Conversations on the Art and Science of Engineering Modeling

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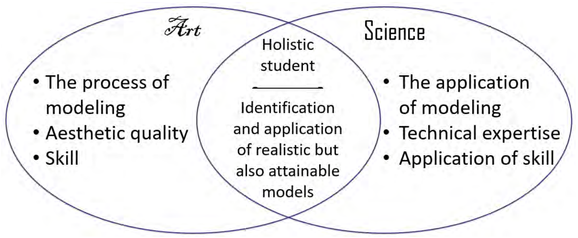
Introduction/Motivation

- Motivation: Desire to present advanced engineering concepts to lower-division students
- Problem: Traditional approaches geared to more experienced learners
- Approach: Engaging in conversations vs. presenting lectures
- Goal: Teaching lower-division students how to understand and apply the art and science of modeling



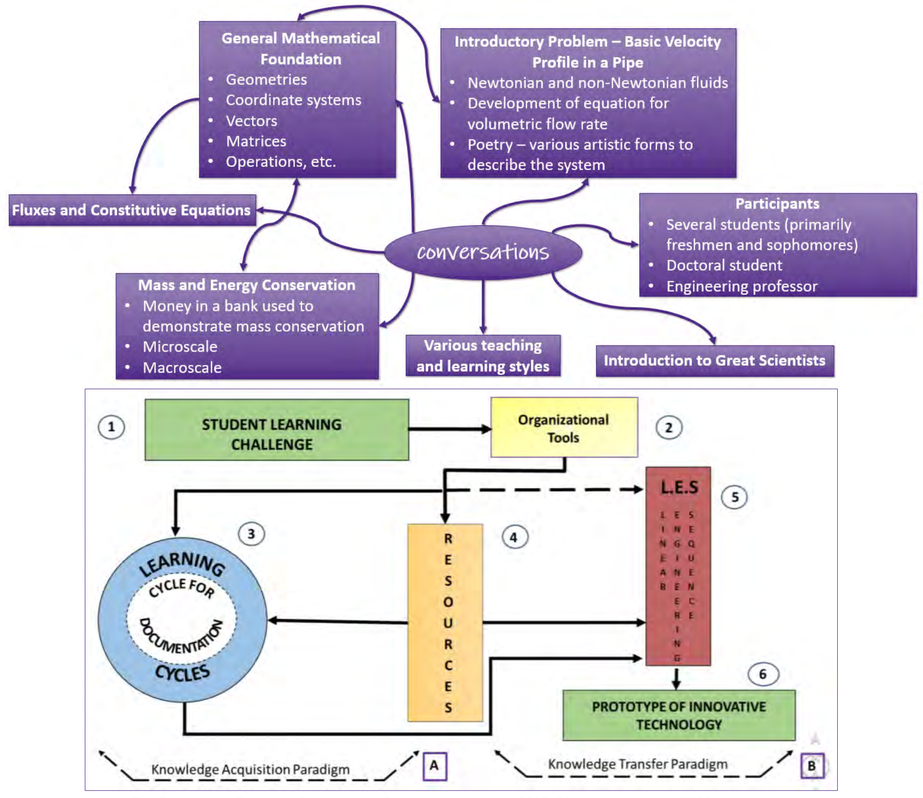
- "Aesthetic creating… happens to be the most natural kind of creating there is. A sensitive encounter with the world leads to a new creation that expresses what we feel."
- "In the world that actually exists, tomorrow gets pioneered by the intuitive lives of artists, scientists, and little kids playing on basement floors."
- "Creating what matters and has not existed before starts with what matters to us. We don't create, or we do so very poorly, by coercion. We create because we feel like it."
- "Intuition and deduction, the wellsprings of art and science, are intertwined in the pioneering life."

****All quotes from* Creating Things that Matter*, by David Edwards*

Current Approaches

Roles	Traditional Lecture Methods	Conversational Approach
Professor	"Only" source of knowledge	Facilitator
Students	Passive learners	Apprentices; active learners
Examinations	Primary assessment	Multi-assessment method
Team Projects	Non-assistive	Inherently present
Conversations	Uni-directional	Multi-directional
Note-taking	Robotic; mechanical	Dynamic; reflective; personal; original
Focus	Discipline-oriented	Multi-disciplinary (art, music, etc.)

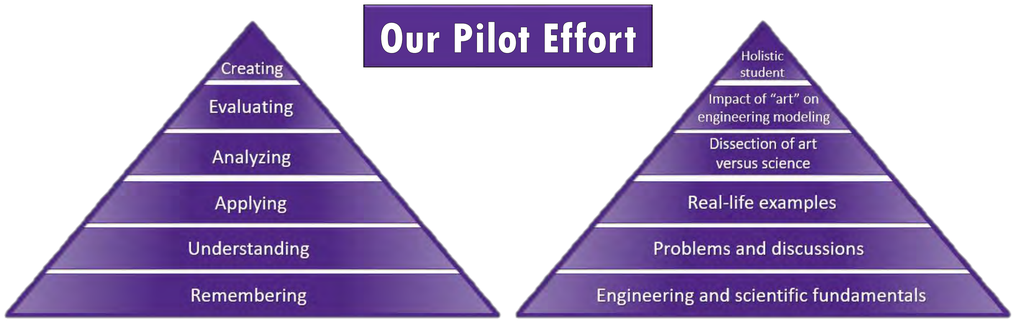
Conversational Approach/Methods



The Renaissance Foundry – Elements and Paradigms. Arce et al. 2015 (Modified from Arce, 2014)

Qualitative Outcomes/Results

Our Pilot Effort



- Exposure to various mathematical concepts before encountered in class
- Preparatory mathematical framework
- Development of analytical skills
- Practice searching for information on their own
- Simulation of the "real world"

Discussion: Beneficial Effects

- Has high potential to *encourage student engagement* in acquisition of knowledge
- *Enhances* students' research *interest*
- Provides *friendly environment for learning* useful mathematical approaches for engineering problems encountered in other courses
- *Develops appreciation* of artistic elements of engineering modeling

Conclusions

- Is an effective way to increase students' interest and skill in engineering modeling
- Makes math modelling more approachable and inviting for students
- Allows a student with minimal mathematical knowledge to explore and understand fundamental aspects of engineering
- Does not require significant time or resources on the part of the instructor/facilitator

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****Please note that all uncited images are the authors' own.*

Acknowledgments

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