STEM APPROACH TO TEACHING AND LEARNING PHYSICS AT HIGH SCHOOL: A DAMPED OSCILLATION APPLICATION OF TUNED MASS DAMPER

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In our presentation, we describe a STEM approach to teaching and learning physics at the senior high school level on damping oscillation and its application through project-based learning (PBL) adopting the STEM convergent model proposed by Quinn, Reid, and Gardner (2020). The students are required to answer an engineering question: "How can the engineer maintain a tall building or skyscraper against a seismic wave of earthquake, strong wind or storm at a pre-defined level?" This STEM project aims to assemble what students have learned in a series of lessons into a practical application, i.e., tuned mass damper (TMD) in a skyscraper. The students are encouraged to use their science and mathematics knowledge to understand the proposed problem and design testing. They will use the engineering design process to design a simple sample structure for testing and seeking improvement (Figure 1). The students can choose appropriate technology such as video analysis, Microbit or Arduino-based sensor to collect data, and Microsoft Excel to analyze experimental results. This STEM project enables students to elaborate on their science knowledge and process skills. Also, the students can improve their 21st-century skills, including critical thinking, creativity, collaboration and communication, through collaborative work as a team to solve the problem and present their project. In our presentation, we will show a case study of pendulum damping as an example of a TMD application to simulate activities teaching and learning activities at school. This STEM project aims to assemble what students have learned in a series of lessons into a practical application, i.e., tuned mass damper (TMD) in a skyscraper.

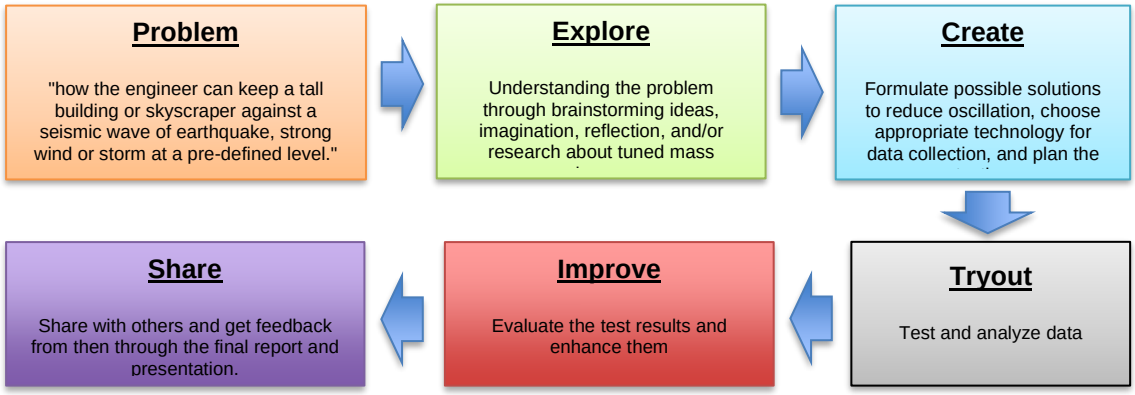

Figure 1: Steps of the engineering process students may experience through the project

REFERENCE

Quinn, C. M., Reid, J. W., & Gardner, G. E. (2020). S + T + M = E as a Convergent Model for the Nature of STEM. *Science and Education, 29*(4), 881-898. https://doi.org/10.1007/s11191-020-00130-w

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