What can an engineer learn from the arts?

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Engineering Innovation Institute
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Innovation in the Arts
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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

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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

Kassabova T, Akcali E. in search for closure, 2013. https://vimeo.com/205067239

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

Akcali E, Kassabova T, Hart T, Corman L. (2015) Creative Storytelling and Choreography Lab for Senior Design*, Proceedings of 2015 ASEE Southeast Section Conference.*

Engineering and Dance (2014) https://vimeo.com/528142178

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 a 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 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

Akcali E, Buraglia M, Essenfeld A, Williams J. Poetry Writing in Engineering Education: Results and Insights From an Exploratory Study. Proceedings of 2021 American Society for Engineering Education Virtual Conference.

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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