Conclusion

Community-centric engineering education is a strategic and effective approach to preparing the "modern engineer" for the societal demands of the 21st century. Throughout our final report, we used social, political, ethical and technical contexts to explore the national and Lafayette-specific conversations about shifting the goals of engineering education. Our research and community outreach provided us with a solidified purpose for reimagining engineering education and a concrete strategy to advance engineering at Lafayette. Our course proposal addresses the undeniable gap that exists between engineers and society.

Our findings identified large issues in engineering culture and with the existing methods of addressing the shift in the identity of the "Engineer of the Century." These large issues center around the consequences of engineers' loss of trust in society and vice versa during the peak of the Cold War. As a result, the definition of the contemporary "traditional engineer" became solidified during this historical shift. The effects of the traditional engineer have influenced the shift in redefining the modern engineer. This historical phenomenon connects directly to Lafayette's engineering education and its manifestation of national engineering culture.

The Cold War's influence on workforce and education influenced the definition of the traditional engineer. The workforce's focus on fast and cheap production and the emphasis of engineering education on the development of technical skills led to the formation of the engineer's "black box," a candid disconnect between engineers and the rest of society as engineers' lack of understanding of their impact on society grew. As a result of this divide, intellectuals' push to invest in holistic education led to educational reform within engineering schools such as MIT and Harvey Mudd. Contemporary engineering culture perpetuates the struggle between technical and holistic value curriculum. While students are trained to focus on

the technical aspects of engineering, there is a growing demand of the engineers' professional and non technical abilities.

At Lafayette, the engineering division adapted at the same pace as engineering educational reforms across the nation. The A.B. degree in Engineering was created to engage a greater interdisciplinary work strategy. However, the college's shifting identity of the engineer was also influenced by technical dominance in the field. Through student and faculty surveys, we gained insight into personal accounts and perspectives relating to current engineering culture at Lafayette.

Furthermore, we drew connections between the national conversation on engineering education and the current Lafayette engineering culture through these student and faculty surveys as well as classroom observations. Both surveys focused on understanding respondents' perspectives of and relationship with community and non-technical skills. Overall, we concluded that despite Lafayette's engineering division's introductory and 400-level project-based courses, there is a lack of consistent integration of community and community-oriented skills within engineering courses. While student survey responses concluded that Lafayette engineering students understood their potential future impact on community, they felt that their engineering experiences and courses have not prepared them for those interactions. Faculty survey responses, on the other hand, were mainly positive; they emphasized a recognition of the importance of interacting with the end-user throughout the design process. However, a few respondents challenged the definition of community and its relevance within engineering. Student and professor survey responses received similar results in regards to the development of non-technical skills implemented in the classroom such as communication, writing and presentation skills. There was a clear lack of community-oriented skills such as

contextual learning and empathy. Our observations of a 400-level mechanical engineering senior design class reflected our survey conclusions. Technical engineering students were more focused on solution-generation than engaging the community. Although the two focuses are not mutually exclusive, we observed a clear detachment between engineering students' idea of the role of the engineer and the role of community. This skewed approach to community engaged engineering design is reflective of the training received by these students.

Currently, education is shifting towards a greater focus on the ethical development of engineering students. This training allows them to better understand, assess and design according to the needs of the community. As an integral part of ABET accreditation criterion, ethics are a necessary component in the development of engineers' non-technical skills. An outlook based in engineering ethics connects societal purpose to engineering design. The ethical context of this report showed the integral role of empathetic design in all projects, not just SCD. There is a growing demand for professionals to adapt to growing global social consciousness at both local and international scales. We consider ethics the "missing link" between community-centric work and engineers' acceptance and actions towards this emerging shift in education and design.

Our research led us to develop a curriculum proposal that achieves economic, professional and cultural benefits for the Lafayette engineering division. We concluded that a 200-level engineering course focused on community-centric design through SCD and engineering ethics would best start the process of reforming Lafayette's engineering curriculum. These two main themes will guide engineering students to better understand the connection and relevance of society and technology. Our focus is to train engineers to think about the non-technical concepts of engineering projects as a key predictor of success within design. In developing our curriculum, we incorporated pedagogical frameworks from two

minors programs from the Colorado School of Mines: Engineering and Community Development and Leadership in Social Responsibility. Colorado School of Mines' courses guided us in deciding the key concepts that would best teach students about community-centric design. Key ethical concepts such as social responsibility and the impact of technology on community and users are inherent in this course, as well.

This course will develop students' nontechnical skills with reference to ABET accreditation and learning outcomes. We define success as the achievement of developing students into social agents who recognize that context matters and use community to further their development and success in the field. From the list of relevant ABET criteria provided in the curriculum design context, we explained how our course will achieve and advance the educational goals of ABET. These criteria include the development of skills such as teamwork, ethical responsibility, communication, contextual analysis and problem-solving along with the implementation of technical engineering techniques. Learning outcomes for this course reflect the attainment of these criteria through the course's concentration in the contextual analysis of society and technology, the study of SCD and ethics and the partnership of both conceptual themes. Ultimately, students should be able to use their developed non-technical and analytical skills with community-centric design to increase the efficiency of their engineering work an use of technical skills.

Lafayette students' participation in this community-centric engineering course not only connects the technical and non-technical aspects of their discipline to achieve a holistic undergraduate engineering education but increases their marketability in the emerging global markets. Students will be prepared to take on any challenge through their acquired transferable skill set. As community needs becomes central in companies' outreach and communities rise in

external dependence and advocacy, multidisciplinary engineers are in high demand. Our course provides the tools for students to strive towards finding context-based solutions that deconstruct and address social inequities.

The research and design of this course proposal, however, would benefit from further analysis into community-centric education. As we attempted to combat the challenges we identified at the beginning of the report, more technical challenges arose such as the time-constraints of the study, the comprehensivity of the group of respondents and limited structural guidance in the process of bringing this course into full fruition. The duration of this project was only a quarter of the time we needed to thoroughly strengthen the details of this curriculum. A longer project would have allowed us to strategize different methods of achieving a greater amount and quality of survey participation, whether it be through the attractiveness of the survey or the phrasing of questions. We also lacked project support from Lafayette's engineering division. We hoped that this support could ignite the conversation of community and engineering in partnership with the Engineering Studies department and engineering organizations to gain great support in reforming Lafayette's current engineering curriculum. Through this support, we could encourage the legitimate expansion of the department to allow for greater progress within achieving interdisciplinary focuses in engineering.

This project is testimony to the growing cultural demand for a holistic engineering education with community needs as a core value. As we reflect on the future considerations to implement this course at Lafayette, we recognize the continuous research, time, communication and review needed to achieve this goal. In hopes of further course development of this project through future Engineering Studies capstone groups, we encourage future project contributors to consider the the following questions: How does the positionality of students and professors'

primary purposes at this College influence research and successful communication within the engineering division? How does identity play a role in the course proposal? Should it be implicitly or explicitly integrated into the course? As an intended Engineering Studies course, can this course address and fit in with the current structure of the department's curriculum? Through these questions, our curriculum research, and our established proposal, we hope to ignite a discussion within Lafayette's engineering departments to seriously consider how they can train engineers and develop society's future engineers to tackle society's most pressing issues. We believe that the foundations of this 200-level engineering course will help begin to bridge the gap between engineering and society and begin to train Lafayette engineering students to become the social agents they are meant to be.