Designing and Implementing Open-Ended Modeling Problems (OEMPs) in Engineering Science Courses

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What is an OEMP
- OEMPs are designed to give students insights and skills into solving real-world engineering problems
- Students are required to make assumptions and simplifications to solve OEMPs
- OEMPs do not have one correct answer, but allow for multiple ways to optimize to the best answer

Why Implement OEMPs
- Current engineering science courses (such as statics and dynamics) are taught like mathematics courses
- Most engineering students are not exposed to open-ended problems until their senior-year capstone courses
- Providing students with OEMPs to solve helps develop their productive beginnings of engineering judgment (akin to intuition)

How We Research OEMPs
- Well Defined
  - No Real-World Context
  - All Information Given
  - One Correct Answer
- Ill Defined
  - Real-World Context
  - Assumptions Required
  - Multiple Correct Answers

Model for a Typical Statics Problem
- 250 lb
- 3 ft
- 4 ft
- 1.5 ft
- 60°
- B
- C
- D
- 500 lb-ft
- A

Model for a Statics OEMP
- NI06Z
- F
- M

Current Implementations
- Our research team has implemented OEMPs at 9 institutions over the past 5 years
- We hope to keep expanding, and provide an easy-to-use guide so any instructor can properly implement OEMPs

References

How to Make an OEMP
- Choose the Mathematical Model
  - Outline the Problem
  - Complete Initial Scaffolding
  - Personally Solve the Problem
- Create the Draft
  - Scaffold the Problem
  - Include Additional Problem Aspects
  - Elicit Feedback
- Decide on a Grading Method
  - Have Multiple Opportunities for Help
  - Have a Rubric Available to Students
- Track Changes During the Semester
  - Consider Survey Data From Students
  - Iterate the OEMP as Needed

Student Views on OEMPs
- I enjoyed completing the OEMP
- I would like more OEMPs in my other engineering science courses
- The OEMP helped improve my understanding of the course concepts