DEVELOPMENT OF THE JAMES MADISON UNIVERSITY UNDERGRADUATE ENGINEERING LEADERSHIP PROGRAM

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I am a senior engineering student at James Madison University. I expect to graduate with a B.S. of engineering and a mathematics minor in May 2015. I am pursuing a career in systems, sustainable, or environmental engineering while continuing to grow professionally by aiding my capstone project team as project manager and mentoring first-year engineering students. I have a lot of drive to uphold integrity and ethics in my work and actions, and I hope to be in a position where I can empower the disenfranchised and underprivileged.

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Work in progress: Development of the James Madison University Undergraduate Engineering Leadership Program

Abstract

The Department of Engineering (Madison Engineering) at James Madison University has a single baccalaureate engineering degree program that is aimed at engaging students and developing their engineering knowledge, skills, and values through a project-based curriculum. One recent development is the Madison Engineering Leadership (MadE Leadership) program. The engineering leadership idea grew from the first lines of the Harvard Business Review Blog Network June 7, 2010 article entitled “British Petroleum (BP)’s Tony Hayward and the Failure of Leadership Accountability,” by Rosabeth Moss Kanter where it stated, “BP doesn’t need an engineer at the helm. It needs a leader.” This article was published three months after the April 20, 2010 explosion of a British Petroleum offshore oil platform and subsequent oil spill in the Gulf of Mexico. More recently, the General Motors ignition switch issues that were reportedly known back in 2001, yet suppressed for more than a decade, provide another example that leadership principles should be incorporated into engineering programs, especially undergraduate programs.

The MadE Leadership program is currently under development. The program has been devised to provide upper-class undergraduate students with opportunities via course content and interaction with first-year students through the linkage to the redesigned first-year course ENGR 101: Engineering Opportunities where the leaders serve as mentors. The mission of MadE Leadership is to help students learn and develop mastery through practicing leadership skills in order to become effective, ethical, and empathetic leaders. The goals of the program are 1) engage engineering undergraduates with the skills and attitudes that will prepare them to be productive and ethical leaders and 2) integrate undergraduate education with leadership principles and practices. We strive for the program to be a model of what is at the core of Madison Engineering, which is the development of a community of learners that engenders respect, fosters excellence, promotes collaboration, inspires generosity, and encourages life-long learning.

In this paper, we present the framework of the program focusing on the structure of the summer workshop (MadE Leadership Mentoring Program) and the introductory course (Engineering Leadership I: Theory and Practice). The MadE Leadership Mentoring Program is a summer workshop that allowed students to conduct individual introspection while developing the core identity of the program and the leader peer group. Engineering Leadership I permitted the exploration into how leadership theory can inform and direct the way leadership is practiced and a platform for feedback during the semester as matters pertain to leading first-year students. The course is constructed to advance our understanding of the many different approaches to leadership and ways to practice it more effectively. The activities within the program are aimed to assist our students in achieving their greatest potential to adapt and to adjust to a diverse and ever changing world.
Introduction

The Department of Engineering (Madison Engineering – MadE) at James Madison University within the College of Integrated Science and Engineering was established in 2005 with the first cohort of students arriving in 2008. The program was granted ABET accreditation under the Engineering Accreditation Commission that took effect in October, 2011.

The First-Year Engineering Seminar course was the engineering entry course for the first-year engineering students in the first four years of the program. The first iteration of the course focused on the student gaining awareness about the multiple disciplines of engineering through mini-design challenges and providing opportunities for students to meet and speak with professionals in field. Assignments ranged from information literacy to reflecting on practicing engineers and upper division students who shared experiences about the discipline and program. In 2012, the seminar course was not offered, leaving only one course in engineering for students to take in their first year. Fall 2014 saw the reintroduction of the course under the title, Engineering Opportunities, where the focus was aiding the transition of the students from high school to college and welcoming the first-year students into the Madison Engineering Community and the discipline. To facilitate the process with the first-year students, upper level students embarked on a process to better themselves so that they could help others learn about the discipline and the community. The process became known as the Madison Engineering Leadership program.

The perspective of this paper is to describe the motivation, structure, and impact of the Madison Engineering Leadership (MadE Leadership) program on the students. This paper is divided into three sections: benchmarking, preparation, and prototyping. Each of these steps was critical in developing the program and creating the foundation.

Benchmarking

In order to provide quality opportunities for undergraduate students to engage in leadership principles, institutional programs were benchmarked. Below are three programs (the BOLD (Broadening Opportunity through Leadership and Diversity) Center, Illinois Engineering First-Year Experience - IEFX, and Penn State Engineering Ambassadors program) that were studied and reviewed to build the Madison Engineering Leadership program.

The BOLD Center at the University Colorado-Boulder (CU-Boulder) was a source for guidance. The BOLD Center is part of the commitment of CU-Boulder to create an environment where students live, learn, and lead efforts that showcase engineering as being essential to the health, happiness, and safety of our world. The students of the program also exemplify that the strongest engineering solutions are created by a workforce diverse in gender, ethnicity, and socioeconomic representation. The BOLD Center provided a blueprint in establishing an environment that fosters success through academic resources, student leadership opportunities and a supportive community.

Additionally, the First Year Experience program at the University of Illinois was benchmarked to gain an understanding on how to train undergraduate leaders for the role of being mentors for first-year engineering students. Their mission is to enhance the experience of the first-year
students by providing them with a supportive community to lay a solid foundation for their college career. The First Year Experience program requires all first-year students to take ENG 100, which introduces them to college life and the profession of engineering. This course splits the first-year students into smaller sections that are lead by an ELA (Engineering Learning Assistant). The purpose of these ELAs are to disseminate course information and provide insight and advice. At the University of Illinois, the course is listed as a 4-week class, however peer mentoring is encouraged throughout the semester to foster a sense of community in the engineering major.

One institution that provides an extracurricular opportunity for students is the College of Engineering at Pennsylvania State University who has established an organization called Engineering Ambassadors. Their mission is to encourage middle and high school students to share their passion for the field of engineering via mentoring and leadership by undergraduate engineering students.

Harnessing the idea of community leadership and sharing the excitement of engineering with students who aspire to attend college together, the MadE Leadership program included responsibilities for the leaders to participate in K-12 outreach, serve the department as ambassadors for activities on and off campus, and work with student led organizations on campus such as the Society for Women Engineers, the National Society of Black Engineers, and the Society for the Advancement of Chicanos and Native Americans in Science. Overall, the Madison Engineering Leadership program charge was to build a means to train peer-mentors, to create awareness that leadership is learned behavior, to explore leadership theories, and to apply leadership principles in order to aid in the crafting of an inclusive community pursuing excellence.

The course outcomes for Madison Engineering Leadership I: Theory and Practice with associated ABET outcomes follows in Table 1.

Table 1. Madison Engineering Leadership I Course Outcomes

<table>
<thead>
<tr>
<th>Upon successful completion of this course, the student will be able to:</th>
<th>ABET Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase their self-knowledge and begin to enhance self-management, social and work facilitation capabilities given activities to recognize personal leadership style, inclusive excellence and group dynamics.</td>
<td>i</td>
</tr>
<tr>
<td>State a description of the leadership theories covered in class with at least 2 strengths and 2 criticisms along with practical aspects of the approach under consideration.</td>
<td>f, g, j</td>
</tr>
<tr>
<td>Analyze case studies to provide insight into the different facets of the process of leadership given case studies of common leadership issues and dilemmas.</td>
<td>f</td>
</tr>
<tr>
<td>Establish effective working relationships with supervisors, peers, mentees and others.</td>
<td>d</td>
</tr>
<tr>
<td>Engage in self-regulated learning.</td>
<td>i</td>
</tr>
</tbody>
</table>
In providing the upper level students with opportunities to lead, the students needed to understand the level of responsibility that was involved in the venture. The students needed to be prepared to persist through the good and bad with the focus of providing a rewarding experience for all that were involved. They were to act on behalf of the college to support first-year students and were expected to always have the best interest of the first-years in mind. They were to be a trusted friend, counselor, motivator, sponsor, coach, role model, and referent. In order for the leaders to be all these and possibly more, they needed training.

**Preparation**

Student leaders participated in the inaugural Madison Engineering Leadership Mentoring Workshop. The goals and objectives of the workshop were the following:

- To know how to foster a network of support for first-year engineering students.
- To know how to aid in the academic, emotional, and social adjustment of first-year students.
- To know how to encourage the development of student relationships with other students, staff, and faculty within James Madison University and the Madison Engineering Community.
- To know how to provide consistent, reliable sources of support, information, and inspiration.

Upon successful completion of the Mentoring Workshop, the leaders would be able to demonstrate how to appropriately maintain and manage a mentoring relationship and further engage with their own college experience by helping and guiding first-year engineering students through theirs.

The workshop consisted of three segments that each targeted a unique area of personal development critical to successful leadership within the program. These areas were identified as personal leadership style, inclusive excellence, and facilitation and group dynamics. An area of development was addressed per segment and was hosted by the following members of the university: Associate Director of the Dux Leadership Research Center, Mr. Michael McCleve; Special Assistant to the President for Diversity, Mr. Art Dean; and the former Department Head of Learning, Technology, and Leadership Education and current Coordinator for Grants, Contracts and Special Projects of the College of Education, Dr. Diane Foucar-Szocki. Each of these individuals specialized in an identified area of personal development and provided instruction to stimulate growth as well as provide tools for the MadE Leaders to utilize in their leadership roles.

Personal leadership style was introduced by prompting the awareness of the leaders to the personal leadership potential of each individual. Awareness of the ability to lead by an individual was a motivation exercise to empower the leaders to apply exemplary leadership behavior within their unique style. The leadership model outlined in James Kouzes and Barry Posner’s *The Student Leadership Challenge* was adopted to accomplish this objective. By establishing Kouzes and Posner’s Eight Elements of the Core Philosophy, leaders were able to embrace leadership as a pattern of their behavior, actions, and attitudes as opposed to position and authority. Leaders
were able to take initiative in developing their leadership ability and in turn, owning their journey towards leadership. The Eight Elements of the Core Philosophy are as follows:

1. Leadership is Everyone’s Business
2. Leadership is Learned
3. Leadership is a Relationship
4. Leader Development is Self-Development
5. Learning to Lead is an Ongoing Process
6. Leadership Requires Deliberate Practice
7. Leadership is an Aspiration and a Choice
8. Leadership Makes a Difference

Embracing leadership as a pattern of behavior, actions, and attitudes permitted the leaders to accept the leadership potential within them. Leaders were given an opportunity to review their previous successes in leadership through Kouzes and Posner’s Personal-Best Leadership Experience. Reviewing personal narratives of moments as a successful leader and formulating Leadership Lessons to take away from these moments allowed the leaders to identify behaviors, actions, and attitudes they exhibited that resulted in effective leadership. This established leadership credibility within the leaders, as they were able to identify themselves as successful leaders.

Personal leadership traits were assessed through Kouzes and Posner’s Students Leadership Practice Inventory (LPI) Self Paper Version, which quantifies an individual’s performance in Five Practices of Exemplary Student Leadership. These practices are defined as Model the Way, Inspire a Shared Vision, Challenge the Process, Enable Others to Act, and Encourage the Heart. The LPI assessment indicates a high, moderate, or low score within each practice based on accumulated research. Through this assessment, leaders were made aware of their leadership strengths and weaknesses from which personal goals were set and action plans created to achieve these goals in exemplifying quality leadership. A leader would set a goal to improve in poor-scoring practices that required taking certain measures within themselves, such as exercising more effort to vocalize praise for recognizable efforts of peers to better encourage the heart. Goals were made within leadership duos such that MadeE Leaders could hold their leadership partner as well as themselves accountable in attaining these goals.

Further development in personal leadership took place in promoting self-awareness of individual behaviors. By acknowledging these behaviors, leaders could characterize settings that called for their unique leadership ability. The Personality Profile Assessment by Personality Insights Inc. assesses behavior styles based on William Marston’s DISC theory. Behavior styles, referred to as Style Blends, were defined in detail and related to particular Style Blend’s Primary Drive, Unique Giftedness, Value to an Organization, Ideal Environment, Fears, Response Under Pressure, and Blind Spots. Leaders were made aware of unique qualities of their Style Blend that indicated intrinsic capabilities that could be utilized in effective leadership.

Inclusive excellence was also an identified area of development for the leaders. Inclusive excellence as defined by the Center for Multicultural Excellence at the University of Denver is the recognition that a community or institution's success is dependent on how well it values, engages and includes the rich diversity of students, staff, faculty, administrators, and alumni.
It is believed and embraced that diversity in such aspects serves to enrich the experience of leadership via understanding the importance of how values, tolerance, and inclusion can offer valuable information in providing viable solutions. Twelve Inclusion Behaviors were shared for leaders to exhibit, which are defined as follows:

1. Greet people authentically—say “hello”
2. Create a sense of “safety” for yourself and your team members
3. Work for the common good and shared success
4. Listen as an ally—listen, listen, listen and engage
5. Be BIG: Lean into discomfort—be willing to challenge self and others
6. Put your stake in the ground and be willing, eager, and able to move it
7. Link to others’ ideas, thoughts, and feelings—give energy back
8. Create 360° vision: Ask others to share their thoughts and experiences, and accept their frame of reference as true for them
9. Address misunderstandings and resolve disagreements
10. Speak up when people are being made “small” or excluded
11. Ask who else needs to be involved to understand the whole situation to ensure right people, right work, right time
12. Build trust: Do what you say you will do and honor confidentiality

MadE Leaders took part in activities where open discussions were centered on presumed differences. These activities led to an increased level of awareness towards the need for diversity and how it may lead to positive impacts on the lives of people. The activity that exemplified the inclusive excellence idea was the mapping of priorities of various aspects of life (including family, friends, deity, material wealth, etc.) for each individual. Leaders were given opportunities to rank each of these and explain their reasoning to their peers so that each could see life from a different perspective and embrace the uniqueness of individuals.

The motivation to aid in developing skills in facilitation and group dynamics for the leaders was geared to aid in their ability to create open environments that promote interaction and effective group dynamics with peers and mentees. Suggestions were expressed in detail for improving facilitation techniques in an exercise known as Becoming Brilliant, which identified guidelines aimed to improve facilitation skills.

The skill of debriefing or processing group activities was also reviewed to instruct leaders in aiding their mentees in making connections between planned activities and learning objectives. Basic Principles of Debriefing that translate the experience of an activity to opportunities for learning and self-awareness for both mentor and mentee were defined as Reflection (What?), Generalization (So What?), and Transfer (Now What?)

A series of questions that the leaders could ask in a facilitator role in order to execute debriefing was also provided known as the Simple Six. These questions consist of 1) What happened? 2) Has it happened before? 3) Are you satisfied with the result? Why or why not? 4) Is it similar or different from other experiences you have had at school, home, or work? 5) Does this tell you anything about yourself? 6) What would you like to do about for the next activity, or when you return to school, home, or work?

MadE Leaders were provided a series of questions that were aimed to assess group dynamics of any given activity. These questions targeted Communicating Effectively, Expressing Appropriate
Feelings, Deferring Judgment, Listening, Leading Others, Following Others, Making Group Decisions, Cooperating, Respecting Human Differences, Respecting Human Commonalities, Trusting the Group, and Closure. These were also practiced during the session through an activity where each leader was given the opportunity to facilitate a group discussion. Leaders separated into groups of four where each leader facilitated a small group activity to generate an innovative idea.

Each of these techniques and styles were taught in eight sessions during four days. Each day included a morning and afternoon session, each lasting about four hours. This workshop was held the week before the fall semester began. That next Monday, the MadE Leaders met the first-year engineering students.

**Prototyping**

The first cohort of MadE Leaders consisted of twelve juniors and nine seniors. There were thirteen women and eight men and the leader duos were formed to have a junior and senior and if possible, of the opposite sex. The first day of ENGR 101: Engineering Opportunities, the first-year students were randomly split into groups of ten to thirteen. Each group had a pair of leaders responsible for being a reliable source of support, information, and inspiration. Every week, approximately 120 first-years would attend a ninety-minute session on Monday afternoon with two faculty instructors and the twenty-one leaders. The first-years would also attend a ninety-minute session on Wednesday afternoon every week where they met in their groups (first-year families of ten to thirteen) with their leader duo. The lecture topics for Monday included personal responsibility, human-centered design, systems thinking, ethics, reflection, communication, and team building. These topics were then taken into the application session on Wednesday in the form of projects or activities that were later presented by a couple members of the first-year families on the following Monday. Social media, mainly Twitter, was encouraged both inside and outside the classroom to document activities pertaining to engineering and the course. The first-years were taught that not only can you ruin your reputation by posting bad comments or pictures on social media, but you can actually market yourself through social media to potential employers by showing excitement, passion, and perseverance in the field of engineering.

At the core of ENGR 101 is Human-Centered Design (HCD). The first-year students in the second design assignment were provided challenges that the group had to agree to work on. These challenges ranged from encouraging low-income families to save a little more each week to enabling more young people to become entrepreneurs. They were given a week for each stage of the HCD process: Discover, Ideate, Prototype, and Implement. During these stages, first-year groups contacted local community programs and sought advice from professors and experts. The leaders aided in the brainstorming process by using lessons learned during the Madison Engineering Leadership Mentoring Workshop. After coming up with a prototype, each first-year family presented their designs to the entire class. The first-years were expected to dress professionally, prepare slides, and be well prepared to present their material for every presentation. By setting the expectations high, many groups did not meet expectations, which prompted some to learn from their mistakes (or the mistakes of others) that led some to exceed expectation at the end of this project.
Towards the middle of the semester, every student created a Pecha Kucha style presentation on how they view ENGR 101, how they view Madison Engineering, and how they will contribute to the program from their core beliefs and mission statement. A Pecha Kucha is twenty slides on a twenty second interval and was to be recorded at the Communication Center in the Student Success Center located on campus. This assignment followed a lecture on ethics where they were asked to look at their personal beliefs and compare them to the values of the department. This topic was introduced in an application session discussion concerning negligence of General Motors and the ignition switch recall.

At midterm, the leaders were given new groups of randomly selected first-years for four weeks. This allowed the first-years to meet and interact with other students and leaders. During this time in the semester, an activity was assigned with tasks that required the first-years to meet and get to know the faculty and staff in the engineering department. The purpose of this assignment was to engage them in the community of the engineering department and gain confidence in approaching professors they may eventually have as instructors. Another assignment was to define core values of Madison Engineering on sustainability. This was prompted after the academic unit head gave a lecture on the topic of sustainability. Most of the assignments during this time were planned and implemented by the leaders. At different points throughout the semester, each leader took the initiative to complete tasks and or projects. Once the first-years had a solid understanding of the engineering department and human-centered design, the role of the leaders changed from “director” to “guide”. With the final first-year student group project (IDEO’s Ebola challenge), the first year students when back to their original first-year families and the role leaders was to provide input if asked and to provide guidance through asking questions. The first-year student groups worked on the project over a month and each group arrived at a solution, presented their work before a panel of professors and alumni, and were judged on their process and final design.

**Course Structure**

The positive feedback from first-year students, the Academic Unit Head and the Dean of the College about ENGR 101 was heavily dependent on the effort and drive of the leaders who were required to enroll in ENGR 498: Madison Engineering Leadership I: Theory and Practice course as part of the Madison Engineering Leadership program. The course utilized a learner-centered framework where the activities (method, assignment, or assessment) were subjected to the test of a single question: “Given the context of the students, course, and classroom, will this action optimize my students’ opportunity to learn?” Instruction for the course was held three days a week for a half hour and the two-hour application session one day a week accounted for the rest of the course contact time. Leaders were expected to participate in the weekly application sessions and to facilitate exercises.

Madison Engineering Leadership I: Theory and Practice allowed for the exploration and reinforcement of concepts and promoted investigation of becoming an effective positive leader. Contract grading was employed to assess the student’s level of achievement on the course outcomes. Table 2 displays the contract that the leaders and the instructor were required to sign at the beginning of the semester.
Table 2. Grading contract for Engineering Leadership I

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Set/Option</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-class Quizzes</td>
<td>Set</td>
<td>5%</td>
</tr>
<tr>
<td>Class Attendance/Participation</td>
<td>Set</td>
<td>10%</td>
</tr>
<tr>
<td>Peer-led activity (1/duo)</td>
<td>Set</td>
<td>15%</td>
</tr>
<tr>
<td>Discussion Board (Case studies)</td>
<td>Option</td>
<td>10%</td>
</tr>
<tr>
<td>Weekly Discussion Topics</td>
<td>Option</td>
<td>10%</td>
</tr>
<tr>
<td>Peer Reviewer of Posts</td>
<td>Option</td>
<td>10%</td>
</tr>
<tr>
<td>Post-quizzes (min 6 of 10)</td>
<td>Option</td>
<td>10%</td>
</tr>
<tr>
<td>Articles (4) or Book (2) reviews blog post</td>
<td>Option</td>
<td>20%</td>
</tr>
<tr>
<td>Personal Statement Presentation</td>
<td>Option</td>
<td>20%</td>
</tr>
<tr>
<td>ePortfolio</td>
<td>Option</td>
<td>30%</td>
</tr>
<tr>
<td>Final Exam - Comprehensive (0-70%)</td>
<td>Option</td>
<td>70%*</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>100%**</td>
</tr>
</tbody>
</table>

Students were given an explanation of the assignments and presented with an opportunity to negotiate changes to the assignments. The “set” assignments were completed by all leaders and the “option” assignments were selected based on individual preference by each leader.

Explanation of the assignments follows:

*Final Exam – Comprehensive (0 - 70%):
This exam will consist of all topics discussed in class. This is the only task where you will be able to “trade-in” a prior grade (i.e. if you miss a post-quiz or assignment, you may replace the grade or grades with that of the exam); however, set work cannot be “traded-in”. You can determine the percentage of the final exam to be factored into your final grade.

**Set**

**Pre-class Quizzes** – After the reading assignment was given, pre-class quizzes were required through the learning management system.

**Class Attendance/Participation** – Class attendance and participation in ENGR 498 and ENGR 101 were expected.

**Peer-led activity (1 per duo)** – A peer-led activity project on a specific topic in leadership was required in order to produce a “learning package.” The elements the package are identified below in Table 3, with the total number of points that counted toward the grade of the students.
Table 3. Peer-lead Activity breakdown

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Briefing Paper</td>
<td>A 2-3 page (double-spaced) briefing paper on the issue for all class members.</td>
<td>30</td>
</tr>
<tr>
<td>Annotated Bibliography</td>
<td>An annotated bibliography of useful resources and references (videos, web sites, texts, etc.). It should include at least 10 items.</td>
<td>20</td>
</tr>
<tr>
<td>Class reading</td>
<td>One <strong>very clear</strong> photocopy of a reading that can be used for class in the future, and discussion (or thought) questions related to that reading. The reading should be something other than the corresponding chapter in Northouse’s Leadership: Theory &amp; Practice (6th Ed.).</td>
<td>10</td>
</tr>
<tr>
<td>Class Assignment</td>
<td>An active learning assignment that can be assigned to class in the future to facilitate learning and insight into your topic.</td>
<td>10</td>
</tr>
<tr>
<td>Class Presentation</td>
<td>A class presentation on your issue (15 minutes) followed by an activity (10 minutes) and class discussion/wrap up (5 minutes). We will devote approximately 30 minutes total to your topic.</td>
<td>20</td>
</tr>
<tr>
<td>Class Assessment</td>
<td>A quiz that can be taken via the course management system. It should include at least 10 items (multiple choice, T/F, short answer, etc.).</td>
<td>10</td>
</tr>
</tbody>
</table>

Options

Students were able to choose the work that they wished to perform so that the maximum potential total grade would equal 100%. The leaders were prompted to consider the opportunities that best align with their learning preferences, learning goals, and the course outcomes.

Discussion Board (Case Studies) – a 1- to 2-page reaction paper about the principle(s) and or theory depicted in the case study. If a theory is being discussed, at least two strengths and two criticisms should be stated along with practical aspects of the approach under consideration in terms of the case study should be specified. The paper should detail specific examples to support the argument being presented using materials above and beyond Northouse, Leadership: Theory & Practice (6th Ed.).

Weekly Discussion Topics – A class blog or discussion stream within the course management system is available to discuss topics pertaining to the chapters under review and/or current events dealing with engineering leadership. Post at least one response per week. Evaluations of posted comments will be done according to criteria such as: 1) demonstrates knowledge of the
reading/subject; 2) thesis is clear; 3) provides solid evidence; 4) understands significance of the topic; 5) extends topic to new area; and 6) raises relevant questions about topic.

**Peer Reviewer of Posts** (Case Studies or Weekly Discussion Topics) - 3 peers’ assignments per two weeks and a self-grade of all of your own work is a minimum. Rubrics will be provided via Canvas.

**Post-quizzes (6 of 10)** - To evaluate your understanding of the topics, post quizzes will be administered via learning management system. Six of the ten quizzes are a minimum. If this option was not chosen as part of the contract students could take the quiz(izes) and the grade would not be part of the contract.

**Articles (4)/(2) or Book (2)/(1) Reviews Blog Post** - Write a short critical review of a current peer-reviewed journal article about a selected topic of interest to you, and discuss it in terms of engineering. You may choose any topic discussed in this course, or other related topic, such as the business ethics, engineering management v engineering leadership, or diversity issues in engineering/engineering leadership. Reviews should be short (about ½ - ¾ page) and written in the style of an Amazon.com review (0 – 5 star rating, a brief overview of the article, and a brief critique.) During a class period, students will present their reviews and lead discussions of the selected articles.

**Book (2) or (1) reviews** - Read and review a selected book on leadership, leadership theory, teaching leadership, leadership pedagogy, engineering leadership, and engineering leadership education. Write a short amazon.com-style review (complete with star rating) from the point of view of an engineering educator, including the background of the author(s), overall objective, intended audience, clarity of topics presented, and usefulness of book for an engineering educator. (i.e. Were examples or specific applications offered that you can actually use in your future career as an engineering?)

**Personal Statement Presentation** – Personal statements are general a part of the application process for future employment and attendance to graduate school. Most statements are part of your "package," that may afford you an opportunity to display aspects of yourself that cannot be developed within a transcript or resume. A statement along with a presentation about your ideals, skills, aspirations could potentially be a strong differentiating factor when applying to competitive programs.

**ePortfolio** - The American Association of Colleges and Universities recent paper titled: It Takes More than a Major: Employer Priorities for College Learning and Student Success states that “more than 4 in 5 employers say an electronic portfolio (ePortfolio) would be useful to them in ensuring that job applicants have the knowledge and skills they need to succeed in their company or organization.” You would work with a Digital Communication Consultant to craft your ePortfolio.

The first class of the week was dedicated to a pair of leaders presenting on a leadership theory or practice. The main text for the course was Peter G. Northouse’s Leadership: Theory & Practice (6th Ed) and the supplemental text was Leadership: Enhancing the Lessons of Experience (8th Ed.) by Richard Hughes, Robert Ginnett, and Gordon Curphy. Prior to class, the leader duo was
required to follow the guidelines listed in the Peer-review Activity breakdown (Table 3). The second class time was primarily used for briefing the leaders on the discussion and activities that would take place later in that day in their first-year groups and how to effectively execute those activities. The last class of the week was devoted to reflecting on the first-year student application sessions, the activities in ENGR 498 and with activities tied to the department.

The application session with the first-year families and the leader duo was viewed by the leaders as the most beneficial part of the integration between ENGR 101 and ENGR 498. Leaders gained practical experience by leading the first-years in discussions and assignments with the goal of creating an open and engaging atmosphere. During this time, first-years frequently asked leaders about their experience in the program and their time at the university in general. Topics of discussion ranged from handling schoolwork, engineering societies, undergraduate research, to non-engineering extracurricular activities.

Assessment and Leaders

Assessment is part of leadership. Upon completion of first multi-week design project by the first-year students, the leaders were charged with evaluating each of their family members by writing one to two comments focused on participation and ranking the students in their families on a scale of 1-5 with 5 being a great team/family member. These evaluations were anonymously distributed to each group member so they could improve their team participation using the constructive criticism that was offered. Also at the midterm of the semester, the leaders were asked to write one to two sentences that were critically positive about each of the first-year students in their family in regards to contributions and areas that needed improvement. The leaders comments were included in a formal letter written by the instructors. The letters expressed the excitement of the instructors with the first-years being welcomed additions to the Madison Engineering community and how the instructors were impressed by the level of effort of most of the first-year students in regards to class participation and assignments. The letter also contained the grade standing of the individual up to that point in the semester.

In regards to the leaders, the first-year students were asked to complete an evaluation of the leaders. The United States Army Cadet Command (Leadership Performance Indicators) instrument was revised to become the Engineering Leadership Instrument. The original instrument was designed to present examples of behavior to assist the user in defining the appropriate leadership attributes and core leader competencies in accordance to adaptive leadership (exploring the practice of creative thinking that uses adaptive approaches drawn from previous circumstances or lessons learned, along with creating innovative approaches to solve issues)\(^2\). The revision is used to assess the attitudes of the first year students towards the leaders of their first-year families. The aspects of interest were perception of the first-year students towards the attributes of the leaders (i.e., character, presence, and intellect) and the competencies of the leaders (i.e., leads, foster teamwork, and accomplish goals).

First-year student responses were gathered using an online survey tool. The Likert scale range has been scaled to 1.0 and adjusted so that 1.0 would be the most desirable score. The aggregate score for all the leaders is presented in Table 4.
Table 4. First-year responses to prompts about Engineering Leaders

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Character</td>
<td>Presence</td>
</tr>
<tr>
<td>0.92</td>
<td>0.89</td>
</tr>
</tbody>
</table>

In general, the scores indicate positive interactions and relationships were established. More data is warranted.

The text data obtained through the collection of reflective questions at the end of the course were analyzed using a qualitative approach. Thematic analysis and emergent-grounded theory methods were used to coded and analyzed the reflections for themes\textsuperscript{13,14}. Thematic analysis helps to pinpoint patterns in the data that link the experiences of students together\textsuperscript{15}. The use of emergent grounded theory methods aid in focusing on the participants words and experience and provides valuable insight into the ways participants construct their worlds and in this case, course experiences as Madison Engineering Leadership students. The most common themes are illustrated in Table 5-8 with the frequency and a student quote that exemplifies the theme.

The qualitative themes were constructed using an emergent coding strategy as mentioned above. The MadE Leaders’ quotes below are in the student’s words and the researchers did not make additions or modify their written statements. Illustrated in Tables 5 - 8 are the most common themes and the frequency that they appear in the reflective statements.

Prompt 1: As a result of this course, what are your thoughts on your abilities pertaining to yourself -awareness, self-management, social and work facilitation capabilities give activities to recognize your personal leadership style, inclusive excellence and group dynamics.

Table 5. MadE Leaders’ responses to the above Prompt 1

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Change</td>
<td>3</td>
<td>My abilities are not able to answer this.</td>
</tr>
<tr>
<td>Confidence</td>
<td>11</td>
<td>After taking this course, I understand and am aware of my personal leadership style and how to apply it to different styles to group and individual leadership situations.</td>
</tr>
</tbody>
</table>
Prompt 2: As a result of you taking this course, how would you describe your individual feelings about the MadE Leadership experience? (Look at what has happened and describe your individual feelings.)

Table 6. MadE Leaders’ responses to the above Prompt 2

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Growth</td>
<td>6</td>
<td>I have grown as a person from this MadE leadership experience and have become a better leader by going through this process of working with the first-years and learning more about myself.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>I have truly loved this experience. I did not think I would get as attached to my first-years as much as I have. Walking into this experience I was nervous about my abilities to lead a group. At the end, I couldn’t wait to see them every week and I feel as if I have adopted new brothers and sisters into my JMU family.</td>
</tr>
</tbody>
</table>

Prompt 3: As a result of you taking this course, discuss and share an important part of learning, growth and/or development that has occurred as a result of the MadE Leadership experience. (Look at making meaning of the MadE Leadership experience through describing how you have changed because of the experience.)

Table 7. Leaders’ responses to the above Prompt 3

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>2</td>
<td>I now make sure that I am connecting with each person in the group instead of not being aware that each person responds differently to the different leadership techniques.</td>
</tr>
<tr>
<td>Confidence</td>
<td>9</td>
<td>I’ve seen that I have been able to voice my opinion more. I have always had trouble communicating with others and this experience has made me more confident in sharing my thoughts and realizing my opinion does matter.</td>
</tr>
</tbody>
</table>
Prompt 4: As a result of you taking this course, how do you hope to use the knowledge gain by the MadE Leadership experience to be a better you. (Will you take any actions or make any changes because of the experience?)

Table 8. Leaders’ responses to the above Prompt 4

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interacting with family/friends</td>
<td>4</td>
<td>A lot of people have seen a change in me and I owe that to the confidence and motivation that the MadE Leadership experience gave me.</td>
</tr>
<tr>
<td>Advancing in career opportunities</td>
<td>6</td>
<td>This experience has given me the confidence to stand up and offer myself to other positions of leadership either with my peers or in my future career.</td>
</tr>
<tr>
<td>Noticing diversity</td>
<td>1</td>
<td>I would like to learn more about the diversity aspect of leadership.</td>
</tr>
<tr>
<td>No change</td>
<td>1</td>
<td>I don’t plan to actively do anything to implement what was learned in this course.</td>
</tr>
</tbody>
</table>

The biggest theme that is seen throughout this course feedback from the leaders was that the course instilled a confidence within them. The questions specifically asked for personal development growth and as seen above in one of the responses, even friends and family noticed a difference in confidence in the leaders. There is also an overwhelming response of excitement due to the growth that the leaders have seen in themselves and through them to the first-years. They are excited to see the long-term impact that this course has on the department of engineering and the reputation that will become of the alumni leaders.

Conclusion

This paper begins globally by building a foundation for the Madison Engineering Leadership Program from big ideas that can be seen in other university’s programs. The mission, goals, and objectives of this program build directly from the university, the college, and the department’s mission, goals, and objectives. This paper describes the workshop training, teaching, and practicing the leaders in this program underwent. During the workshop training, Madison Engineering Leaders had the opportunity to interact with people in the university who drew out the potential within them. Also, discussed in this paper are the immediate benefits to the Department of Engineering as well as the expected benefits for Madison Engineering Leaders in the workforce and graduate programs. A longitudinal study will be put in place for the first-year engineering students until they graduate and a survey study will be implemented for the leaders who have graduated.

References


4. Personality Insights Inc. (2014). *Personality Profile Assessment*


7. Personal interview with Dr. Diane Foucar-Szocki


