLERS
EE-479 DIGITAL CONTROL SYSTEMS
EE-481 FUZZY SETS AND APPLICATIONS
EE-484/584 NEURAL NETWORKS
EE-486 C LANGUAGE
EE-487 MACHINE VISION
EE-488 INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS
EE-493 ARCHITECTURE AND PROGRAMMING OF A 16-BIT MICROPROCESSOR
EE-499 INDEPENDENT STUDY
(MSOE, 2002)