Title: Building Conceptual Physics Understanding By Using Design Thinking

Outline the content of your article.

My goal in this article is to offer a suggestion of one of the most effective ways that I have found to teach any Physics content. In the past whether one of my colleagues was a novice Physics teacher or a veteran or even a non-specialist who for some reason had to teach Physics content, I have recommended the practice of using Engineering Design thinking as a pedagogical approach to teach Physics content. Not only have my colleagues found this method to be feasible to use, it often tends to encourage a significant level of' engagement of students with the course.

The ideas that I will share can be used by any teacher who has to teach a physical science concept. For example, It can be used in a middle school general science class to teach physical science content. It can also be used to teach specific concepts in high school physics class or even be used to teach teachers training to become Physics teacher at the university level. Moreover, the content of this article can be used by STEM teachers who teach STEM courses or who conduct elective courses.

The content of the article will be presented in three sections. The first section will highlight the effectiveness of using Engineering Design thinking to teach content that students might find challenging to understand in Physics. The second section will then explain the steps that I use to Physics content by utilizing Engineering Design thinking. Finally, the third section will provide an example of a lesson that I have taught using this method.

In this article I will be utilizing an engineering design resource - "On the Moon" Activity Guide- which comes from a collaboration between PBS and NASA Design Squad. This guide has six activities that bring engineering and NASA's moon missions to life for students of all ages. The specific activity from the guide that I will use to illustrate the method proposed by the article is the "Roving on the Moon"activity which is most appropriate for grades 6-12. This resource was shared with me last summer when I took "The E in STEM: Meaningful Content for Engineering" course with Endeavor.

STEM content area(s) that the article will focus on:

The main STEM content area that this article will cover is the Science concept of energy transfer. This includes the types of energy, energy conservation, forces and friction. This will align with the following standards:

National Science Education Standards (Grades 6–12)
Physical Science
• Motions and Forces (6–12)
• Transfer of Energy (5–8)
• Conservation of Energy (9–12)

This article will also cover the following technology standards:

International Technology Education Association Content Standards (Grades 6–12)
Design
• Standard 8: Students will develop an understanding of the attributes of design.
• Standard 9: Students will develop an understanding of engineering design.
• Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

Abilities for a Technological World
• Standard 11: Students will develop abilities to apply the design process.

Additionally, the article will highlight how mathematics concepts can be woven into a teacher's lesson plan when they use this method.

Assessment

In the article I will show teachers how to develop assessments that will combine elements from the Engineering Design Cycle evaluation stage and those that test the specific subject content covered in each lesson.

Reference

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