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Leadership, culture, and academic success, an internal and external departmental analysis and comparison of the James Madison University Engineering program

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Leadership, Culture, and Academic Success, an Internal and External Departmental Analysis and Comparison of the James Madison University Engineering Program

An Honors Program Project Presented to

The Faculty of the Undergraduate

College of Integrated Science and Engineering

James Madison University

by Sierra Hahn-Ventrell

May 2016

Accepted by the faculty of the Department of Engineering, James Madison University, in partial fulfillment of the requirements for the Honors Program.

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PUBLIC PRESENTATION  

This work is accepted for presentation, in part or in full, at James Madison University’s' Engineering xChange on April 16, 2016.
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Preface

As a double major in engineering and computer information systems I obtained the unique experience of being a part of two vastly different educational departments. I was also a member of the newer Department of Engineering here at James Madison University and thus went through the beginning growth phases of the program and what some would call “growing pains.” From my diverse experiences and my distinctive perspective, I began to look at our engineering program through a new light.

This project in hopes of working with our department head to develop and understand why our program is successful or is not and what we can do to better the program as it moves through its adolescent years. As a student-athlete I have seen how culture and leadership can impact the success of a team and I wanted to apply that understanding in an educational setting. Mass amounts of research have been done to show that certain types of leadership and certain cultures lead to successful businesses {Huang:2009hr}. With the help of my professors and my project team we continued to explore these topics in hopes to answer the following questions. We began this thesis to determine if similar factors could be applied to education. Can we treat an educational department as a business? Do the same influences and factors apply in relation to success of a educational program and as they do in the success of a business?

The following project analyzes leadership, culture, and success in relation to academics. We identified eight schools with some qualities that Department of Engineering could use as engineering program “models and with possible features for future emulation.” Out hope was to apply our interests in leadership and culture to give the Department of Engineering an understanding of what we can do to better our program for future generations.
Acknowledgements Page

I would like to express my sincerest gratitude to all parties who made the completion of this project possible. To the professors that served on my senior honors project committee, Dr. Steven Harper, Dr. Matthew Rutherford, Dr. Kurt Paterson, and Dr. Samuel Morton, thank you for your assistance, participation and knowledge throughout my thesis. I would not have been able to succeed or complete this accomplishment without your assistance and for that, I am forever grateful.

I would also like to thank to Department of Engineering, the Department of Business Management, and the Honors Program from James Madison University for giving me the funding and opportunities to complete my research. I am extremely grateful for the Edythe S. Rowley Honors Scholarship that gave me the ability to not only complete my honors seminar but the opportunity to begin this project and complete the honors program.
Abstract

Madison Engineering is a unique young program that does not follow the traditional teachings of engineering education. The following study analyzes the output variable of academic success of the Madison Engineering program in relation to the culture of the program and the leadership styles of those in management positions within the department. Eight comparative schools were selected, analyzed, and surveyed to compare to Madison Engineering and cross-examine how different leadership styles affect certain outputs.

From extensive research and benchmarking, data was collected to compare measures of leadership and culture to output variables of academic success. A survey was further conducted of the selected universities to gather complete data for accurate comparison. The U.S. News and World Report rankings of desired engineering programs was used as an output variable of academic success as well as many other variables in relation to the program, faculty, students, and additional factors.

The goal of this project was to understand relationship between a programs’ culture and academic success, and leadership and academic success, and describe how they affect and relate to engineering higher education. With proper analysis and further understanding of these factors, management of Madison Engineering will be able to use these findings to identify strengths and weaknesses, areas of improvement, and areas of strength to emphasize. Ideally, this project below will help grow the Madison Engineering program and advance academic success for future generations to come.
Purpose

The purpose of this project is to 1) define leadership, culture, and academic success in relation to engineering education, 2) determine the relationship between leadership, culture, and academic success in an educational setting and 3) apply these findings to analyze the James Madison University Department of Engineering.

Objectives

The objectives of this research project are outlined below.

- To study departmental organizational leadership in identified comparative universities
- To determine how to measure success in these engineering departments
- To determine how to measure leadership in engineering departments
- To analyze and describe organizational culture within an engineering department
- To determine how organizational culture relates to success within an engineering department
- To determine how managerial leadership relates to success within an engineering department

The objective is to study both departments in James Madison University, such as business and engineering departments as well as external departments at peer institutions and comparative schools through surveys, interviews and data analysis of leadership, culture and demographics. The goal is to use this analysis and understanding to develop suggestions for improvement and enhancement of the James Madison University Department of Engineering.
Methodology/Approach

Extensive research into types of leadership, culture and the definition of academic success helped outline the starting point and understanding of appropriate methods and previous knowledge. Using the comparative schools identified, data collection and analysis was performed from literature review, research and readily available data of the identified schools. These results were then cross-examined with an electronic survey conducted on faculty and management at the identified schools. The survey (Appendix I) was conducted and data collected to further analyze these relationships and add to the incomplete data available from research. The survey on leadership and cultural analysis, as well as specific departmental factors, was conducted to the institutional cohort. The results were analyzed using SPSS and visualized with Tableau.

Findings

The findings of this study showed that JMU has a similar culture and leadership style to its comparative schools but neither factor is as strong as in the comparative schools. JMU had the highest score for autocratic leadership which has been linked to decrease in U.S. News Ranking, starting salary after graduation, and retention rate. These factors indicate then even though JMU leadership follows the norm of a laissez-faire style, Madison Engineering has areas of concern as it has the most features of a potentially negative impactful style.

The cultural analysis demonstrated that again, JMU follows similar culture as its’ comparative institutions but lacks strength. Compared to the initial test culture, presented by Larson & Grey (Larson & Gray, 2011, pp.79-80), JMU achieved none of the highest scores in any of the 10 dimensions of leadership. In fact, it contained two of the worst scores for risk tolerance and reward criteria, meaning that in these two categories JMU culture was the furthest from the ideal compared to all peer institutions.
The findings discovered many preliminary correlations and areas of interest but none that could provide or create strong correlations and verify findings. In conclusion, this study provides preliminary analysis and results and provides a basis for further analysis to be performed in order to achieve any sort of relationship between variables of leadership and culture in relation to measurements of academic success.
Introduction

Madison Engineering is not a traditional engineering program. It does not follow the age-old values and rules that most engineering programs live by and that is exactly why many of the Madison Engineering students chose this program over these more traditional programs. Sir Ken Robinson stated in a TED Talk in 2005 that “we stigmatize mistakes,” and that we are “running national education systems where mistakes are the worst thing you can make into the ground. And the result is that we are educating people out of their creative capacities.” James Madison University’s (JMU) engineering program focuses on design and sustainability, they push students to be creative and that is exactly why Madison Engineering does not fall into the traditional engineering education mold. JMU is not the only program out that is approaching engineering education in a different way and wavering from the traditional beliefs. “Comparative schools” or “peer institutions” are those programs that operate similarly and have parallel goals as one’s institution. Eight comparative schools were identified by faculty whom are currently researching to determine an appropriate list of peer institutions. These schools were further confirmed through research as they have similar beliefs and structure comparable programs to Madison Engineering.

Leadership, success, and culture are three unquantifiable characteristics that are vital to understanding any organization {Korman:1977th}. How companies, universities, and people measure these three characteristics can help create an understanding of the meaning of each trait and its role in development and maintenance of the organization. In an academic setting, these principles are even more important because their ability to influence the success of a program directly influences the education of the work force of tomorrow. One problem is that for new administration and department heads there is little information and analysis done to help understand why some programs are successful why others are not (“Defining and Measuring Academic Success,” 2015). This information is vital to their development of the program because without a
basis or understanding of these relationships they have no information to use to develop a strong “up-and-coming” department.

Leadership and culture are two extremely important aspects of organizational life and business (Cameron National Center for Higher Education Management Systems, 1978). They are readily talked about yet widely misunderstood as how their relationship influences academic student success {Korman:1977th}. When applying these aspects to an academic setting it is important to understand how different types of leadership and cultural developments influenced a university’s ability to succeed as a program and produce successful students. Many studies have been done to analyze leadership and culture in businesses, but very little has been explored in the study of academic institutions or department academics. The previous studies that were available, dealt with either leadership or success and tried to explain a foundation for quantifying these variables. From this research, metrics of academic success were developed to perform analysis through modeling and surveying these factors to further examine their relation to Madison Engineering. This study used a variety of research methods (archival data retrieval and a survey) to understand the relationship between leadership and culture with student academic success.

This study began with conversations with the academic Department Head discussing how to better the Madison Engineering Program and the evident lack of applicable data. As a result, it was determined that a department comparison and analysis between the James Madison University Department of Engineering and its identified comparative schools was necessary to further developing Madison Engineering. Examining if these schools succeed and how they succeed by focusing on leadership and culture was purpose of this study. Examining curriculum, departmental organization, defining academic success and selecting a method of leadership study were the initial steps taken to provide a basis of understanding.
Overall, the goal is to answer the following questions, how can we make our program better? What can we do to better our students in relation to experience, knowledge, post-graduate opportunities and satisfaction? What makes one program successful and another not? How does leadership, meaning those in management positions, and culture relate to academic success?

After detailed analysis, the findings were presented in comparison based on each school, comparing JMU to its sister schools, and comparing department heads to non-department heads. The findings were analyzed using statistical analysis and correlation and presented using Tableau. Final discussion emphasizes the difficulties approached during this project and the further recommendations for future work. It also addressed how this research and these findings can be applied to Madison Engineering and answers the questions above to better our engineering program. The following paper outlines the preliminary research, the theory and hypothesis taken by the project team, the methodology performed, the preliminary results and a discussion of the results.
Literature Review

Engineering Education

The article, “The Future of Engineering Education II” discusses how traditional engineering teaching methods have an abundance of inaccuracies and problems that stem from this engineering education system (“The Future of Engineering Education II. Teaching Methods That Work,” 2000). It analyzed points of opportunity to importance and how the education system can be changed to reflect these points (“The Future of Engineering Education II. Teaching Methods That Work,” 2000). The article provides tools to understanding the problems with traditional engineering educational structure. They provide engineering education analysis that can be applied to engineering management, especially department management, to meet the needs that are not currently being met by the system (“The Future of Engineering Education II. Teaching Methods That Work,” 2000).

Dr. Richard M. Felder has published extensive works on engineering education; his tale of two paradigms contrasts the conflicts between the traditional teacher-centered paradigm for engineering education and the emerging learner-centered paradigm, and predictions about their eventual resolution (Rich, 2015). His results displayed a detailed comparison between specific characteristics of the two educational pathways. 1. Deductive (T) vs. Integrated (E) - integrated infuses entire engineering curriculum with real problems and introduces fundamentals (Rich, 2015). The new approach gives students exposure to real engineering as apposed to applied science (Rich, 2015). Content (T) vs. Content and skill (E) content and skill better prepare students for changing industry. Design taught in capstone (T) vs. Design taught throughout curriculum (E) where learning objectives are phrased in the form of “students will be able to” and teaching styles address broad spectrum of learning styles (Rich, 2015). Research indicates inductive learning promotes deeper learning and conceptual understanding (Rich, 2015). Active learning is a specific method of teaching, that
contained a methodology called flipped classroom, where students read and study at home and work problems in class. Tests involve convergent and divergent problems (Rich, 2015).

Felder also looked at the relationship between research undergraduate universities and its effect on teaching. He concluded that for research and teaching "the relationship is 0" (“Does Faculty Research Improve Undergraduate Teaching? An Analysis of Existing and Potential Synergies,” 2007). This means that there is no relationship between the two and he then prepared suggestions to aid research institutions in both research and teaching progression (“Does Faculty Research Improve Undergraduate Teaching? An Analysis of Existing and Potential Synergies,” 2007):

1. Formally recognize and reward faculty members who successfully integrate their teaching and research
2. Establish faculty development programs in both teaching and research at the school or college level, including ways to integrate the two domains
3. Promote involvement in research for undergraduates
4. Recognize and reward faculty performance in all four Carnegie scholarships
5. Encourage inductive teaching methods

**Academic Success**

“Academic success” is one of the most widely used terms in educational research and assessment within higher education (“Defining and Measuring Academic Success,” 2015). Most organizational businesses focus on defining success based on your original strategy, goals, or preliminary assessment and progressing from there to see what you have and have not accomplished (Mullins, 2013). Academic success is viewed in the eyes of the beholder. Every person has a different
image of academic success and the term is therefore highly ambiguous. If you asked people in an engineering department if they are successful, the department head, students, and faculty will have very different answers.

York, Gibson, and Rankin, on Defining and Measuring Academic Success, uses the model below to outline how different inputs and the environment affect academic success (“Defining and Measuring Academic Success,” 2015). The paper continues to describe how different features impact academic success and how you can measure these impacts and measure success. While these are not ideally the factors that were studied in this project, it provided a model for understanding how to study, measure and describe the factors that were chosen. Figure 1 displays the model that Rankin used and provided a basis for developing a similar model. The environment was not taken into consideration when studying this project.

![Figure 1 Rankins' conceptual framework for examining academic success ("Defining and Measuring Academic Success," 2015)](image)

Their initial framework of academic success consists of academic achievement, acquisition of knowledge, skills, competencies, persistence and retention. After critiques of readers, the model was refined to look like figure 2. The figure below is the basis for developing the model of academic success used in this project and presented in the results.
Measuring Performance in Engineering Education

Liu and Tsais’ study from the Journal of Business Venturing focused specifically on measurements in entrepreneurship education (Evaluation on Higher Education Using Data Envelopment Analysis, 2015). They provide analysis for how they arrived at their measurement techniques such as analyzing leaders in quality organizations and then helps to expand the understanding of leadership and measure the importance of a leader in an organization (Kanji & e Sa, 2001). Leadership, performance, and success are all extremely hard to measure and each article or study found a way to measure these intangibles in a specific niche.

Liu and Tsai discussed how they arrived at their measurements specifically what tools they were using {Anonymous:EWaC8uQa}. Using similar measurement tools, an additional study by Vesper and Gartner looked at a variety of public and private universities and applied the Data Envelopment Analysis to measurements of success within their Engineering programs {Anonymous:EWaC8uQa}. The purpose is to “use a linear programming model to demonstrate a
novel benchmarking process for higher education performance, and identify the efficient practice of institutions among the peer group as well as each classified group” {Anonymous:EWaC8uQa}.

The Performance Prism book takes a broader look at a company and provides an overall perspective of how companies can be successful overtime (User, 2007). This method provides background knowledge to understand the topics to be analyzing while the first three articles help understand how to measure and analyze these topics.

**Measuring Success**

Measuring Organizational Effectiveness in Institutions of Higher Education is an extremely difficult task. Kim Cameron examined the concept of organizational effectiveness in institutions of higher education and states the obstacles of assessment and criteria problems among ranking institutions (CameronNational Center for Higher Education Management Systems, 1978). The criteria were generated from dominant coalition members in size institutions, and nine dimensions of organizational effectiveness were derived (CameronNational Center for Higher Education Management Systems, 1978). Reliability and validity of the dimensions were tested and evidence was found for certain patterns of effectiveness across nine dimensions.

Based on extensive research, findings of examining how academic success is operationalized is not available in literature (“Defining and Measuring Academic Success,” 2015). Most sources confirmed that there is “no complete presentation of empiric instruments available to educational researchers seeking to measure various aspects of academic success despite being perhaps the most researched outcome in education” (“Defining and Measuring Academic Success,” 2015).
A study on four year and above, public and not-for-profit universities was conducted using 270 schools located in the southern region of the United States to analyze and measure the performance of university education systems (Evaluation on Higher Education Using Data Envelopment Analysis, 2015). The study used research and external data to assist in conducting their analysis from the U.S. Department of Education statistics and removed some schools they believe to be outliers or outside the scope of their focus (Evaluation on Higher Education Using Data Envelopment Analysis, 2015). The results can help management analyze or evaluate the programs performance in terms of student retention rates and graduation rates (Evaluation on Higher Education Using Data Envelopment Analysis, 2015). The study breaks down the data into potential to achieve higher efficiency and overall efficiency, in terms of institutional type, location and size (Evaluation on Higher Education Using Data Envelopment Analysis, 2015). The results indicates that private institutions with small institutional size have higher opportunities to achieve their goals while public institutions with larger institutional size may find it easier to achieve higher efficiency (Evaluation on Higher Education Using Data Envelopment Analysis, 2015). The results provide suggestions for general guidance of decision makers and planners for higher education systems (Evaluation on Higher Education Using Data Envelopment Analysis, 2015). The study helps bring perspective into how analysis of performance has been done and categorized in the past.

Measuring progress is a difficult task, a study from the Journal of Business Venturing focused specifically on measurements in entrepreneurship education (“MEASURING PROGRESS IN ENTREPRENEURSHIP EDUCATION,” 2003). This study used a survey to explore how universities determined their courses and developed their program while taking into consideration the criteria that impacted the quality of the program (“MEASURING PROGRESS IN ENTREPRENEURSHIP EDUCATION,” 2003). They also focused on the Malcolm Baldrige National Quality Award as a useful tool for measuring entrepreneurial education (“MEASURING
PROGRESS IN ENTREPRENEURSHIP EDUCATION,” 2003). The top eight criteria suggested for ranking such programs were offered to be: faculty publications, impact on community, alumni exploits, innovations, alumni start-ups, and outreach to scholars (“MEASURING PROGRESS IN ENTREPRENEURSHIP EDUCATION,” 2003). The survey also uncovered a number of problems and discrepancies with how this program is ranked compared to other programs (“MEASURING PROGRESS IN ENTREPRENEURSHIP EDUCATION,” 2003). In conclusion they provided an approach called the MBNQA, which is an evaluation of this specific type of program including goals, objectives, and pedagogical perspectives of the programs analyzed (“MEASURING PROGRESS IN ENTREPRENEURSHIP EDUCATION,” 2003). The conclusion was a rough criteria list but opened for discussion and problems problems for unique programs.

A balanced scorecard approach was used to analyze businesses in Croatia but is less applicable to universities or higher education. It is still important however, to understand how they developed their metrics and variables to be measured. It has been proved as an effective instrument for measuring and evaluating the performance in order to improve efficiency and company management (korisnik, 2015). The intention of the balanced scorecard approach was to provide a way of measuring achieved results in comparison with planned success of a business. The approach is based around the business strategy and the development methods that have been enacted due to this strategy. Four principles provide measurements of performance for a company, customers, internal processes, finances and employee learning and growth (korisnik, 2015).

Business to Academic

The Performance Prism book takes a broader look at a company and provides an overall perspective of how companies can be successful overtime (User, 2007). The book is very focused
towards a business organization but has many implications to a higher education university such as the measurement techniques and strategies aligned with management. The structure of the analysis provides an example of putting the performance prism into action, how it is measured and what the model was based on (User, 2007).

**Structure**

When analyzing an organization, it is important to understand why an organization is structured the way they are. Why is a business flat, or why is there a strong hierarchy? Similar organizational analysis can be applied to educational programs. Understanding why a program is designed the way that it is, helps analyze why a program performs a certain way and emphasizes a certain thing. Looking at the age of an organization can help understand why it developed its curriculum the way it did. Also, understanding how long the current department head has been in power and their previous expertise aids in providing perspective to understanding the programs current organizational structure.

**Previous Findings**

The study found that authoritarian leadership styles had a generally negative affect on business performance on these companies while democratic leadership type had a generally positive effect (Korisnik, 2015). It was also determined that the impact of laissez-faire leadership was generally neutral, no direct correlation was discovered between laissez-faire leadership style and business performance (Korisnik, 2015). The study also suggests that business performance, or in this case
organizational performance, should be analyzed in different stages of development as it is believed that certain types of leadership will work better in certain stages of the company’s development.

**Measuring Leadership**

The “Measuring leadership Excellence” study analyzes why and how leadership is the most effective and primary role in an organization (Kanji & e Sa, 2001). A study on four year and above, public and not-for-profit universities was conducted using 270 schools located in the southern region of the United States to analyze and measure the performance of high education systems (“The Future of Engineering Education II. Teaching Methods That Work,” 2000).

Measuring leadership excellence study analyzes why and how leadership is the most effective and primary role in an organization (Kanji & e Sa, 2001). The study first explains what leadership is and then reviews many core theories developed around leadership (Kanji & e Sa, 2001). Next they analyze leaders in quality organizations and then helps to expand the understanding of leadership and measure the importance of a leader in an organization (Kanji & e Sa, 2001). Similar to the study below the measurement techniques of both performance and leadership are especially hard to quantify and justify so tools to do this are extremely valuable. The process of this study was particularly important as it applies directly to the study of internal and external university education comparisons. According to this study, the authors believe that leadership is a widely viewed and studied practice which high important but there are a lack of models to explain how it works (Kanji & e Sa, 2001). The conclusion identifies and explains the ‘Leadership Excellence Model’ which helps score and measure overall leadership performance (Kanji & e Sa, 2001). Understanding how people measuring intangibles is a huge piece of the topic described above and the research can be expanded upon to further understand measurements and benchmarks.
Understanding Leadership

Leadership is highly influential. Many studies have been done to prove that leadership does in fact influence success in a business or organization. The issue with the current literature is that little is known about how impactful leadership is on the success of a company. Being a leader, and those that follow a leader are directly connected and have high influences on success. Leaders must understand that they need to achieve a positive relationship with those that follow them in order to influence them and guide them towards achieving goals and objectives (Hollander, 1995).

There is no single best style of leadership. Leadership is about people and every person is different. It’s also about adapting to your surrounding and understanding the environmental issues that push you. Each environment, business industry, or organizational culture is vastly different, so while one type of leadership may work in a certain environment, it could be catastrophic in another (kbrisnik, 2015). The same logic applies to leading humans, each person will respond to leaders differently so it is impossible to say that one type of leader is the best for everyone (Podsakoff, 1995).

Leadership is viewed from three different groups of people, the leaders themselves, their immediate subordinates, faculty, and their subjects, the students. Leadership in relation to corporate businesses has been extensively analyzed, but can these findings and can this research be applied to higher education?

Does a university leader fall under the same category as a business organizational? Does a university qualify as a corporate business? These are the questions that research and further analysis hoped to answer.
According to Korisnik, “desirable” leadership qualities include independent spirit, self-esteem, respect for others, efficiency, effectively mastering new skills and accomplishing tasks, the willingness for rapid change, a willingness to learn new skills, pleasant private life and most importantly the ability to communicate with all people but especially new people (Korisnik, 2015).

“Only a leader is capable of creating an environment in which his co-workers are encouraged to be leaders and to cooperate and develop, thus contributing to the development of [organizations],” Ivan Miloloza (Korisnik, 2015). While this may be true for businesses, leadership in universities comes from a variety of different areas; teachers, faculty, administrative staff, and event students. For the purpose of this study, leadership by management and faculty is the sole focus on the leadership studied here. While many different studies of leadership were analyzed and used in different scenarios, the chosen method to apply to this project was used by Ivan Miloloza to study the relationship between leadership and its affects on business performance by surveying a sample of Croatian companies. The three types of leadership studied were authoritarian, democratic and laissez-faire.

Understanding Types of Leadership

The three types of leadership studied here focus on the behaviors of leaders and all fall under the category of leadership based on the use of authority. Autocratic, democratic, and the leader free of hand are the three basic styles of leadership that use authority (Mullins, 2013).

**Autocratic:** An autocratic leader is an individual who manages people by using a system of rewards and punishments. Their communication consists of ordering, commanding and asking submission of the subordinates (Korisnik, 2015).
**Democratic:** A democratic leader is an individual who cooperates closely with subordinates and not only welcomes but also encourages their participation. They utilize others in decision-making and ask for support and participation in many areas.

**Laissez-Faire:** A laissez-faire (or free of hand) is an individual who almost completely allows subordinates autonomy and independence in their work. These leaders have little to no requirements or demands for their subordinates and allow individuals to function on their own (Levicki, 2001).
Culture

The model in figure 3 analyzes different areas of organizational culture from the Project Management textbook (Erik W Larson, 2006). Culture describes the personality of an organization. Ten characteristics create the foundation for understanding an organization’s culture and are listed below (Erik W Larson, 2006):

1. **Member identity** - the degree to which employees identify with the organization as a whole rather than with their type of job or field of professional expertise
2. **Team emphasis** - the degree to which work activities are organized around groups rather than around individuals
3. **Management Focus** - the degree to which management decisions take into account the effect of outcomes on people within the organization
4. **Unit Integration** - the degree to which units within the organization are encouraged to operate in a coordinated or independent manner
5. **Control** - the degree to which rules, policies, and direct supervision are used to oversee and control employee behavior
6. **Risk tolerance** - the degree to which employees are encouraged to be aggressive, innovative, and risk seeking
7. **Reward criteria** - the degree to which rewards such as promotion and salary increases are allocated according to employee performance rather than seniority, favoritism or other non-performance factors
8. **Conflict tolerance** - the degree to which management focuses on outcomes rather than on techniques and processes used to achieve those results
9. **Means versus ends orientation** - the degree to which management focuses on outcomes rather than on techniques and processes used to achieve those outcomes
10. **Open-system focus** - the degree to which the organization monitors and responds to changes in

*Table 1 Displays the definitions of culture from Project Management: The Managerial Process, Larson & Gray, 2011, pp.79-80*
Figure 1 displays the dimensions of organizational culture profile that support strong organizational management (Erik W Larson, 2006). The bars located in the middle of the diagram display the areas of initial test culture according to Larson, pg. 22.

Figure 3 displays a culture that has been widely used and linked to creating the best outcomes. These results, found by Erik W. Larson, are used throughout this study to aid in understanding an initial test culture. According to Larson, this type of culture has been proved to be most widely accepted as providing the best influence on subordinates and creating the greatest opportunity for change while also fostering accomplishments in many different areas and fields. Whether this can be applied to academics is still uncertain. For now, it was compared to the findings of each school and the schools as a whole.
Theory and Hypothesis

After research was conducted, models, hypothesis and definitions were developed to answer the following questions. The most important question to answer is how does leadership and culture relate to academic success in higher education departments? The questions below build from this question and help determine steps to discover the final solution.

Initial questions to answer:

Q1: How does one measure leadership?

Q2: How does one measure success?

Q3: Can one measure organizational culture? If so, how?

Q4: Do business organizational leadership theories still apply to university leadership?

Q5: What can departmental management do to better their students?

Q6: How does James Madison University Engineering compare in terms of academic success to the identified peer institutions?

In order to answer these questions, analysis was performed to look at leadership, culture, and organization and how each of these three factors relates to the program and the students’ success.

Definitions:

Initially, academic success means some sort of student advancement (“Defining and Measuring Academic Success,” 2015). The basis for the original definition was built around the U.S. News and World Report rankings of undergraduate engineering programs. However, by the end of
In this project a tailored and descriptive definition of academic success will be presented. For now, academic success in relation to this study will focus on analyzing faculty, program, and other factors that influence the success of the students and the program as a whole.

**Leadership** is a process of influence on people in a variety of environmental settings and influences to gain a desired action or exemplify a desired action (leading by example). Success of an organization depends heavily on the process of leadership. The process of leadership is influencing others to the execution of tasks, but also includes their willingness to follow a leader (Korisnik, 2015).

**Organizational culture** is a reflection of the personality of an organization and refers to a system of shared norms, beliefs, and assumptions which binds people together, thereby creating shared meaning (Korisnik, 2015).

The definition of academic success could vary between institutions and could even vary depending whom you ask. A department head may have a very different definition of academic success compared to a research assistant or an instructor. In this study, academic success is defined as that which dealt with the success of the students and the success of the program as a whole. In terms of student success this variable was measured through average starting salary, job placement percentage, and graduation rate.

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*Equation 1: Academic success and leadership and culture relationship to be modeled in this project*
Developing a relationship between leadership, culture, and academic success is not widely understood based on the literature found. Therefore, the following simple model was developed to display the relationship that was tested during this project. This model provides a basis for understanding how and why each of the two factors is related to academic success. This entire thesis is based around explaining this model.

Leadership however, was broken down based on the model represented in figure 4. It focused on emphasizing mechanics, the age of the program and how long the department head has been in position and then contrasted those metrics with the style of leadership found from the survey. It is predicted the certain types of leadership will be more prevalent in younger organizations and will create certain effects on academic success.

The next model developed was based on understanding metrics of measuring academic success. The preliminary model displayed in figure 5. builds on the model mentioned in the literature review. This model is tailored to apply specifically to engineering education with emphasis on topics
or areas that were of particular interest to Madison Engineering management or department leads. This is the preliminary model, the revised model based upon analysis, data availability and findings is presented in the results section. It is predicted that commonalities in certain measurements will appear based on certain types of leadership and culture. For example, it is hypothesized that programs with a small student to faculty ratio and small class sizes will emphasize student learning over research and will have group projects over individual assignments.

![Diagram of Academic Success](image)

Figure 3 Expands a few of the factors leading to academic success factors and models certain metrics (“Defining and Measuring Academic Success,” 2015)

The following hypothesis are based on the models above and the preliminary research. They are to be tested and analyzed from the data collected. The results are discussed later in this report.

**H1:** Autocratic leadership style negatively influences academic success

**H2:** Democratic leadership style positively influences academic success

**H3:** Laissez-Faire leadership style does not have a significant influences on academic success

**H4:** The undergraduate programs selected are more student focused versus research focused
H5: Department heads have different views or perspectives on culture and leadership compared to non-department heads

H6: The peer institutions will have similar cultural and leadership findings

H7: JMU should have similar cultural and leadership findings compared to the peer institutions

Based on these hypothesis, the data will be analyzed to determine which are accurate and where further analysis can be explored. While some of these may not be entirely possible to conclude because of the small amount of entries, attention can be brought to areas of interest where differences are being brought into the light.
Methodology

The initial approach to this project was to define the three areas of interest, culture, leadership, and academic success in relation to engineering higher education and understanding their relationship to engineering education. The next step was to research the current relationship between leadership, culture and success that is available in literature. Further analysis was to apply this research to higher education at James Madison University, specifically engineering. The definition of academic success were then refined to fit the boundaries of this study and describe the variables to be tested. Research and literature review were performed to understand different aspects of leadership and culture before deciding on a reference of each to use in further analysis.

The identified comparative schools were chosen after consulting engineering faculty at James Madison University who had been conducting research into compiling a list of these schools. While this is not an approved official list of peer institutions, this list of schools was developed because they have similar goals and methodologies to the Madison Engineering program and through extensive consultation the list was narrowed and finalized for the purpose of this study.

The following project used a combination of data analytics from archival or readily available data and cross examined the results to a survey conducted. The questions are attached in Appendix I. The survey was sent to all faculty, management, and staff at all of the identified institutions. Both qualitative and quantitative data were gathered from an electronic survey sent to the eight identified comparative schools.

Peer institutions or comparative school have been identified as undergraduate engineering schools with a singular degree program or a program with similar foci. Ideally these peer institutions also do not offer additional engineering programs nor do they offer a masters or doctorate degree in engineering. The listed comparative schools were chosen based on similarities in program goals,
structure, offerings, and availabilities and were used as a basis of comparison for achievements. The Madison Engineering program looks to the following schools as models and examples while also serving a benchmark for unique engineering programs.

The eight comparative schools, Rose-Hulman Institution of Technology, Western Kentucky University, Western Washington University, Mercer University, Franklin W. Olin College, Cooper Union university, University of Illinois and Harvey Mudd College were specified by the leadership in Madison Engineering as exemplary programs or departments to which Madison Engineering would like to emulate. Their relation to Madison Engineering was specified by the consulted faculty with Rose-Hulman Institute of Technology being the most important to emulate and University of Illinois and Harvey Mudd College being the least.

Data gathering consisted of two sets of quantitative data. A large set of data was pulled from the U.S. News rankings database that included all schools with an engineering undergraduate program. This dataset was then divided into school with doctorate engineering degrees offered and those without. An additional survey was conducted to determine the type of culture at each of the benchmarked institution. This survey will seek to understand the organizational and institutional culture of the department. The results should determine what type of culture each department has.

**Measuring Leadership and Culture of a Program**

Specific leadership style and cultural questions were included in the survey conducted during this study (Appendix I), while mechanics and descriptive data were gathered through benchmarked research. The leadership questions took place in questions 13 in the survey. These questions were taken from previous research done by Ivan Miloloza to perform leadership analysis of three types of leadership, autocratic, democratic and laissez-faire. Under question 13, the first fourth, seventh,
tenth, thirteenth and sixteenth statement presented claims that measure the presence of autocratic leadership in an organization \{korisnik:2015ug\}. The higher the score, the higher the presence of autocratic leadership. The breakdown of understanding which statements related to which style of leadership is below in Table 2.

<table>
<thead>
<tr>
<th>Autocratic</th>
<th>Democratic</th>
<th>Laissez-Faire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Employees need to be supervised closely, or they are not likely to do their work.</td>
<td>2. Employees want to be a part of the decision-making process.</td>
<td>3. In complex situations, leaders should let subordinates work problems out on their own.</td>
</tr>
<tr>
<td>4. It is fair to say that most employees in the general population are lazy.</td>
<td>5. Providing guidance without pressure is the key to being a good leader.</td>
<td>6. Leadership requires staying out of the way of subordinates as they do their work.</td>
</tr>
<tr>
<td>7. As a rule, employees must be given rewards or punishments in order to motivate them to achieve organizational objectives.</td>
<td>8. Most workers want frequent and supportive communication from their leaders.</td>
<td>9. As a rule, leaders should allow subordinates to appraise their own work.</td>
</tr>
<tr>
<td>10. Most employees feel insecure about their work and need direction.</td>
<td>11. Leaders need to help subordinates accept responsibility for completing their work.</td>
<td>12. Leaders should give subordinates complete freedom to solve problems on their own.</td>
</tr>
<tr>
<td>13. The leader is the chief judge of the achievements of the members of the group.</td>
<td>14. It is the leader’s job to help subordinates find their “passion.”</td>
<td>15. In most situations, workers prefer little input from the leader.</td>
</tr>
<tr>
<td>16. Effective leaders give orders and clarify procedures.</td>
<td>17. People are basically competent and if given a task will do a good job.</td>
<td>18. In general, it is best to leave subordinates alone.</td>
</tr>
</tbody>
</table>

Table 2 lists the statements from the survey, question 13, that represented each type of leadership style.

The survey (Appendix I) gave respondents the opportunity to express their agreement or disagreement or association with any of the areas of leadership or culture represented. The scale ranged from 1 to 7 depending on the factor and was then interpreted to understand each type of
leadership or cultural component score. The dimensions of leadership that were analyzed and studied are graphically displayed in figure 4.

Variables

The variables of interest used to describe each of the three topics of interest are described and listed below.

Factors that explain or examine why and how a program is structured or shaped the way it is also helps analyze or display any relationship to academic success. The following factors did not fit into leadership nor culture but examine the structure of the organization or the program and were used to identify relationships between the output variables listed and the input variables stated here.

Other factors not listed in models above:

- IO1. Percentage of individual assignments
- IO2. Percentage of group assignments
- IO3. Percentage of individual projects
- IO4. Percentage of group projects
- IO5. Length of capstone
- IO6. Percentage of capstone projects with external clients
- IO7. Percentage of capstone projects with internal clients
- IO8. Percentage of capstone projects with no clients
- IO9. Age of the Program
Measuring Academic Success of a Program

Measuring the success of an organization is typically done in relation to their ability to achieve their goals, and objectives. In order to find benchmarked comparable data, and cross examine university programs, the following general metrics and measures of performance were determined. Figure 5 outlines the initial dimensions to be studied graphically, the list below is the data that was collected with enough results to provide analysis.

Dimensions of the Program:

- P1. Percentage of classes with fewer than 20 students
- P2. Percentage of classes with more than 50 students
- P3. Number of applicants
- P4. Number of students in the engineering program
- P5. Endowment
- P6. Retention
- P7. Acceptance

Dimensions of the Faculty:

- F1. Student to faculty ratio
- F2. Percent of faculty with tenure
- F4. Percent of faculty who are full-time

Dimensions of the Students:

- S1. Graduation percentage
• S2. Alumni giving percentage

• S3. Starting salary

Data collected by preliminary research was analyzed and relationships were identified to examine correlations between these output variables listed above, and the input variables of leadership and culture. One of the most widely used measured of academic success is a third party ranking system. For this project, U.S. News rankings, O1 were utilized and that was considered an output variable or a result of certain leadership and culture. The relationships were analyzed and influences of the input variables on the ranking was identified.

Leadership mechanics help determine what style of leadership different programs have. These factors include variables such as who makes the decision, how decisions are made and how these decisions can impact the future success of the program.

Important common measurements of ideal universities are class sizes and student to faculty ratio. Both of these variables were collected from the large data set and were analyzed with relations to both culture and leadership. Other variables of interest included endowment, age or history of the program and the gender of the department head. From the survey, data on measuring the culture of the organization and the leadership style was collected. The survey helped understand whether departments are teaching focused versus research focused.

Limitations

The limitations of this study primarily pertain to the availability of information, specifically descriptive or qualitative information. Much of the analysis of culture and leadership are based on
responses to a survey of a small select group of individuals. These results then need to be analyzed to preexisting data that describes an institution. The data available is presented according to the institution and many metrics desired are not available to the public or are not of interest to the institution and are therefore not reported. Due to the ambiguity of the topic and the terms chosen it was difficult to find preexisting research and benchmark analysis. It created difficulties especially when heavily relying on an electronic survey that does not generate mass respondents.

These topics have a mass variety of applicability and the analysis can be tailored in many different directions. The complexity of this topic could have extended years into thesis research. The limitation was struggling to pinpoint a specific area of interest that was possible to accomplish within the time frame. Unquantifiable variables, such as the ones used in this study, are extremely difficult to validate and therefore would have added significant amount of time to dive into each of these areas in depth.
Results

The model represented in figure 5 was developed based on findings from Travis T. York, Charles Gibson and Susan Rankin from the University of Pennsylvania and Valdosta State University. Their extensive literature analysis helped develop a final definition of “student success,” which they claim is used interchangeably with academic success (“Defining and Measuring Academic Success,” 2015). The model developed here was based upon their findings with emphasis on particular areas of interest identified by leadership within Madison Engineering.

York and his colleagues defines student success as “academic achievement, engagement in educationally purposeful activities, satisfaction, acquisition of desired knowledge, skills and competencies, persistence, attainment of educational outcomes and post-college performance” (“Defining and Measuring Academic Success,” 2015). The following describes this projects developed definition of academic success and the research model.

**Academic Success**, for the purpose of this study, is defined as a relationship between faculty performance and influences, program or organizational structure, persistence, satisfaction, and post-college performance. The updated preliminary model based on findings and literature research is displayed in Figure 6 below.
Figure 4: Displays the updated model of the measurements and factors that define Engineering Programs Academic Success.

The model above helps visually represent and understand the many dimensions of academic success. Each of the five categories or areas, satisfaction, program/organizational structure, faculty, persistence, and post-college performance are all influenced by leadership and culture. The variables above can be quantitatively measured and correlations can be identified. For example, if a school values small teams or has a culture built around close relationships it can be expected that they have a smaller student to faculty ratio than others. If a program creates a culture around satisfaction of student life and happiness it is predicted that they will have a higher alumni giving percentage. The purpose of this model was to display and convey the tailored definition of academic success to engineering education.

From the survey shown in Appendix I, metrics that describe how a program is internally ran and details about the program became available. This made available comparison of Madison
Engineering’s’ curriculum and its’ comparative schools curriculum. Figure 7 graphically shows the group and individual assignments and projects in comparison between JMU and non-JMU engineering programs programs. These percentages were gathered from the survey analysis and averages were taken for comparison. While all of the values are fairly close the one area where JMU varies the most is group projects. Non-JMU programs have more group projects (26.7%) compared to the JMU program (23.8%) while JMU has slightly more individual projects than non-JMU programs.

![Figure 7](image)

The survey also captured data on the capstone projects of each of the identified peer institutions. The capstone length for each schools’ curriculum is listed in the academic success factor table, Table 3. Madison Engineering has a fairly equal breakdown of external clients, internal clients, and no clients for their capstone classes. No clients take the largest percentage at JMU with 37.6% while capstones without clients at non-JMU programs makes up only 3.4%. For non-JMU programs the distribution is heavily weighted toward capstones with external clients. The external clients available to non-JMU programs is significantly higher than the JMU capstone clients.
The survey given asked the respondents to give their opinion or perspective on how leadership is conducted in their department. The survey is attached as Appendix I. The leadership question asks leaders to reflect on themselves or asks faculty to reflect on their leader. Questions that reflected each type of leadership leadership were averaged, grouped by school and represent the schools’ “score” for each type of leadership. The results are shown in Table 3. In regards to
autocratic leadership Western Washington had the lowest autocratic score at 1.4 while JMU had the highest, at 2.94, of all universities. Western Washington also had the highest democratic leadership score at 3.83 and Harvey Mudd had the lowest at 2.5. University of Illinois laissez-faire leadership score is 2.89 and that was the lowest of all schools. Mercer University had the highest laissez-faire score of 3.6 across all of the identified comparative schools. All schools had either a laissez-faire leadership style in management or a democratic style. Most schools had laissez-faire and two school had both. All schools' lowest score was autocratic leadership. Understanding the different leadership scores can tell us how these organizations relate to each other.

At first glance examining the three types of leadership scores by comparing Madison Engineering to all of the identified school it would seem that JMU falls into the mix and follows the appropriate trend. JMU had the highest leadership score as a laissez-faire leadership style, as well as most of the other identified comparative schools. JMU however, has a lower laissez-faire score than all other schools except Western Kentucky, with a Laissez-Faire score of 3. It is also important to notice that while JMU’s dominant leadership style is not autocratic, they had the highest autocratic score among all surveyed universities. This means that among all of the autocratic leadership statements, JMU faculty believed they applied to their organization more than any other university faculty. This is very important to note because autocratic leadership has been tied to decreasing many important factors of academic success such as U.S. News ranking, starting salary, and alumni giving rate.
<table>
<thead>
<tr>
<th>Leadership Style</th>
<th>Autocratic</th>
<th>Democratic</th>
<th>Laissez-Faire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Franklin W. Olin</td>
<td>1.6</td>
<td>3.17</td>
<td>3.5</td>
</tr>
<tr>
<td>Harvey Mudd</td>
<td>1.9</td>
<td>2.5</td>
<td>2.92</td>
</tr>
<tr>
<td>JMU</td>
<td>2.94</td>
<td>3.11</td>
<td>3.17</td>
</tr>
<tr>
<td>Mercer</td>
<td>2.28</td>
<td>3.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Rose-Hulman Institute of Technology</td>
<td>1.75</td>
<td>3.53</td>
<td>3.1</td>
</tr>
<tr>
<td>University of Illinois</td>
<td>2.73</td>
<td>3.33</td>
<td>2.89</td>
</tr>
<tr>
<td>Western Kentucky</td>
<td>2.4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Western Washington</td>
<td>1.4</td>
<td>3.83</td>
<td>3</td>
</tr>
<tr>
<td>Cooper Union</td>
<td>2.8</td>
<td>3.3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Table 3 Displays the score for each school in the three different types of leadership. The highest score for each school is highlighted in red.

From this study it is clear that many factors of leadership and culture relate to academic success. The unclear part is that some of these factors also influence each other and thus it is not a simple one-way equation. Many correlations were identified through the survey. For example, in relation to culture, high team emphasis and low conflict tolerance showed positive correlations to the U.S. News Rankings. Higher team emphasis showed a strong positive correlation to graduation rate and both high unit integration and team emphasis were related to higher alumni giving. In terms of leadership, the lower the laissez-faire and autocratic score the higher alumni giving percentage. The higher democratic or autocratic style the higher the graduation percentage. Overall the study showed the beginning of strong correlations and that further analysis with greater quantity of values would need to confirm these findings. These findings are further analyzed below.

While the above Table describes the leadership results, Table 3 lists the cultural analysis for each cultural factor for the university. Cultural factors were measured on a scale of 1 to 7. The higher the score the closer to the factor associated, the lower the score, the closer to the opposite
factor. Of the 10 components of culture the scale contains low rankings for identifiable factors such as job identity, individuality, independence and low risk. The high scale for each of these factors includes cultural identities such as organization identity, team emphasis, people focus, and interdependent integration.

The Table also depicts the initial test culture to provide the best outcomes for projects. This initial test culture has also been applied to many other businesses, organizations or programs. It is used here as a basis of comparison. The initial test culture has members that identify more with their organization, they focus on team emphasis, management focuses slightly on people over tasks, unit integration is highly interdependent, there is a slightly loose control system, high risk tolerance, a reward criteria focused on performance, high conflict tolerance, an even balance of means and ends focus and a highly external focused open system.
<table>
<thead>
<tr>
<th>Scale - Low (1)</th>
<th>Member Identity</th>
<th>Team Emphasis</th>
<th>Management Focus</th>
<th>Unit Integration</th>
<th>Control</th>
<th>Risk Tolerance</th>
<th>Reward Criteria</th>
<th>Conflict Tolerance</th>
<th>Means-Ends</th>
<th>Open System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Job</td>
<td>Individuals</td>
<td>Task</td>
<td>Independent</td>
<td>Loose System</td>
<td>Low Risk</td>
<td>Performance</td>
<td>Low Tolerance</td>
<td>Means</td>
<td>Internally Focused</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scale - High (7)</th>
<th>Member Identity</th>
<th>Team Emphasis</th>
<th>Management Focus</th>
<th>Unit Integration</th>
<th>Control</th>
<th>Risk Tolerance</th>
<th>Reward Criteria</th>
<th>Conflict Tolerance</th>
<th>Means-Ends</th>
<th>Open System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Organization</td>
<td>Teams</td>
<td>People</td>
<td>Interdependent</td>
<td>Controlled System</td>
<td>High Risk</td>
<td>Other</td>
<td>High Tolerance</td>
<td>Ends</td>
<td>Externally Focused</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial test culture</th>
<th>Member Identity</th>
<th>Team Emphasis</th>
<th>Management Focus</th>
<th>Unit Integration</th>
<th>Control</th>
<th>Risk Tolerance</th>
<th>Reward Criteria</th>
<th>Conflict Tolerance</th>
<th>Means-Ends</th>
<th>Open System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Organization</td>
<td>Team</td>
<td>Slightly People</td>
<td>High Interdependent</td>
<td>Slightly Loose</td>
<td>High Risk Tolerance</td>
<td>High Performance Focus</td>
<td>High Conflict Tolerance</td>
<td>Middle means and ends</td>
<td>Highly External Focus</td>
</tr>
</tbody>
</table>

| Franklin W. Olin     | 5.2            | 4.6            | 3.8               | 4.8             | 2.5     | 6.5            | 2.5             | 4.7               | 2.8       | 4.7         |
| Harvey Mudd          | 4.0            | 5.0            | 3.0               | 3.5             | 1.5     | 3.5            | 4.0             | 3.0               | 5.5       | 3.5         |
| JMU                  | 2.3            | 2.9            | 3.1               | 2.6             | 3.8     | 2.9            | 5.1             | 2.8               | 3.1       | 2.3         |
| Mercer               | 4.0            | 4.4            | 3.6               | 4.4             | 2.2     | 3.4            | 3.6             | 3.0               | 6.2       | 3.2         |
| Rose-Hulman          | 4.7            | 4.3            | 5.1               | 3.5             | 3.6     | 3.5            | 3.9             | 3.4               | 4.0       | 2.8         |
| University of Illinois | 2.7          | 2.0            | 5.0               | 2.3             | 5.3     | 3.3            | 2.3             | 2.0               | 5.7       | 4.3         |
| Western Kentucky     | 2              | 1              | 2                 | 4               | 1       | 4              | 4               | 2                 | 4         | 2           |
| Western Washington   | 3              | 5              | 6                 | 3               | 6       | 6              | 1               | 6                 | 4         | 5           |
| Cooper Union         | 1              | 6              | 4                 | 2               | 2       | 5              | 1               | 6                 | 4         | 4           |

Table 4 Outlines the cultural analysis based on factor averages from each university. The purple highlight is the ideal organizational culture according to “Project Management: The Managerial Process, 2014.” The blue highlighted numbers are those that were measured dimension was closest to the ideal values. The orange is where scores were furthest from the ideal values.
Table 5 Displays the academic success factors as well as some of the input variables that could influence academic success. James Madison is displayed in purple. Orange represents the best, highest, or most desirable characteristics within each category. Green represents the lowest or least desirable characteristics of each category.
Table 5 listed above, displays the dimensions of academic success. This Table helps summarize basic structural data and findings. Rose-Hulman was identified as the most important peer institution because JMU management idolizes their program the most. In relation to Rose-Hulman JMU has a higher student to faculty ratio, half the teachers with tenure, and a lower full time faculty percentage. They have similar percentages of classes with fewer than 20 students but JMU has a much higher percentage of classes with greater than 50 students, 11% compared to 0.2%. While JMU is a much larger school, Rose-Hulman has a much larger program, with a capstone half the length of JMU and a higher alumni giving percentage and starting salary. The Table presents findings in an easily visual comparative feature and we can clearly see how JMU fits into the mix of schools.

After further detailed analysis from the gathered survey results, correlations were identified between input and output factors. While these findings provide an area of interest, more respondents and additional responses are required to provide an accurate analysis. These findings display relationships or correlations that need to be further explored.

- Faculty from schools ranked highest in the U.S. News ranking also rated teaching importance highest among other institutions
- Faculty from schools ranked highest in the U.S. News ranking also rated research importance as the highest among other institutions
- The lower the U.S. News rank, the lower the starting salary
- The lower the U.S. News rank, the higher the student to faculty ratio
- The higher the graduation rate the higher the U.S. News rank
- The higher the alumni giving percentage the high the U.S. News rank
- The higher the number of students in the engineering program the higher the US. News rank

Leadership

- Correlation between the higher the autocratic leadership score the lower the U.S. News ranking
- Democratic leadership style may have some influence on U.S. News but it is inconclusive - no current correlation but correlation could be developing
- Laissez-Faire leadership style has clearly no correlation to U.S. News Ranking
- The higher the democratic leadership style the higher the starting salary
- The higher the autocratic leadership style the lower the starting salary

Culture

- The higher the team emphasis score the higher the U.S. News rank
- The higher the member identity the higher the U.S. news rank
- The lower the management focus the lower the starting salary, the larger the management focus the higher the starting salary
- The higher the open system score the higher the starting salary
- The higher the team emphasis the higher the starting salary
- The higher the conflict tolerance score the higher the graduation rate percentage
- The lower the control score the higher the graduation percentage rate
- The higher the risk tolerance the higher the graduation rate percentage
- The higher the open system score the higher the average alumni giving percentage
- The lower the control system the higher the average alumni giving percentage
- The higher the control factor the higher the student-faculty ratio
- The higher the team emphasis the lower the student faculty ratio
- The higher the open system the lower the student faculty ratio

Overall, this project provided a preliminary exploration of culture, leadership, and academic success among engineering departments at various universities. The findings are interested and provide areas to explore but they cannot be conclusive because of limited methodologies, lack of data, and the inability to perform proper statistical analysis. Moving forward, Madison Engineering students, faculty, and administrators can utility this better understanding of the ideas that make up academic successes and factors that might influence them. To determine extensively how and why these factors influence them, additional research will have to be conducted.
Discussion

The goal of this study was to use this analysis and understanding to develop suggestions for improvements and enhancements of the James Madison University engineering program. My suggestion is to give further analysis to the leadership style. When analyzing the survey results many people responded that they did not feel their opinion was taken into consideration by management. These respondents were almost all from James Madison University. It is important to analyze Madison culture in relation to the comparator schools is also interesting. JMU was not closest to the initial test culture in any category. In fact, they were the furthest from the ideal of all schools in both risk tolerance and reward criteria. From analyzing these results, it is clear that if JMU engineering wants to become a “model for the engaged university” they must further analyze their current leadership style and their culture. The Madison culture and leadership are both in the adolescence of their development and are thus easier to change or influence now than they will be years from now. That is why it is important to perform further analysis.

Reflecting on this project many challenges can be identified and arose during this study, the largest being response to survey and quantifying unquantifiable variable such as academic success leadership, and culture. These factors are opinion based and lack standard metrics which made it very hard to measure. The project also took place in an ever changing environment and was attempting to analyze a changing program.

The largest challenge for me was identifying unquantifiable characteristics and finding measures to quantify these characteristics. Overall, the project was a huge learning experience and provided me with a unique perspective. Unfortunately, because of the enormity of the terms “leadership,” “culture,” and “success”, further analysis with additional time allocation would be
required to provide any statistically sound findings and correlations. These findings provide an introduction and awareness to flag areas of interest and topics to be further developed.

**Future Recommendations**

This project and analysis did not analyze how the environment impacts leadership, culture, or academic success. The environment would be a fourth dimension that will impact all three aspects studied and thus was left out in this project. Leaving out environmental characteristics allowed leadership and culture to be isolated. For future recommendations analyzing environmental impacts on leadership and culture would create a multidimensional analysis and would provide more accurate results.

Additional future recommendations include focusing on a specific area of leadership, for example autocratic, or a specific feature of culture and further developing and analyzing it to determine exactly how it relates to academic success. The models and metrics of academic success can be used to measure understanding but the input variables and the data needs to be expanded as many additional influences were ignored in this study and could have massive impacts on results.
Appendix/Appendices

Appendix I. Leadership and Culture Survey

Q24 Please select your institution:
- James Madison University
- Cooper Union
- Franklin W. Olin College
- Harvey Mudd
- Mercer University
- Rose-Hulman Institute of Technology
- University of Illinois
- Western Kentucky University
- Western Washington University

Q25 I am a:
- Female
- Male
- Other

Q18 Please select your rank:
- Assistant Professor
- Associate Professor
- Full Professor
- Instructor/Lecturer

Q19 Do you have tenure?
- Yes
- No

Q20 Are you the department head?
- Yes
- No
Q21 Please enter the number of years you have been the following:

Professor at any college or university:
Professor at your current college or university:
Professor in your current department:

Q23 Do you feel that your opinion is valued in making departmental decisions?

<table>
<thead>
<tr>
<th>Influence on Decisions</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Somewhat disagree</th>
<th>Neither agree nor disagree</th>
<th>Somewhat agree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○</td>
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</tr>
</tbody>
</table>

The following (Q1 to Q10) are slider questions with 7 point Likert type scales:

Q1 Member identity refers to the degree to which employees identify with the organization as a whole rather than with their type of job or field of professional expertise. Individuals that identify highly with their job feel that their type of job or field of professional expertise provides a sense of identity for themselves. Individuals that identify highly with their organization feel that their organization provides a sense of identity for themselves.

_____ Member Identity

Q2 Team Emphasis refers to the degree to which work activities are organized around groups rather than individuals. Organizations that have a high team emphasis focus on groups and team work over individual priorities. Organizations that have a high individual emphasis focus on individuals over group and team priorities.

_____ Team Emphasis

Q3 Management Focus refers to the degree to which management decisions take into account the effect of outcomes on people within the organization. Cultures that identify as task focused value management decisions based on the tasks required. Cultures that identify as people focused value management decisions based on the people within the organization.

_____ Management Focus

Q4 Unit Integration refers to the degree to which units within the organization are encouraged to operate in a coordinated or interdependent manner. Organizations that consistently encourage independence tend to operate in a highly independent manner. Organizations that consistently encourage interdependence tend to operate in a highly interdependent manner.
Q5 Control refers to the degree to which rules, policies, and direct supervision are used to oversee and control employee behavior. Organizations that have little rules, or lack clearly defined policies and direct supervision to their employee behavior and operate on a loose control system. Organizations that have an extensive list of rules, or clearly defined policies and direct supervision to their employee behavior and operate on a tight control system.

Q6 Risk Tolerance refers to the degree to which employees are encouraged to be aggressive, innovative, and risk seeking. Organizations that have low risk tolerance do not encourage risk taking by their employees and even go so far as to prohibit and discourage risk taking. Organizations that have high risk tolerance encourage risk taking by their employees and even go as far as providing incentives or encouragement for risk taking.

Q7 Reward Criteria refers to the degree to which rewards such as promotion and salary increases are allocated according to employee performance rather than seniority, favoritism, or other nonperformance factors. Organizations that focus on performance reward criteria provide promotions and salary increases based on employee performance. Organizations that focus on other factors, such as seniority, nonperformance factors, and favoritism, provide salary and promotion increases based on such factors.

Q8 Conflict Tolerance refers to the degree to which employees are encouraged to air conflicts and criticisms openly. Organizations that identify as highly conflict tolerant promote employees to openly air conflicts and criticisms. Organizations that identify as low conflict tolerance promote employees to conceal conflicts and criticisms to the others.

Q9 Means-ends orientation refers to the degree to which management focuses on outcomes rather than on techniques and processes used to achieve those results. Organizations that are means oriented make management decisions based on the processes and techniques to achieve results. Organizations that are ends oriented make management decisions based on the outcome or the results desired.

Q10 Open-System Focus refers to the degree to which the organization monitors and responds to changes in the external environment. Organizations that are externally system focused monitor and respond quickly and
often to changes in the external environment. Organizations that are internally system focused block out, or do not monitor or respond to changes in the external environment.

_____ Open-System Focus

Q11 How strongly do you feel your organizational leadership, department head, dean, co-workers, etc. views the importance of, or uses the following:

<table>
<thead>
<tr>
<th>Research</th>
<th>Not at all Important</th>
<th>Very Unimportant</th>
<th>Somewhat Unimportant</th>
<th>Neither Important nor Unimportant</th>
<th>Somewhat Important</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student success and advancement</td>
<td></td>
<td></td>
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<tr>
<td>Teaching</td>
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</tbody>
</table>

Q12 When making an important decision, how often does your organization to use the following:

<table>
<thead>
<tr>
<th>Authoritative or individualistic decision making</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Most of the Time</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitative or group decision making</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Consultative or asking for aid from subordinates or outside sources</td>
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<td></td>
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<tr>
<td>Delegation or passing responsibility to subordinates</td>
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</tbody>
</table>

Q13 The following questions relate to the style of leadership. If you are a leader please answer in accordance to how you agree or disagree with the following statements. If you are not a leader please answer in accordance to how you believe your leader follows or does not follow the following statements.

<table>
<thead>
<tr>
<th>The leader believes employees need to be supervised closely, or they are not likely to do their work.</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The leader believes employees want to be a part of the decision-making process.</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>The leader believes that in complex situations, leaders should let subordinates work problems out on their own.</td>
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<tr>
<td>The leader believes it is fair to say that most employees in the general population are lazy.</td>
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<tr>
<td>The leader believes that providing guidance without pressures is the key to being a good leader.</td>
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<tr>
<td>The leader believes that leadership requires staying out of the way of subordinates as they do their work.</td>
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<tr>
<td>The leader believes that, as a rule, employees must be given rewards or punishments in order to motivate them to achieve organizational objectives.</td>
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<tr>
<td>The leader believes that most workers want frequent and supportive communication from their leaders.</td>
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</tr>
<tr>
<td>The leader believes that, as a rule, the leader should allow subordinates to appraise their own work.</td>
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</tr>
<tr>
<td>The leader believes that most employees feel insecure about their work and need direction.</td>
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<tr>
<td>The leader believes that leaders need to help subordinates accept responsibility for completing their work.</td>
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</tbody>
</table>
The leader believes that they should give subordinates complete freedom to solve problems on their own.

The leader believes that they are the chief judge of the achievements of the members of the group.

The leader believes that it is the leader's job to help subordinates find their "passion."

The leader believes that in most situations, workers prefer little input from the leader.

The leader believes that effective leaders give orders and clarify procedures.

The leader believes that people are basically competent and if given a task will do a good job.

The leader believes that in general, it is best to leave subordinates alone.

Q15 Select a class you are teaching this semester. (Excluding a capstone class). Please enter the percentage breakdown of the following class grades: An assignment applies to a short term, problem, homework, or small research work. A project applies to a longer term, more complex assignment that could take up a larger amount of the semester.

<table>
<thead>
<tr>
<th>Individual Assignments</th>
<th>Group Assignments</th>
<th>Individual Projects</th>
<th>Group Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>
Q16 The capstone projects at your organization has the following percentage of internal, external or no clients. Please drag the bar to the appropriate percentage. If the capstone is completed without the purpose or guidance of a client creating requirements please indicate no clients and the percentage of capstones without clients.

______ External Clients (Outside University)
______ Internal Clients (Within University)
______ No Clients

Q22 My highest degree is:

- Ph. D.
- Masters Degree
- Bachelors Degree

Q27 The discipline of my highest degree is in: (Ex. Chemical Engineering)
References


http://doi.org/10.1016/0149-2063(95)90015-2


[18] R.M. Felder, "Research on Teaching and Learning in Engineering." A transcript of the Academy of Chemical Engineers Award Lecture on the history, categories, and techniques of research on engineering education, presented to the Department of Chemical and Biological Engineering of the University of Missouri-Rolla, April 18, 2007.
