INSTITUTE OF INDUSTRIAL & SYSTEMS ENGINEERS

IISE
Operational Excellence Divison

Lean Manufacturing Laboratory for Hands On Learning in Industrial Engineering

August 27, 2 PM to 3 PM EST

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Department of Industrial Engineering Technology
at Dunwoody College of Technology

Operational Excellence Division

Mission

- To provide its membership with the operational excellence practices body of knowledge, networking opportunity, recognition, and educational programs to stay competitive in the global market.

Vision

- To be the hub that facilitates knowledge development and sharing in the domain of operational excellence, lean six sigma, and all continuous improvement practices.

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- *Serve on the **Division's Board** (Professional and Student Leadership)*

Lean Manufacturing Laboratory for Hands-on Learning in Industrial Engineering

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Agenda

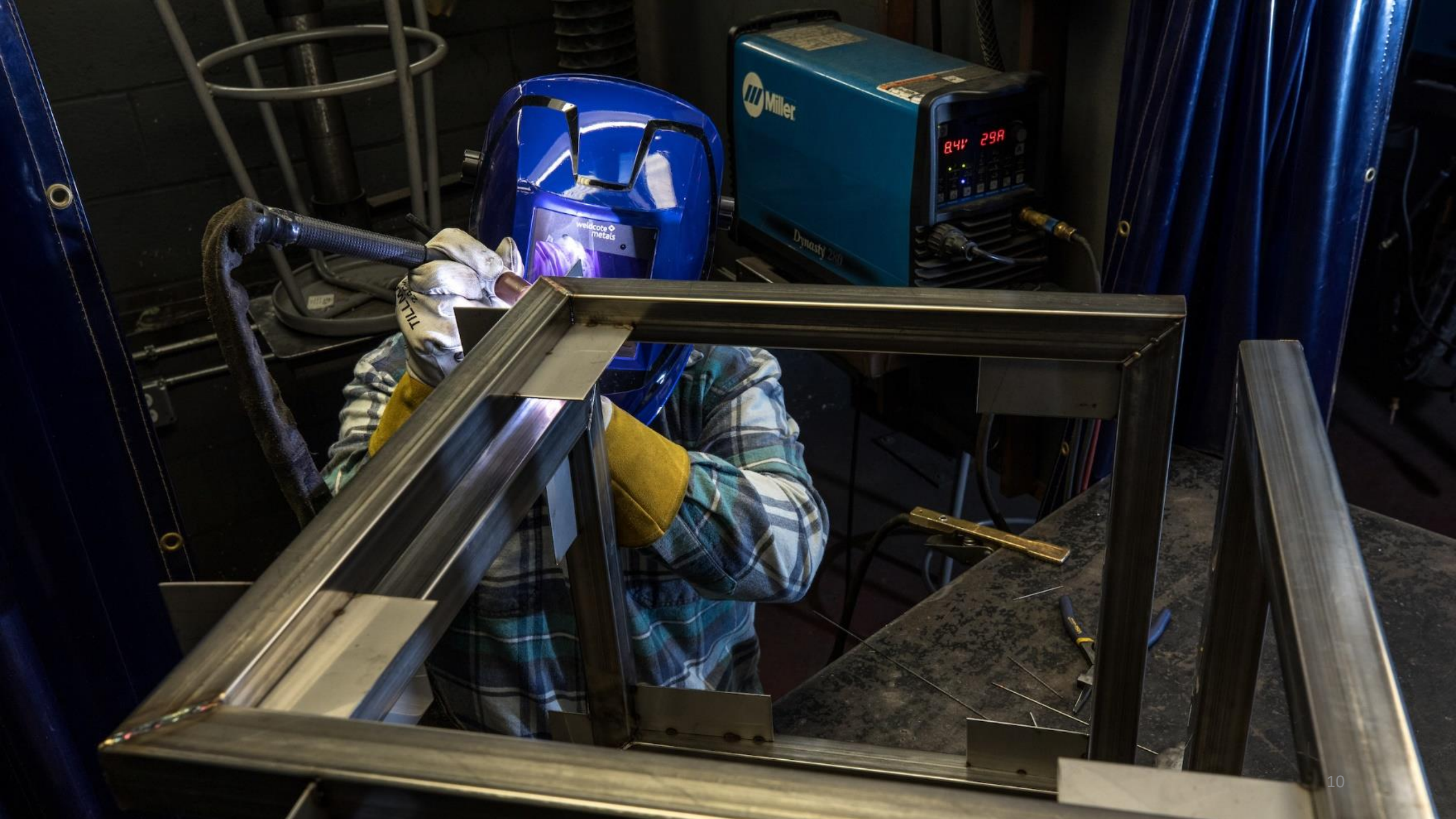
- Background and Objective
- Laboratory 1: Introduction to Standard Operating Procedures
- Laboratory 2: Standard Operating Procedures for Disassembling and Assembling Engines
- Laboratory 3: Continuous Improvement of an Engine Assembly Line
- Key Observations
- Challenges and Lesson Learnt
- Materials and Costing

Dunwoody College of Technology

- Private non-profit college located in Minneapolis, MN
- Dunwoody College of Technology offers two and four-year technical degrees in several disciplines
- School of Engineering offers BS degrees in various disciplines
- High focus on hands-on education


POWER ON
POWER OFF
EMERGENCY STOP
HANDLE JOG
DISPLAY
RESET
CURSOR


Dunwoody


Miller
Dynasty 280
weldcote metals

School of Engineering @ Dunwoody College of Technology

- Industrial Engineering Technology program is a "2+2" program
- Mechanical, Electrical and Software Engineering programs are traditional 4-year programs
- Adding a traditional 4-year Industrial Engineering program is being investigated

How People Often Learn Lean?

- On the job training programs
- Doing Gemba walks, Kaizen activities, etc. on the manufacturing floor

Objective: Simulating the Way Lean is Taught in the Industry

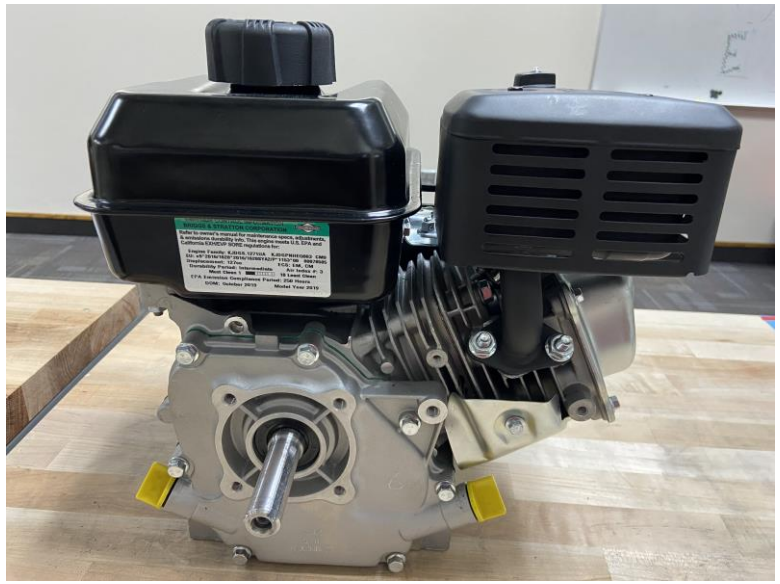
Laboratory 1: Introduction to Standard Operating Procedures (SOP)

- SOP defines process and:
  - Serve as a baseline for future improvement of processes, facilitates training, and reduces variability
  - Backbone to conduct kaizen activities
- Laboratory 1: assembling workbenches
  - DIY workbenches
  - Using manufacturer's SOP
  - Groups of 2-3 students

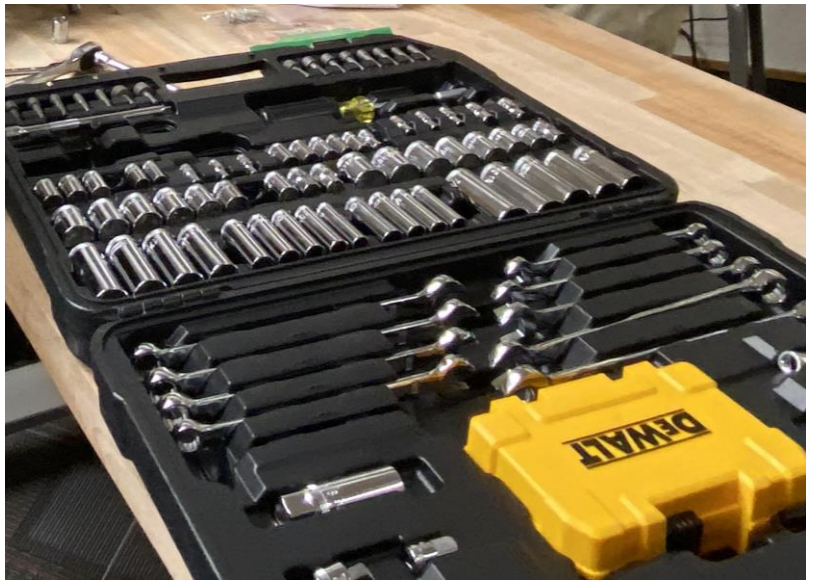
Laboratory 1: Outcomes

Laboratory 2: Standard Operating Procedures for Disassembling and Assembling Engines

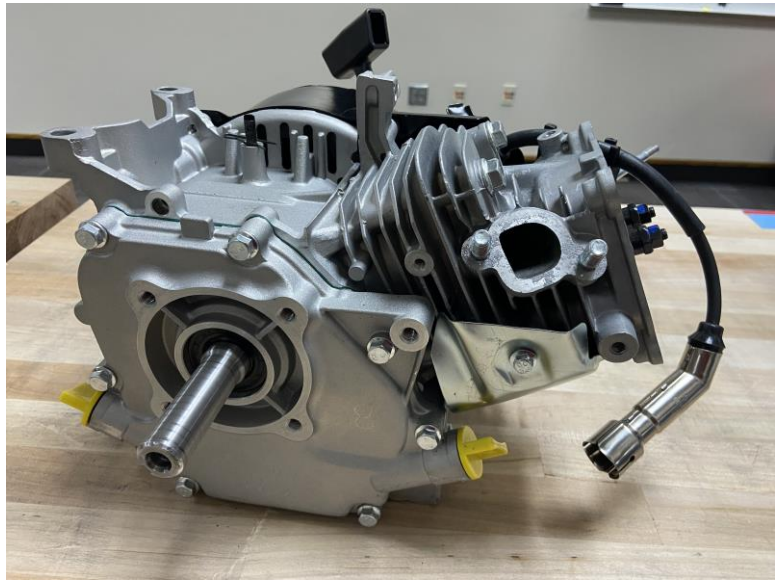
- Briggs & Stratton Engines were used
- Students were provided with pictures showing step-by-step approach to disassemble engines



Assembled engine



Hand tools



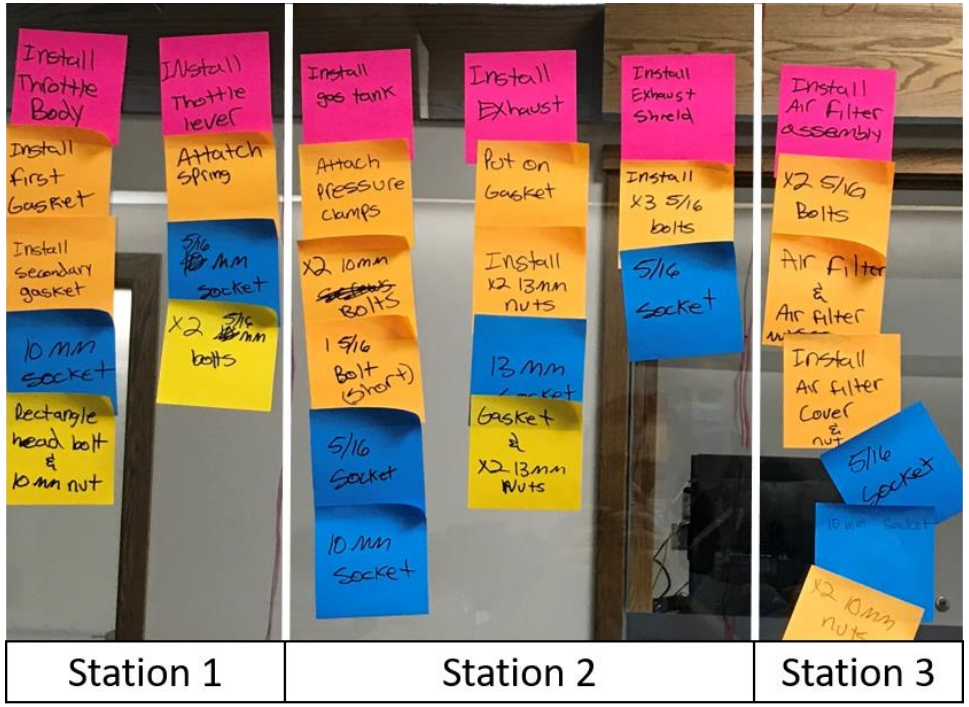
Disassembled engine

Laboratory 2: Outcomes

- Students developed SOP to disassemble engines
- SOP were swapped between groups to assemble engines for peer feedback

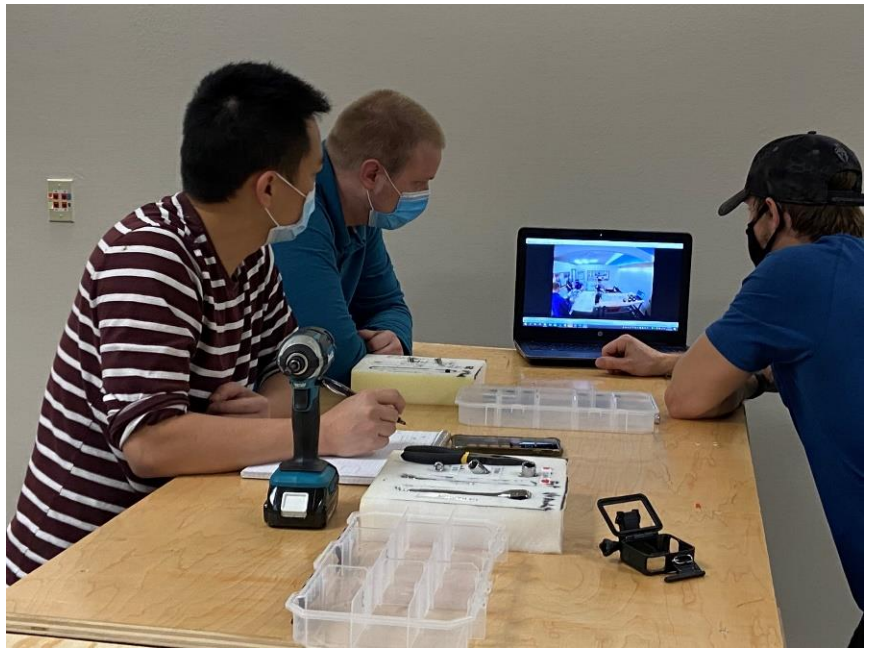
Laboratory 3: Continuous Improvement of an Engine Assembly Line

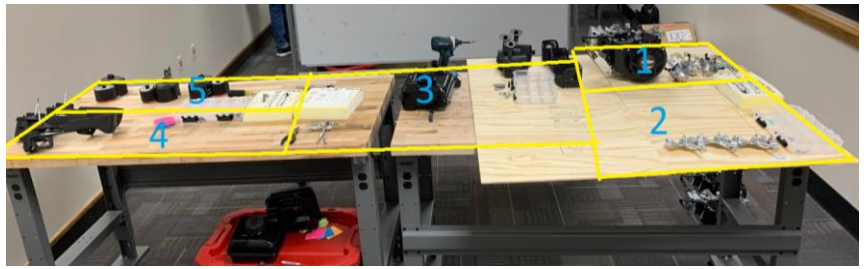
- Students were reorganized in a group of three
- Each group set up the initial assembly layout by themselves
  - Drew the process map for assembling engines using sticky notes

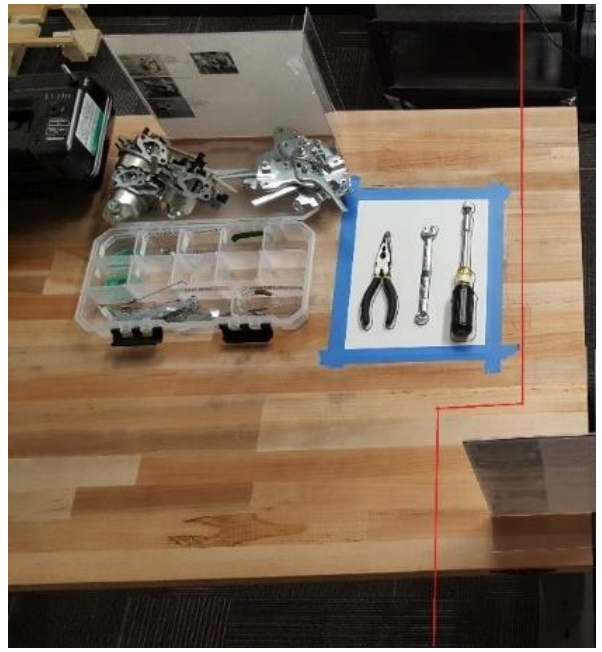


Laboratory 3: Kaizen Events on the Assembly Line

- Students used different lean methods (e.g., 5S, visual management, poka-yoke, SOP) to improve the assembly line throughput
- Student video taped their activities to conduct time studies and balance the assembly line



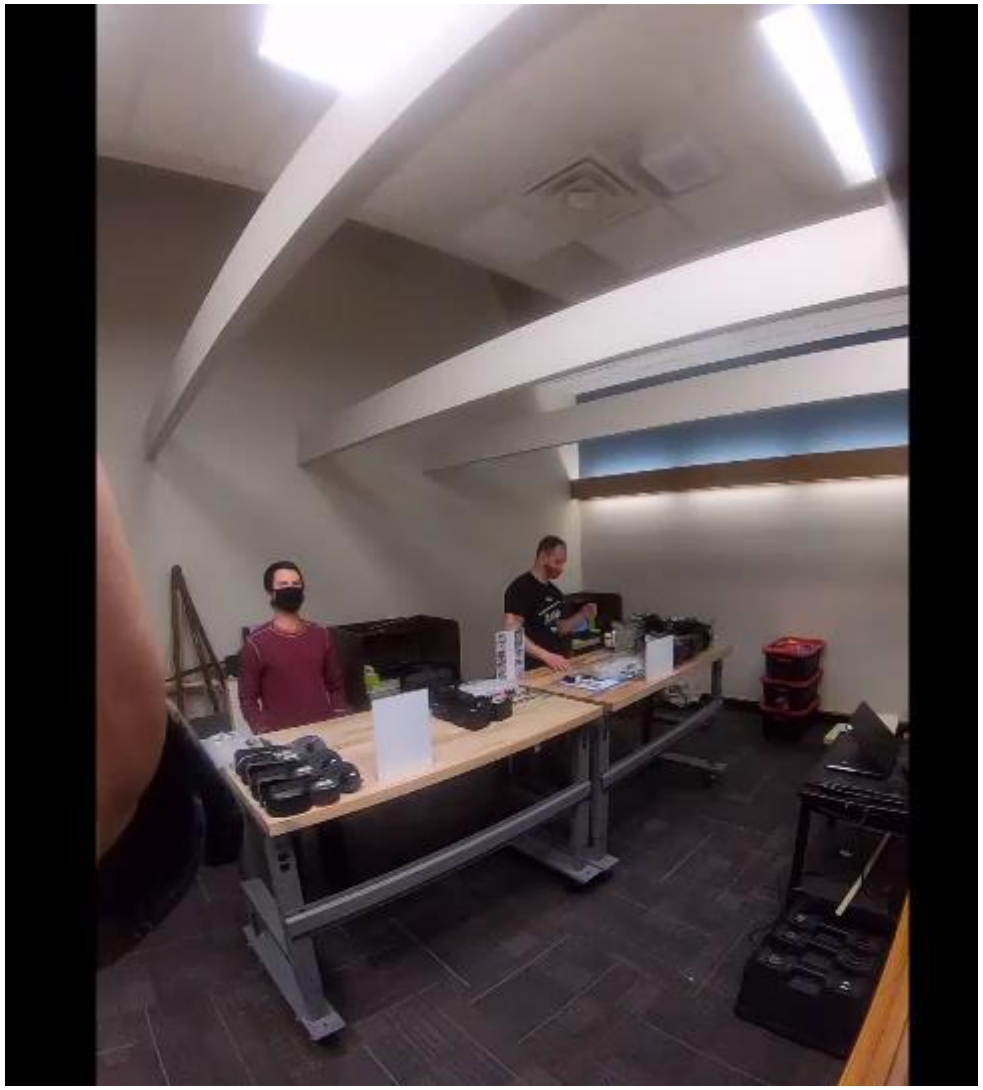




Laboratory 3: Before and After

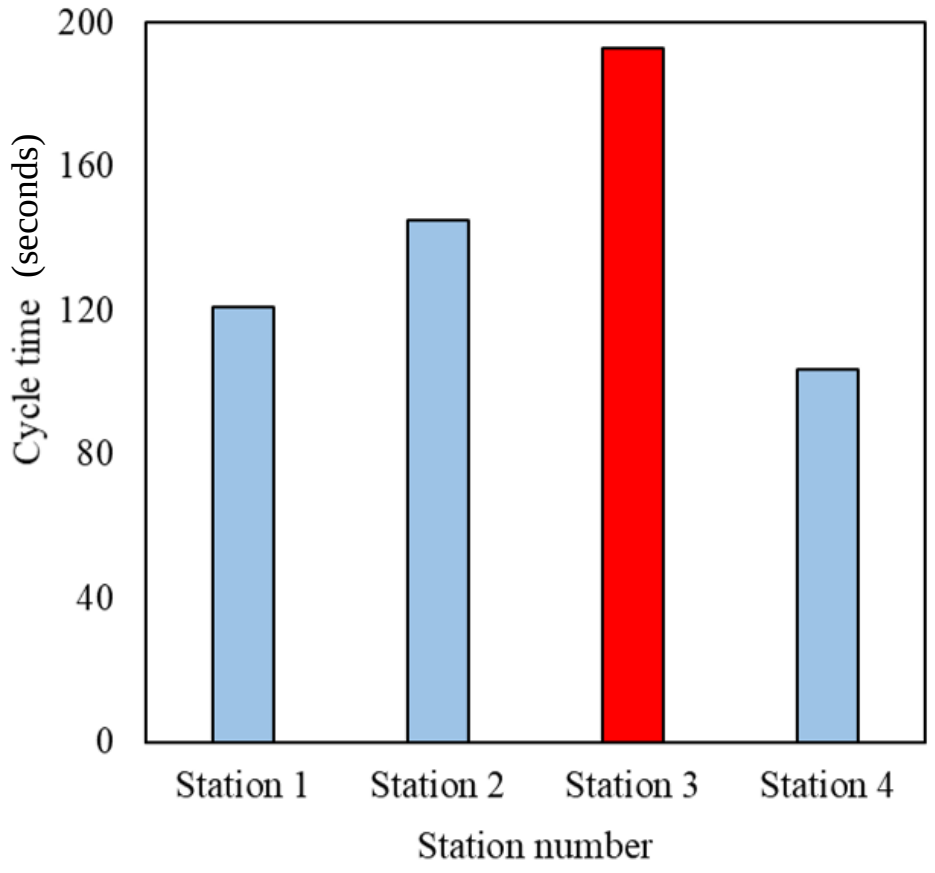
Before

After

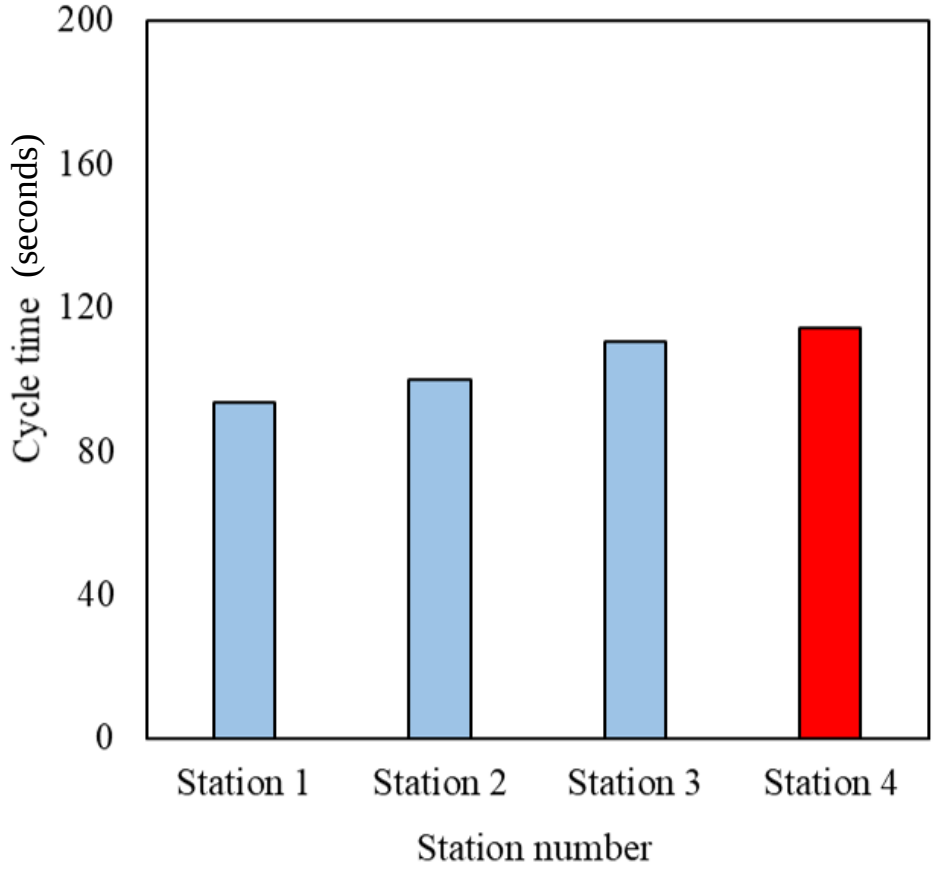


Laboratory 3: Before and After Results (Group 1)

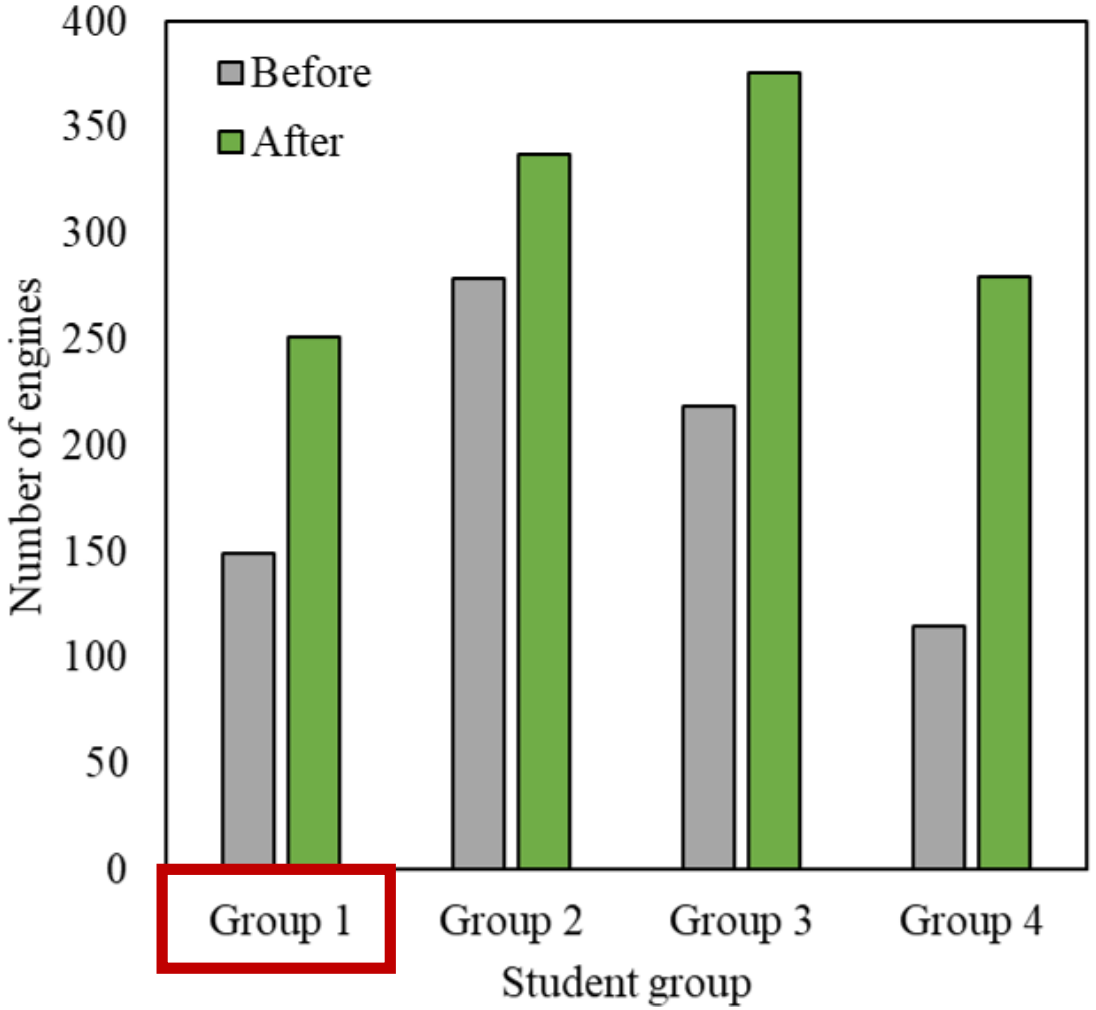
Before



After

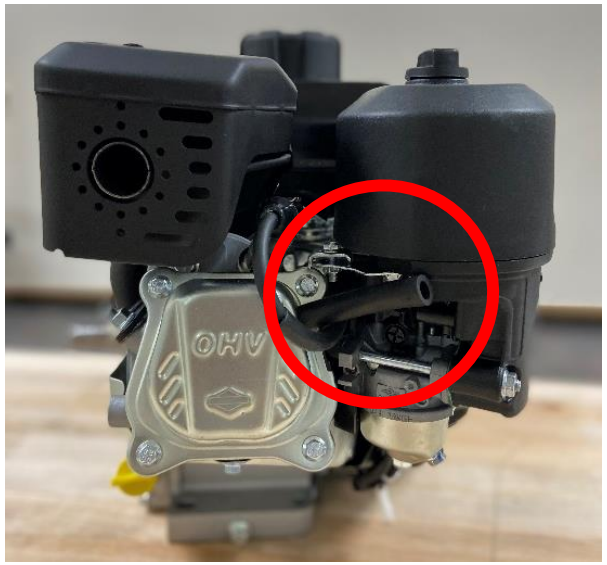


Laboratory 3: Outcomes



Overall Observations

- Benefits of using real engines and tools as compared to simpler products like Lego
- Built-in a level of complexity makes the application of lean tools realistic and is representative of what students experience in the industry
- A good way to learn is by struggling through more complex tasks



Challenges and Lesson Learned

- In the initial weeks of Laboratory 3, assembly line activity turned into "how fast the engines can be assembled as a group"
- Using mobile phones/stop watch to conduct time studies is cumbersome
- Laboratory 1 cannot be repeated each semester: alternate product need to be identified for Laboratory 1 on SOP
- Important to have uniformly skilled groups if comparing results: student background differs

Materials and Costing

- Briggs & Stratton Engines: ~$300 each
- DeWalt hand tool sets: ~$90 each
- Workbenches: ~$450 each
- GoPro cameras: ~$300 each
- Miscellaneous material (~$25 each week for each student group)
- Total expenditure for a class size of 12: ~$10,280

Acknowledgements

- William B. Hudson, Dean for School of Engineering, Computer Technology, Math and Science, Dunwoody College of Technology
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- Benjamin Dudley, Junior, Department of Mechanical Engineering, Dunwoody College of Technology
- Janet Nurnberg, Former Faculty, Department of Industrial Engineering Technology, Dunwoody College of Technology

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