Radio Controlled Toys to Incorporate Experience into Teaching Construction Operations

Rokenbok
Best Ever Class Ever

Overheard while running the truck simulation
Problem

• Required, senior level class; Civil, Architectural and Environmental Engineering
• Teaching construction means and methods
• Specifically, for a set of conditions, there is a “right” number of trucks for moving earth
Problem

• Required, senior level class; Civil, Architectural and Environmental Engineering
• Teaching construction means and methods
• Specifically, for a set of conditions, there is a “right” number of trucks for moving earth
• More generally, we need to match productivity in a lot of areas; there is a “right number of bartenders for a given set of conditions too
Problem

• Physical learners + abstract Powerpoint = low levels of comprehension and retention
• Need to discuss & consider uncertainty, real construction is “messy”
• Not all students have really watched large equipment working; very few have operated anything
Loaders and Haulers

Loader → Load Truck (3 minutes) → Full Truck (9 minutes) → Spotter (2 minutes) → Dump → Travel (7 minutes) → Empty Truck → Load Truck → Travel

Diagram:
- Loader
- Load Truck (3 minutes)
- Full Truck (9 minutes)
- Spotter (2 minutes)
- Dump
- Travel (7 minutes)
- Empty Truck
Loaders and Haulers

- Loader
- Load Truck
- Travel (3 minutes)
- Empty Truck
- Full Truck
- Dump
- Travel (7 minutes)
- Spotter

7:00 am
Loaders and Haulers

7:00 am

Loader
Load Truck
Travel
3 minutes
Load Truck
Empty Truck
Travel
7 minutes
Full Truck
Dump
Travel
2 minutes
Spotter

9 minutes
Loaders and Haulers

- **Loader**
  - **Load Truck**
    - **Travel**
      - 9 minutes
    - **Full Truck**
  - **Empty Truck**
    - **Travel**
      - 7 minutes
  - **Dump**
    - **Spotter**
      - 2 minutes

**Time:** 7:03 am
Loaders and Haulers

Loader → Load Truck

Load Truck → Travel

Travel → Full Truck

Full Truck → Dump

Dump → Spotter

Spotter → Travel

Travel → Empty Truck

Empty Truck → Loader

7:03 am
Loaders and Haulers

Loader

Load Truck

Travel

Full Truck

Spotter

S

Dump

Travel

Empty Truck

7:03 am

9 minutes

7 minutes

3 minutes

2 minutes
Loaders and Haulers

7:06 am

Loader

Load Truck

Travel 9 minutes

Full Truck

Spotter

Dump

Empty Truck

Travel 7 minutes

3 minutes
Loaders and Haulers

7:06 am

Loader

Load Truck

Travel

Full Truck

Spotter

Dump

Travel

Empty Truck

3 minutes

9 minutes

7 minutes

7 minutes

2 minutes
Loaders and Haulers

Loader

Load Truck

Travel

Full Truck

Dump

Spotter

Travel

Empty Truck

7:06 am

9 minutes

3 minutes

2 minutes

7 minutes
Loaders and Haulers

Loader

Load Truck

Travel

Full Truck

Spotter

Dump

Empty Truck

Travel

9 minutes

3 minutes

2 minutes

7 minutes

7:09 am
Loaders and Haulers

Loader

Load Truck

Travel

Full Truck

Dump

Spotter

Empty Truck

Travel

7:12 am

9 minutes

3 minutes

2 minutes

7 minutes
Loaders and Haulers

- Loader
- Load Truck (3 minutes)
- Full Truck (9 minutes)
- Dump (2 minutes)
- Spotter

- Travel
- Empty Truck (7 minutes)
- Travel

7:12 am
Kolb’s Theory

• Learning progresses through a cycle
• Most classroom instruction is AC only, which has low retention
• Full cycle has best retention rate
Earthmoving Simulation

Groups have:
- either 4, 5, or 6 trucks (=# of drivers)
- 2 timekeepers
- 1 “mechanic”
- A few “sidewalk superintendents” to offer driving advice
Simulation

- Move 50 loads (1 load = 1 or more balls moved)
- Time the cycles
- Drivers become timers, mechanics, superintendents
- Timers, etc. become drivers
- 50 more cycles
PAUSE....
Collisions and Bottlenecks Happen
The queues can get pretty long
Students then:

• Determine their first load time
• Determine an average load time for all trucks
• Determine the total cycle time for their first trip
• Determine an average cycle time for all trucks
Students then:

• Find the “right” number of trucks (total cycle time / load time = balance point)

• Compare the results of using point estimates of cycle times with actual results of the simulation

• Comment on whether the “right” number of trucks calculated is really the right number of trucks
9 trucks are NOT better than 5
What I found

• 2 sections in FS 11
  – One I only lectured to
  – One I skipped a lecture and we played with trucks
  – Assessment: both sections were statistically then same

• 1 section in Spring 12
  – Redesign of the exercise
  – Redesign of the assignment
  – Assessment: (next week) and no control group
FS 12

• 2 sections
  – One will get to do the simulation and the redesigned assignment
  – One will get a lecture
  – Assessment will (perhaps) show a difference
What did I learn?

• A day without lecture is not a day lost
• Do something memorable
• It’s not easy to design a good lab
• It’s even harder to design an assessment
• It’s still worth it
Best

Class

Ever