

Shaping the Future of Vacuum Technology Education

WORKSHOP #4: STUDENT PERSPECTIVE



JANUARY 29, 2021

This work was made possible in part by a grant from the
National Science Foundation (ATE DUE #1700624)





Workshop Series Timeline

Session 1	• September 24, 2020
Assignment 1 – Gap Analysis	• Due back October 8
Session 2	• October 30, 2020
Assignment 2 – Gap Analysis	• Due back November 13
Session 3	• December 11, 2020
Assignment 3 – Q&A	• Due 2 weeks after session 3
Session 4 – Student Panel	• Jan 29, 2021, 1-2pm CT
Prep for Session 5	• 1 week before session 5
Session 5 – Wrap Up	• March 26, 2021
Final Report	• Early April 2021



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Thank you, NSF

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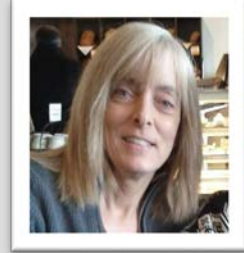


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Thank you, Normandale

With gratitude for the support of the administration of Normandale Community College and the DELIVER Project team.



DELIVER Project Team @ Normandale

Nancy Louwagie, PI; Program Chair, Intro to Vac Tec

Tom Johnson, Co-PI; VACT Instructor

Dr. Ruth Robinson, Co-PI; CHEM faculty, VACT instructor

John Lasswell, Sr. Personnel; VACT Instructor

Dr. Angela Foudray, Sr. Personnel; PHYS, ENGR, VACT Instructor

Rand Whillock, Sr. Personnel; VACT Automation Instructor

Steve Osell, Lab Assistant

Cindy Zoul, Grants Development Specialist

Tim Lapanne, Kim Klein, Student Services

Bob Bailey, External Evaluator, Outcomes Consulting Services

Sarah Holsted, Communications Specialist

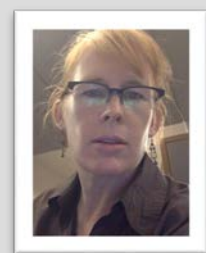
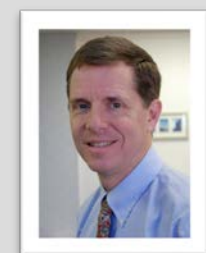
Cary Komoto, Dean
Science, Technology,
Engineering, and Math Division

Workshop Organizers

Nancy Louwagie

Bob Bailey

Sarah Holsted





Technology Orientation

Zoom meeting

Speaker View

Chat

From Me to Everyone:
walter and stew said yes to the invite

From Me to Alan Crosswell:
(Privately)
you are muted

Jill Williams

David Millman

Vace

Linda

Raise Hand

yes

no

go slower

go faster

more

Anthony Cirillo

Melissa Metz

Alan Crosswell

Stew F

Kathy

Unmute

Stop Video

Participants 11

Chat

Share Screen

Record

Reactions

Leave

To: Alan Crossw... (Privately)

Type message here...

Control features

- 1) Mute
- 2) Camera
- 3) Chat
- 4) Raise Hand-> Reactions

Process

- Summary in chat box
- Raise hand and / or chat
- Q&A breaks



Workshop Series Agenda and Objectives

Past

- Provide history and context
- REVAMP and DELIVER Projects at Normandale
 - Results
 - Impact

Present

- Map the current state of vacuum technology in the U.S.
 - Identification of gaps
 - Industry perspective
 - Student perspective
 - Demonstrations of current practice

Future

- Plan for growing and sustaining the program
 - Identification of opportunities and needs
 - Identification of sectors
 - Brainstorm



Present: Map the current state of vacuum technology education in the U.S.

Identify Gaps

- Assignment 1: Gap Analysis on Vacuum Tech Education
- Session 2: Develop Issue Trees
- Session 3: Review Issue Tree Summary
- **Session 4: Student panel discussion**
- Session 5: Develop Solution Tree

Industry Perspective

- Spring 2020: Industry survey
- Session 2: Society of Vacuum Coaters presentation
- Session 3: Review report from industry survey; Industry and R&D panel discussion
- Assignment 3: Complete Q&A, writing assignment

Demo of Current Practice

- Session 1: Overview of Anywhere Technical Education Classroom & Foundations of Vacuum Tech (VACT 1010)
- Session 2: Intro to Vac Tech (VACT 1292) & Rough Vacuum Equipment Trainer system
- Session 3: Thin Film Deposition (VACT 2297) & Remotely operated deposition system
- **Session 4: Vacuum Analysis & Troubleshooting (VACT 2293) & High Vacuum Equipment Trainer system**



Vac Tech Program History



1996

- Normandale Community College begins to offer credentialing in vacuum technology

2014

- National Science Foundation (Project ReVAMP, NSF DUE #1400408)

2017

- Project DELIVER (NSF DUE #1700624)

2020-2021

- Workshop series designed to examine vacuum technology education in the U.S. and to develop a framework for the future

Growth and Sustainability





Distance Education and Learning in Vacuum Technology for Employment (DELIVER) NSF DUE #1700624

Expand pathways through easy access

“Focused track” credential

Increase pool of instructors

Asynchronous foundations course

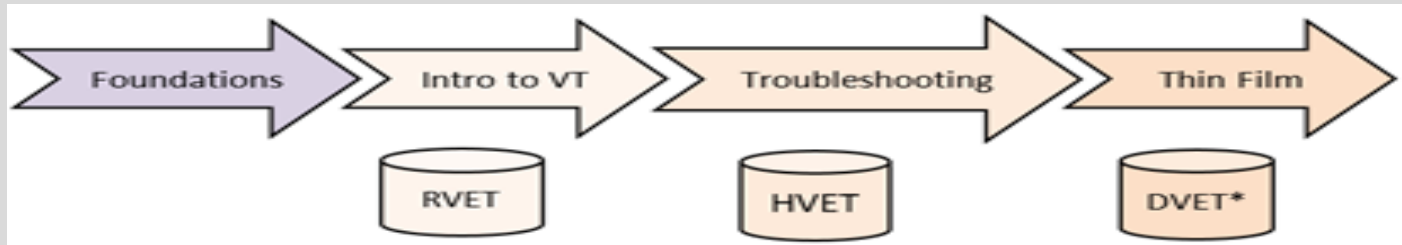
Expanded telepresence to capstone courses

VACT certificate

Instructor guide VACT 1292

Semester long class observation, teaching partnership

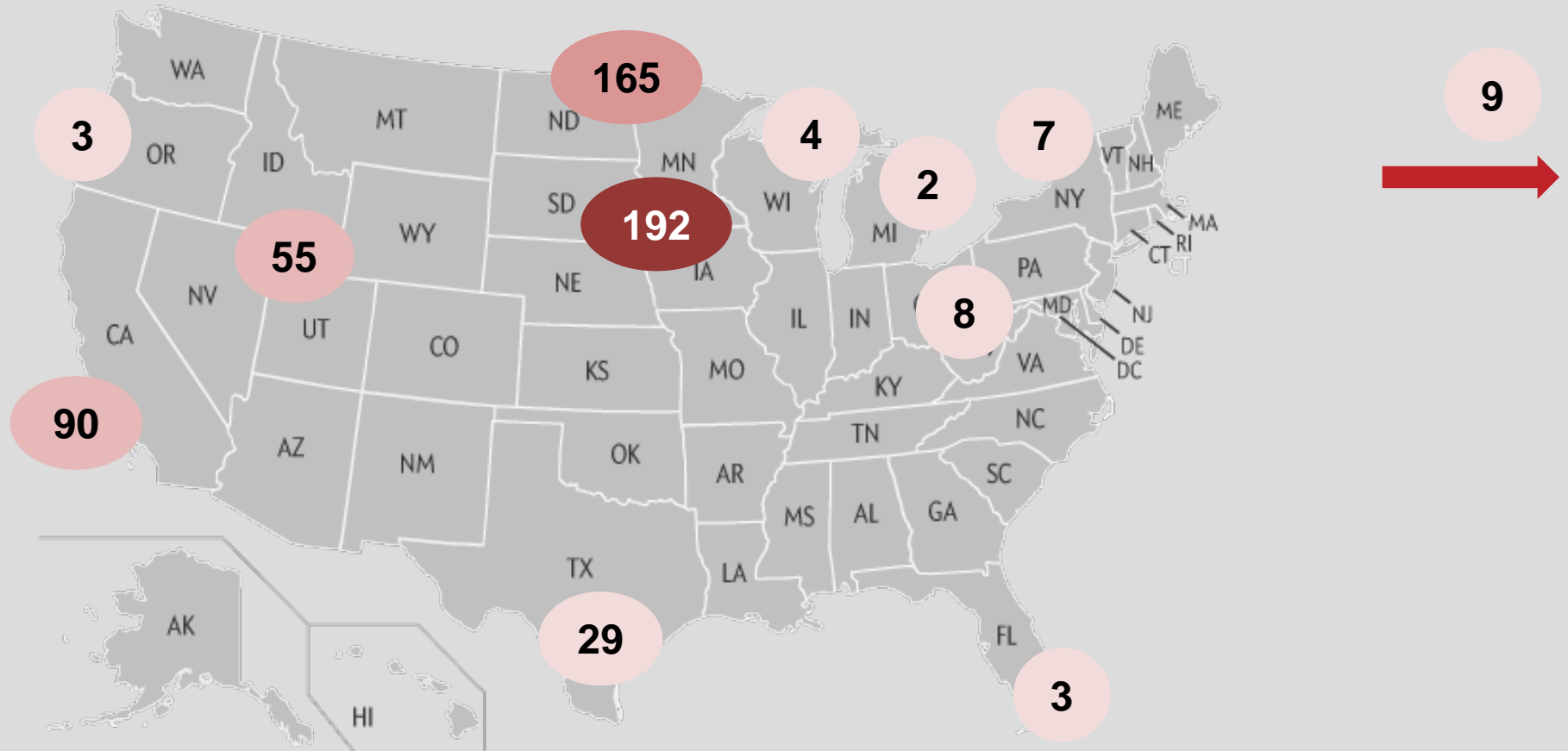
Industry partners





Reach of Vac Tech Program since 2014

State	# Enrolled
MI	2
FL	3
OR	3
WI	4
NY	7
PA	8
NI	9
TX	29
UT	55
CA	90
MN	165
Traditional Student / Unknown Affiliation	192





Partners: Industry, Academic, Professional Society





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**Practical Application of Vacuum Technology Theory -
Vacuum Analysis & Troubleshooting (VACT 2293)**

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General Format of VACT 2293 Classes



Logistics

Attendance
Announcements
Administrative Tasks



Safety Conversation

Brief overview of OSHA General Industry
Vacuum Technology focused wherever possible



Questions Since Last Time

Homework Review
Exam Review & Discussion
“Stuff I Saw at Work...” discussion



Lab Experience Related to the Class Session Theme

Hands On – as much as possible
Remote Control – Lesker 36, Automated HVET
Demonstrations & Examples



Class Session Theme Discussion

Equipment significance, features, & functionality
Operation & Maintenance
Safety - Hazards, exposures, risk
“It’s the same thing you will see on the job”



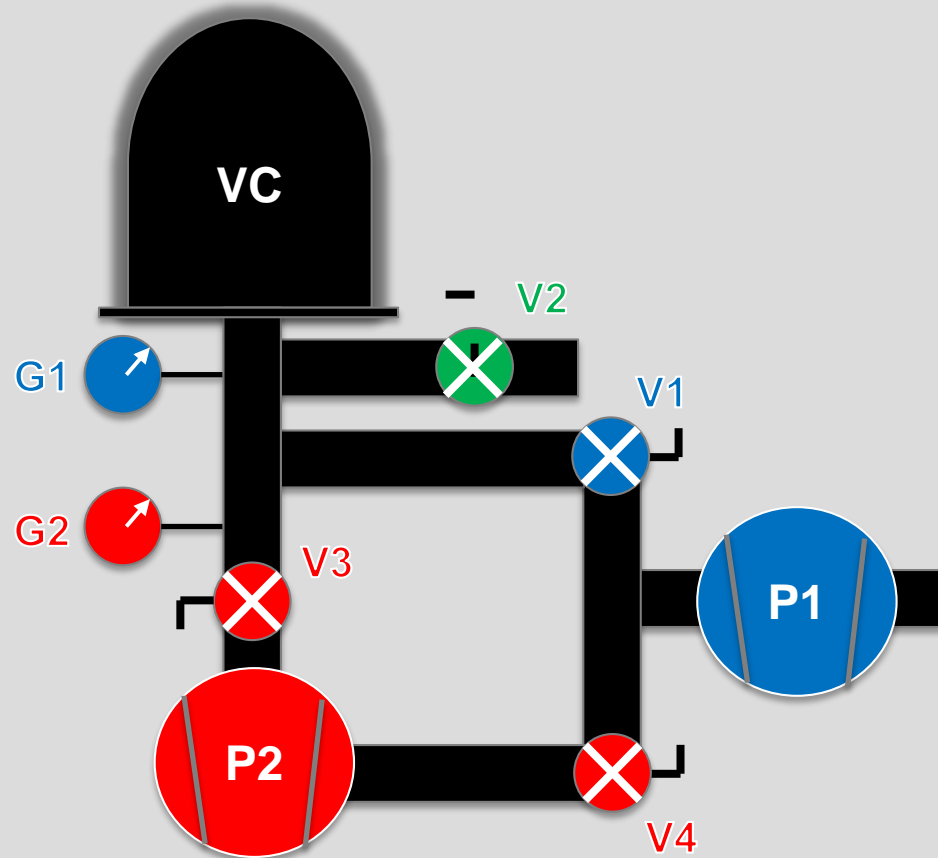
2293 Class Themes Spring 2021

1. Introduction to High Vacuum Operations
2. Relevant Physical Concepts
3. Gas Load & Vapor Pressure
4. Considerations in System Design
5. Problem Solving and Troubleshooting
6. Pressure Measurement under Vacuum Conditions
7. Turbo & Molecular Drag Pumps
8. Rough Pumps/Diffusion Pumps
9. Cryogenic Pumps
10. Using Multiple Pumps/Vacuum Hardware
11. Residual Gas Analysis
12. Leak Detection
13. Plasma & Pressure Control
14. Plasma & Vacuum Coating
15. Ultra High Vacuum
16. Web Handling



Primary Teaching Tool: High Vacuum Education Trainer (HVET)

Components



- VC – Vacuum Chamber

- V1 – Roughing Valve

- P1 – Roughing Pump

- G1 – Roughing Gauge

- V2 – Venting Valve

- V3 – High Vac Valve

- V4 – Foreline Valve

- P2 – High Vac Pump

- G2 – High Vac Gauge

- Not Shown:

- Butterfly Valve

- Mass Flow Controller

- LabJack Interface Device



Other Lab Tools & Equipment

- Lesker NANO 36 Thin Film Coater
- Rough Vacuum Trainer (RVET)
- Sputter Coater
- Evaporative Coater
- Cryogenic Pumping System
- Ion pump
- Leak Detectors
- Residual Gas Analyzers
- “Show & Tell” artifacts
- Small Library
- Danielson articles
- Soon...
 - Automated HVET
 - Automated RVET



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Demonstrating the Science





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Last but not Least...





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Q&A Break

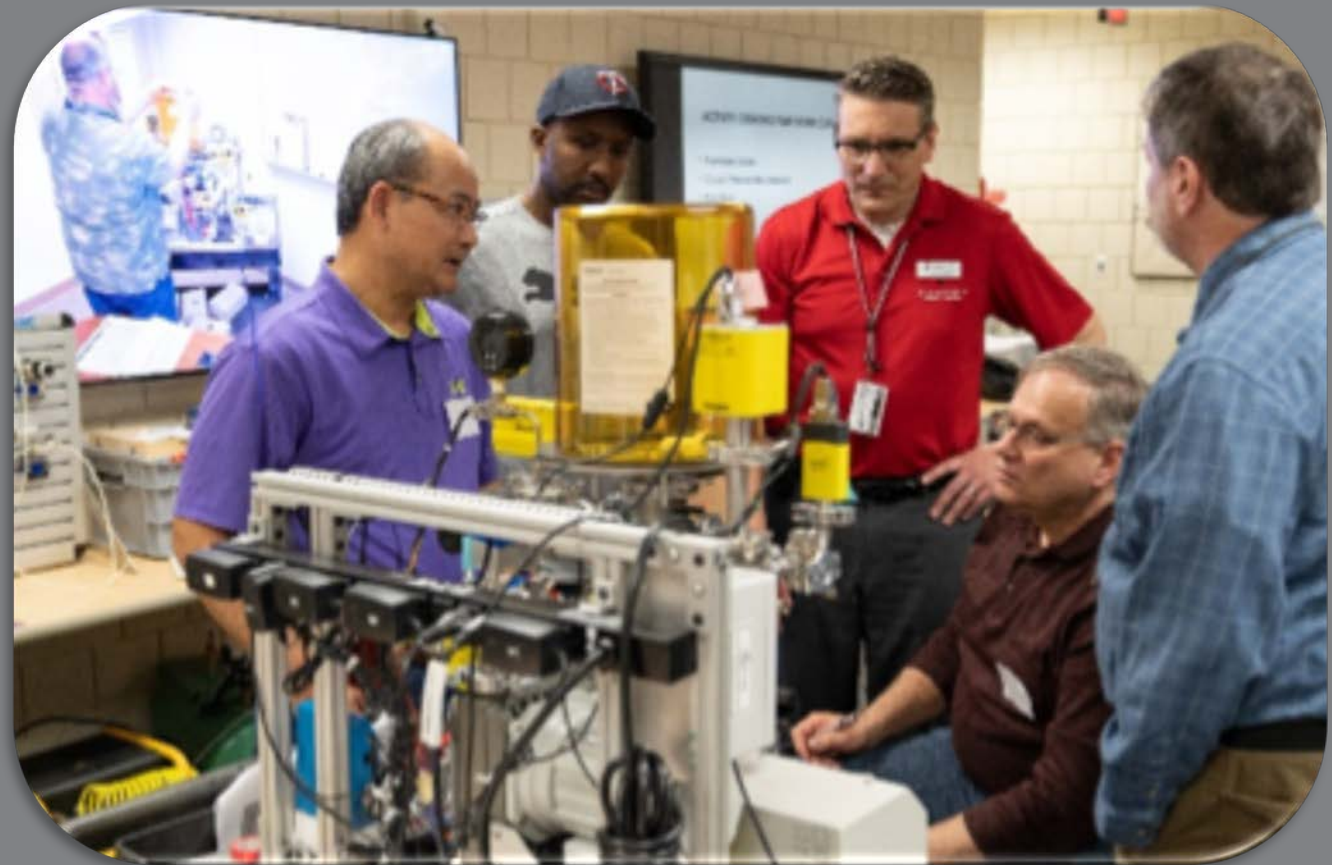


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WORKSHOP #4: STUDENT PERSPECTIVE

The State of Vacuum Technology: Applied Learning

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Workshop 4 Panelists



Anthony Lopez, Texas
Fall 2018 - Spr 2020
Vac Tech Certificate



Antonio Correa Barrios, California
Sum 2017– Spring 2018
Vac Tech Certificate



Jesse Sietsema, Minnesota
Spr 2015 – Spr 2016
A.A.S. Vacuum & Thin Film Technology

Patrick Perez, California
Fall 2017 – Fall 2018
Vac Tech Certificate

Phuong Phan, Minnesota
Spr 2017 – Spr 2018
Vac Tech Certificate



Bob Bailey – Panel Moderator
External Evaluator, Project DELIVER
Outcomes Consulting Services
Virginia

Zachery Bailey, Minnesota
Sum 2018 – Spr 2020
A.A.S. Vacuum & Thin Film Technology



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Assignment Solution Tree



Next Steps



- Today: Complete the end-of-workshop survey:
<https://www.surveymonkey.com/r/2ZJQ8YR>
- Next week: Expect an e-mail from Normandale with
 - Link to end-of-workshop survey
 - Attachment: Assignment 4
 - Attachment: Instructions for application for stipend
 - Link to workshop website at Normandale
<https://www.normandale.edu/departments/stem-and-education/vacuum-and-thin-film-technology/shaping-the-future-of-vacuum-technology-education>
- Session 5 – Friday, March 26 1 – 2:30 pm



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**WORKSHOP #5:
WRAP-UP!**

THANK YOU!!!

MARCH 26, 2021



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