What can an engineer learn from the arts?

University of Florida
Department of Industrial and Systems Engineering
Engineering Innovation Institute
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Innovation in the Arts
Inova Unicamp
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• **Engineer:** Mathematical modeling and algorithm development; simulation modeling and analysis for supply chain design and analysis.

• **Artist:** Mixed-media artist and community-based site-specific installation focusing on visual inquiries of individual and collective stories.

• **Engineer/Artist:**
  – Arts in Engineering
    • Creative Storytelling and Choreography Lab for Senior Design Project
    • Divergent Thinking for Entrepreneurship and Innovation
    • Poetry for Inventory and Supply Chain Systems
  – Engineering in the Arts
    • Choreography based on sorting and search algorithms in heuristic optimization
    • Value Stream Mapping for editing dance works
Background

• Early education
  – Part-time classical piano student at the State Conservatory of Ankara through middle school
  – Had to make a choice and gravitated towards a career path in science and engineering

• Engineering education
  – All degrees in industrial engineering – very linear

• Art training
  – Workshops on drawing, painting, illustration, and graphical storytelling – very non-linear
Choreography on based on sorting and search algorithms in heuristic optimization

• Creative Scholar-in-Residence in the School of Theater + Dance (2013-2014)
  – UF Creative Campus program “releases” a faculty member from their home department and college and “loans” to another department and college with an identified host
  – UF Science, Engineering and Arts Committee provided a forum for like-minded people to get together and talk

• Fall 2012 through Spring 2013
  – *in search for closure*

• Solution search approaches from discrete optimization and bubble sort algorithm’s inspiration can be seen in certain phrases

Creative storytelling and choreography lab for senior design course

• Creative Scholar-in-Residence Project 1

• Team
  – Tom Hart (cartoonist), Leela Corman (graphical novelist), Tzveta Kassabova (dance) and Elif Akçalı (engineering)

• Fall 2013 and Spring 2014
  – 1 hour lab session each week for 15 weeks about drawing, storytelling or dance
  – Each senior design team had to choreograph a piece
    • Fall 2013: Engineering students worked with dance students
    • Spring 2014: Engineering students danced themselves


Value stream mapping for editing dance works

• Creative Scholar-in-Residence Project 2

• Team
  – Tzveta Kassabova (dance) and Elif Akçalı (engineering)

• Spring 2014
  – 4 hour workshop session with graduating seniors who were choreographing their dance works
  – Each graduating senior had to choreograph a piece
    • Using tools from value stream mapping they were invited to identify the shape and tempo of their dance works and identify “waste”
    • How do you move through the stage?
    • What elements do your repeat? What do you vary in your repetitions?
    • What if you had half the time to show your work?
    • What if you had 15 seconds to show your work?
Divergent thinking course for engineering entrepreneurship and innovation

- 3-credit graduate level elective course titled “Divergent Thinking”
  - 15 weeks, 3-hour once a week meeting, 35 students

- Structure of a class meeting
  - 2 hours on an arts-based approach
  - 1 hour on the use of their learnings to approach an engineering problem

- Structure of overall material
  - Observing
  - Questioning
  - Learning
  - Experimenting

- Fall 2014 through Spring 2016 experimental course, as of Fall 2016 a formal course on the books

- Modules for existing courses

Akcali E, Giang WGC, Landrum ME. Incorporating Divergent Thinking Skills Development into a Project-Based Course in Industrial and Systems Engineering, Proceedings of 2020 American Society for Engineering Education Virtual Conference.

Akcali E. Divergent Thinking, lecture notes and a book draft in progress.
Poetry in industrial and systems engineering

• 3-credit undergraduate level required course titled “Inventory and Supply Chain Systems”
  – ~150 students per year since Fall 2012

• Two assignments
  – An “I am” poem about themselves in the first week
  – An “I am” poem about an inventory and supply chain topic in the last week

• UF Creative Campus grant
  – Qualitative analysis with a professor from communication studies
  – Developed a proposal for the United States National Science Foundation to conduct more research on its effectiveness and scale out to other majors and institutions

Some thoughts

• Interdisciplinary, multi-disciplinary, and trans-disciplinary research and teaching are challenging

• Challenges can be personal, institutional or field-wide.

• But we can do challenging this. We are doing them all the time.
But you can…

• Be curious, open-minded, patient, and generous – I thought I was but I realized I was not

• Be process-focused as opposed to product-focused – I have “products” but it took years of “process” focus which may be difficult to afford

• Be ready for discomfort and welcome awkwardness – I had to learn to create space for the work to emerge and create space for the other
Artists and engineers

• Artists do not dismiss engineers for being too “inside a box.”

• Engineers do not dismiss artists for being too “out of the box.”

• Making art and engineering are both about problem solving.
  – That is a common thread…

• The arts and engineering are both human experiences.
  – That is another common thread…

• The arts and engineering can collaborate to drive innovation…
Thank you for your time!

Questions?

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