GRAVITY POWERED LIGHT

RESTRUCTURING EDUCATION TO FUEL CREATIVITY AND INNOVATION

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SOCIOTECHNICAL SYNTHESIS

Creative engineers are able to apply their technical background to transform the world. The technical research project demonstrates the value of creativity in engineering, and sociotechnical thesis explores how to promote creativity in education. The technical research project challenged the Capstone team to apply their background in mechanical engineering to explore potential applications of human-generated electricity. The final product of the technical research project was a camping light powered by the energy of a falling weight. While creativity is a necessary skill for innovative engineers and so many other professions, American education has failed to foster creativity. The sociotechnical research project explored how to reverse the decline of creativity in America by asking what resources are needed for creative development and how can these resources be adequately provided.

Designing a human-powered electrical device presents technical and practical challenges which can be overcome with creative engineering solutions. The technical research project was the first long-term open-ended design challenge in the University of Virginia's engineering school curriculum. After years of technical education, the Capstone team was prepared to apply their technical background to an open-ended project. The open-ended nature of the technical project prepared the engineers for a career where true innovation comes from originality of thought instead of simply following equations. The technical research project first provided an opportunity for creative expression through an ideation phase, during which the engineers shared potential applications of human-generated electricity. During the second phase, the engineers evaluated their ideas in terms of technical feasibility and practicality and selected the most promising idea. The third phase consisted of several iterations of design and evaluations.

The result of the technical project was a design for a camp light powered by the energy of a falling weight. The design is intended to be used by backpackers at the campsite, where users would attach the camp light to a tree and hang a backpack to power the device. The final design is expected to be able to produce light for up to fourteen minutes from weight of a fifteen-pound backpack. Unfortunately, the performance of the device was unable to be tested due to complications created by COVID-19. The predicted results indicate that this design is technically feasible; however, the design requires complex mechanical components which may increase the cost of the device beyond the reasonable benefits it provides. The technical research project taught the Capstone team how to use creative engineering to explore new product spaces and address technical challenges with physical and economic restraints.

The sociotechnical research paper explored how to promote creative development in American education. The thesis holds that creative development largely depends on early childhood thinking styles and children's shared experiences with their mentors. The paper viewed creative development through the lens of social constructionism, through which one's view of reality is defined by their relationship with others. The paper establishes the state of creative development in America from studies of samples from creativity tests. Next, the nature of creativity is analyzed from the perspective of sociologists and psychologists. In providing methods for creative development, the paper pulls from research published by creative research journals. Finally, a new structure for creative development is suggested.

Creativity has been widely identified as one of the most valuable skills of the future; however, it has been in decline for decades. Creativity is a natural skill for children that need not be taught. Nonetheless, without concerted efforts to promote creative development, creativity will be undervalued and penalized due to the contrarian nature of creative thinking. Therefore, in

order preserve creativity throughout education, certain resources must be provided to encourage creative thinking. Mentors, especially parents, have been shown to be highly effective in shaping children's social and cognitive abilities. By spreading the responsibility of providing the various resources for creative development among several mentors, namely parents, teachers, and role models, creative development can be structured in a way which more readily provides the necessary resources while reducing the burden on the individual mentors.

The future is full of unknowns, and engineers will be expected to solve problems that have never been faced before. Creativity will be key to coping with the ambiguity and complexity that large societal problems present. Engineering schools can provide creative learning opportunities through open-ended projects, but creativity needs to be promoted throughout education if its full potential is to be preserved. Creative development can be a core of education if mentors take responsibility for their part. Our future will be bright if it is powered by human creativity.

TABLE OF CONTENTS