

From Traditional Teaching and Learning to Student Engagement - A Case Study

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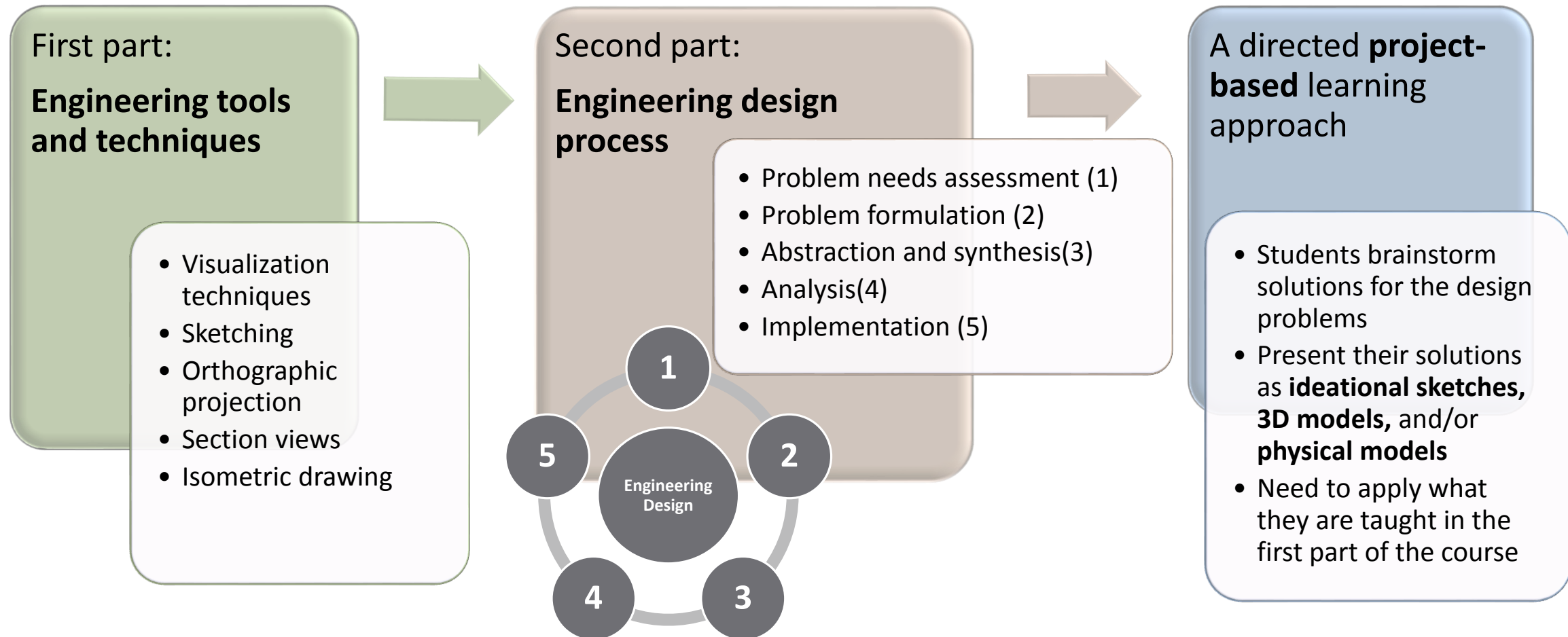
The need

- A transformation from traditional teaching methodologies is required to actively engage "**digital brains**". [1] [2]
- **Digital technology** is affecting our day to day life in so many levels; it became essential to transform teaching and learning experiences using technological tools.
- Canadian undergraduate engineering programs move towards an outcomes-based curriculum that requires the implementation of a **continuous improvement process**

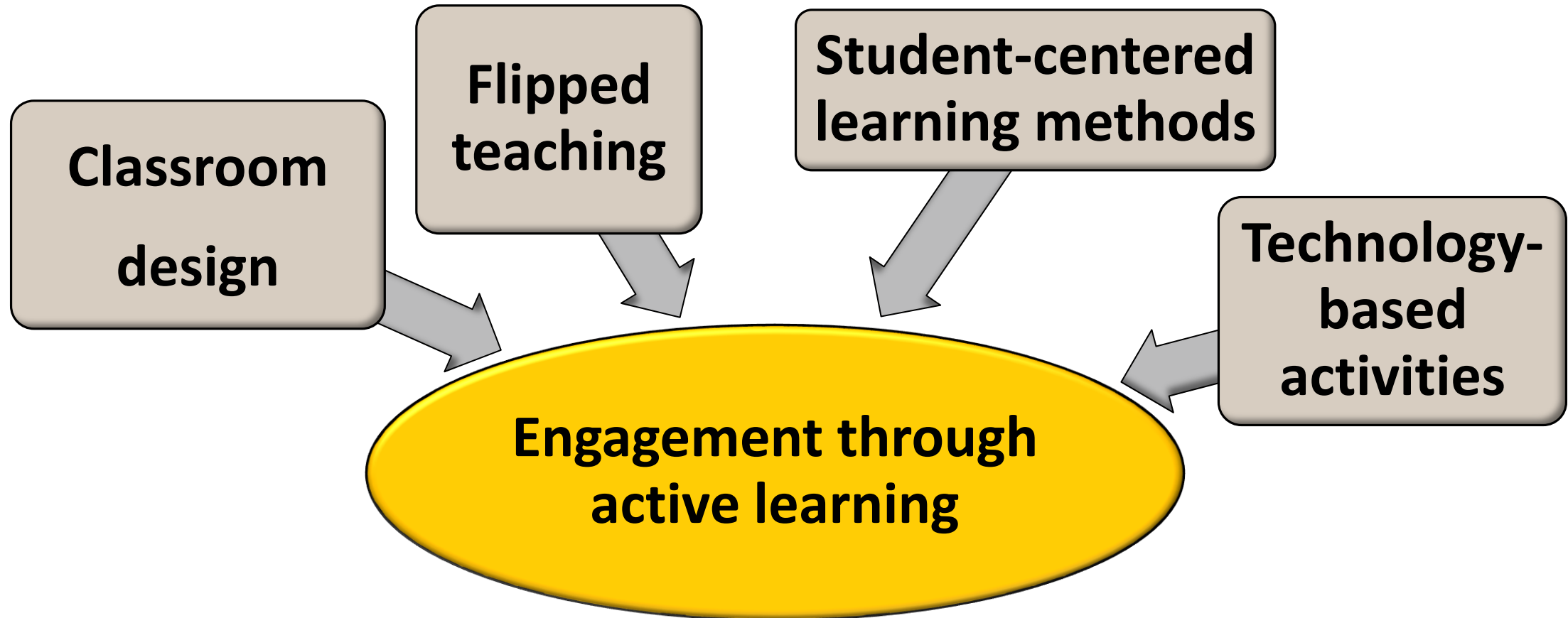
[1] Cavanaugh, J.M., Giapponi, C.C., Golden, T.D. (2015) Digital technology and student cognitive development: the neuroscience of the university classroom , *Journal of Management Education* , 12 December 2015, <http://jme.sagepub.com/cgi/reprint/1052562915614051v1>.

[2] Hainline, L., Gaines, M., Feather, C.L., Padilla, E., Terry, E. (2010) Changing students, faculty and institutions in the twenty-first century, *Peer Review*, 12(3), 7-10.

Engineering and Design: Course Overview



So, what to consider for student engagement?



Classroom design for active learning



- To facilitate students' engagement the layout of the classroom was changed from the traditional design, to a new, user-centered design.
- Students are encouraged to work in groups and to collaborate for different assignments.

Flipped teaching

How it was implemented

Using the university Learning Management System (**LMS**):

- lecture content and other related resources are made available to the students before the class

What was achieved ^[3]

For the instructor – frees up more of class time to :

- engage students in activities that will help them to master the lecture content
- use assessment tools to determine whether or not the students meet the requirements, do not meet the requirements, or exceed the requirements related to the specific topic

For students:

- *students are using class time to deepen their understanding and increase their skills at using their new knowledge*

[3] Brame, C., (2013). Flipping the classroom. Vanderbilt University Center for Teaching, April 30, 2015, <http://cft.vanderbilt.edu/guides-sub-pages/flipping-the-classroom>.

Technology-based activities

For **instructional activities**, two aspects were considered:

- ***Selection*** of technology-based teaching and learning tools, in the context of a student-centered approach and active learning
- ***Implementation*** of digital technology in order to expand teaching effectiveness and increase students' engagement and learning capacity

So, why digital technology?

The need to implement these tools was triggered by the need to:

- **Improve** students' spatial abilities and visualization skills
- **Engage** the students in the learning process
- **Provide** opportunities for hands-on learning and learning by doing

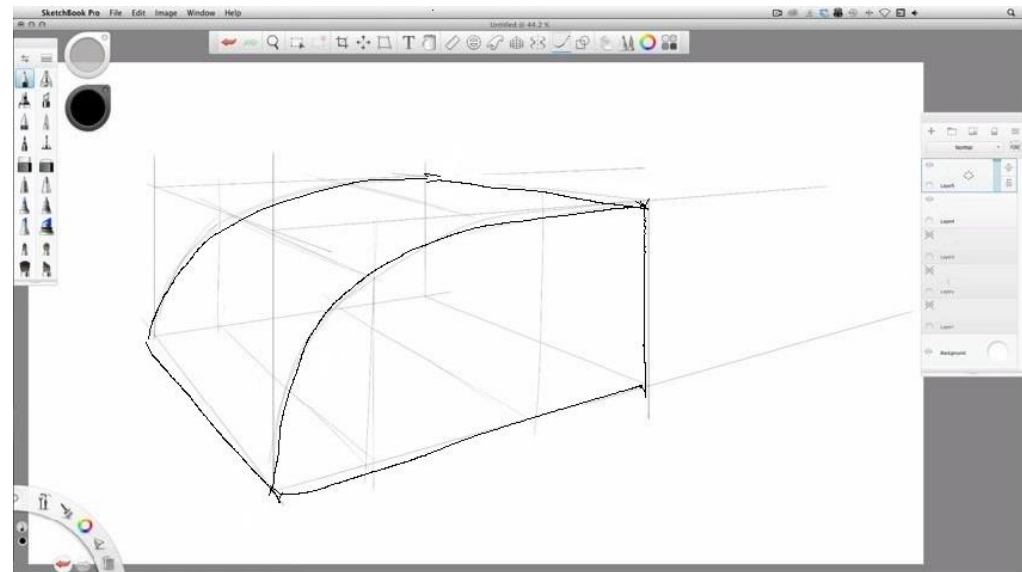
Mobile Devices: digital sketching



Used in the process of teaching and learning to develop three important competencies:

- freehand sketching
- view generation
- visualization skills

Example: Lenovo tablet and digital sketch of a two-point perspective using *SketchBook Pro*



Mobile Devices: Augmented Reality



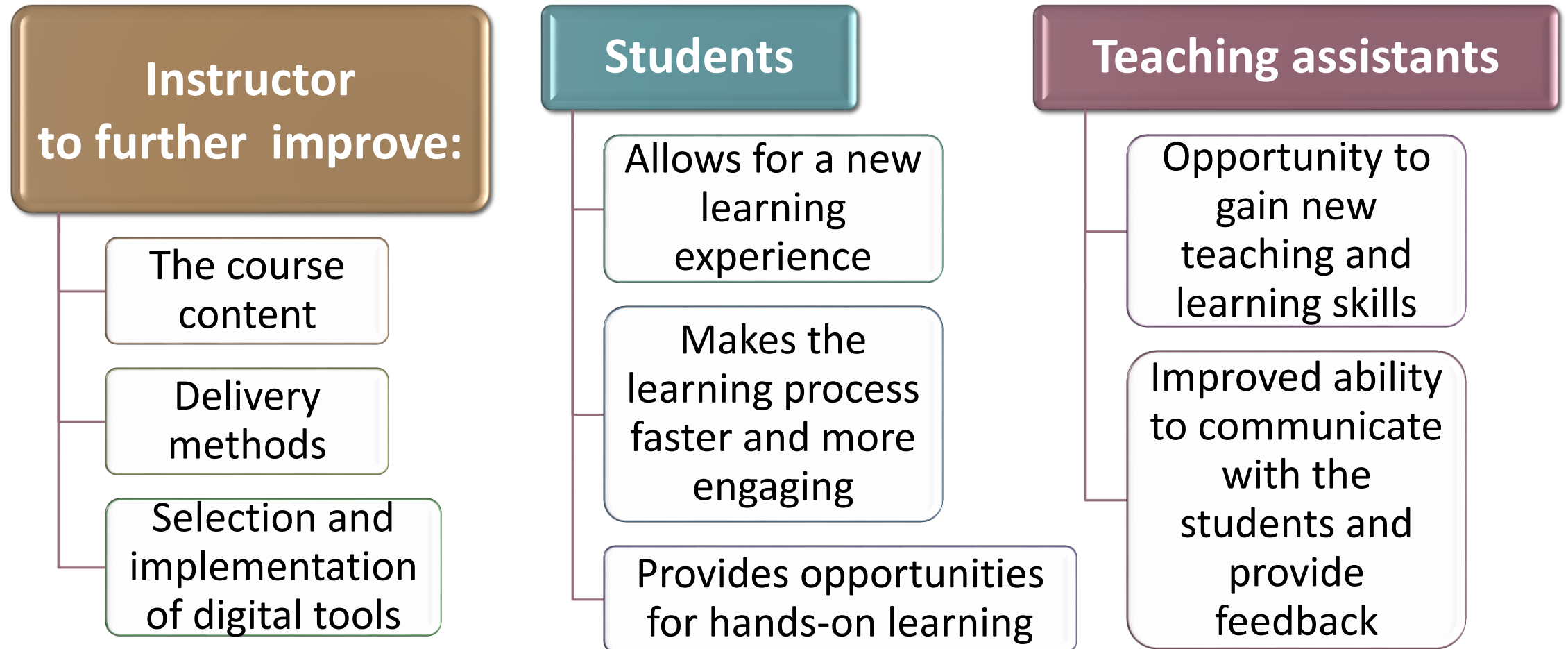
Example of an object rendered in real time on the screen using AR Engineering [4].

- Augmented reality (AR) is used as visualization tool
- The textbook contains embedded markers associated with the 2D applications
- Markers are scanned using cell phone or computer tablet with the AR Engineering mobile application
- It produces a 3D model that will appear on the screen superimposed on top of the marker.
- Improved 3D visualization skills have shown to increase retention of students in engineering. [5]

[4] Camba, J.D., Otey, J., Contero, M., Alcaniz, M., *Visualization & engineering design graphics with augmented reality*, (2nd edition), SDC Publications, ISBN 978-1-58503-905-0 (2014).

[5] Sorby, S.A., Baartmans, B.J., (2000) The Development and Assessment of a Course for Enhancing the 3-D Spatial Visualization Skills of First Year Engineering Students, *Journal of Engineering Education*, 89 (3), 301-307.

Who will benefit from introducing digital technology?



Additional Challenges

Increased Enrollment

- Teaching assistants were present during the lab/tutorial sessions.
- Group project encouraged team work and decreased workload for graders.

Tracking Graduate Attributes

- New learning management system was used.
- Specific assessments and rubric criteria were aligned to learning outcomes/graduate attributes.

Thank you!