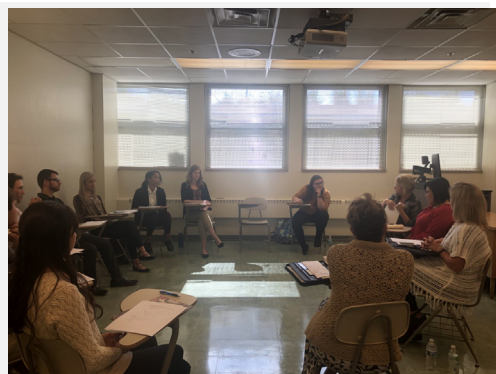


# Improving Student Training and Leadership Competence Through Applied Research: An Interdisciplinary Approach

Michael Kirchner, Ph.D., Assistant Professor of Organizational Leadership  
Purdue University-Fort Wayne

## Needs Analysis Meeting



## Background

OLS 475:

"Human Resource Development"

- Primarily juniors and seniors
- Class size—up to 24 students
- Course content: (1) *HRD process*, (2) *employee development*, (3) *career development*, (4) *organization development*
- Two partner companies per semester
- Two teams per company
- Partner companies have included: Fort Wayne Metals, OmniSource, Ultra Electronics, Gladieux Refinery, Franklin Electric, Rea Magnet Wire

## Project Description

- Semester-long project w/local employer
- "Training and HRD Process Model" guides the course/project (see adjacent image)
- Needs analysis begins w/instructor meeting company representatives prior to start of semester
- Students listen to audio recording of initial meeting
- Students continue training needs analysis by meeting w/company representatives on campus
- Follow-up tour of facility
- Follow-up surveys and interviews conducted w/employees
- Diagnosis of training needs
- Development of a training program identified through needs analysis
- Student-facilitated training on-site to partnering company employees
- Evaluation of training

## Challenges/Limitations

Challenges:

- Employer support & communication
- Student schedules
- Student buy-in
- Social loafing

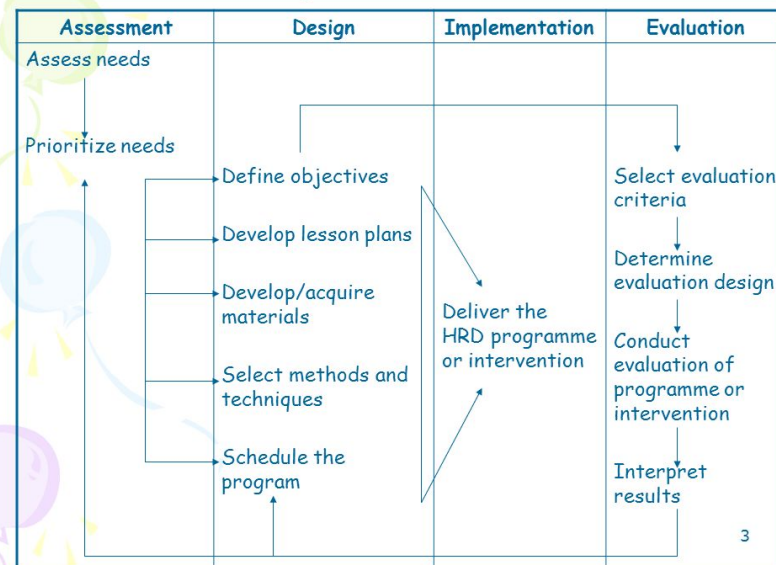
Limitations:

- One semester timeframe (start to finish)
- Time distribution between lecture and group work on project
- Group sizes
- Local employer interest

## Outcomes/Impact

- Students hear and observe the many challenges plaguing today's organizations
- Students receive first-hand opportunity to develop, provide, and assess training
- Resume-builder
- Increase community engagement
- Builds brand awareness of degree program/campus
- Multiple students have received job offers as a direct result of project participation
- Replicable across disciplines, including education, business, engineering, and healthcare

Training and HRD Process Model



## Student-led Training at FW Metals



# INVESTIGATION OF CLASSROOM ENVIRONMENTS FOR STUDENTS AT PURDUE UNIVERSITY FORT WAYNE

Natalie Neuenschwander, Elementary Education Major Student and Jeong-il Cho, Ph.D., School of Education, Purdue Fort Wayne

## Abstract

An ethnographic essay was developed by a student in an elementary education major and an honors program. The classroom environments at Purdue University Fort Wayne were evaluated based on her two years of experiences. The observational data on multiple views toward the Purdue FW's classroom environments were gathered from faculty and students in three months as the student researcher participated in university events with other students, faculty, and staff at Purdue FW. The results show a discrepancy between the established socio-emotional, behavior, physical, teaching, and evaluation/grading environments and environments students want. The current presentation shared adaptation and improvement ideas.

## Model: The Systematic Approach for Adapting the Learning Environment [SAALE]

It is not what we teach, but how we teach that opens doors for students who learn differently. Universal Design of Learning (UDL) and identification of "Mismatches" are key points.

### Three Major Environments

- I. Learning Environment
  1. Socio-emotional
  2. Behavioral
  3. Physical
- II. Teaching Environment
- III. Evaluation and Grading Environment

Source: Wood, J. W. (2006). *Teaching students in inclusive settings: Adapting and accommodating instruction* (5th ed.). Upper Saddle River, NJ: Merrill/Prentice Hall

## Literature Review

- College students learn better when their physical classroom reflects the culture of the class itself. For example, students prefer having bold wall colors that reflect their learning excitement and experience (Cotterill, 2015).
- Students began to feel pressure from their classes when they are overloaded with many assignments, tests, and dates that are close to one another. (Rathmann, Herke, Hurrelmann, & Richter, 2018).
- Students who learn new material in a student-centered learning environment are more likely to remember the material and then recall it on their tests. (Kearney, Smith, & Maika, 2016).
- A study conducted among special needs students of the most effective strategies that they believed helped them succeed in their classes. The strategies include assistive technology, direct assistance, and strategy instruction (Zeng, Ju, & Hord, 2018).

## Method

- Participant and Setting:**
  - The researcher is a student in the Elementary Education major at Purdue University Fort Wayne (PFW) and she is also pursuing an honors program certificate. She evaluated the classroom environments at PFW based on her experiences for two years as a student and developed an ethnographic essay.
- Data Source**
  - The student researcher gathered the data from faculty and students for a period of three months in university events, such as *Teaching in Today's Students Workshop* and *Alliance Student/Faculty Event (Don't Miss the BOATE! Bringing Students Onboard)*, that are designed to share multiple views of students, faculty and staff on classroom environments at PFW.

## Results - Issues

### Socio-Emotional Environment

- Job demands on top of schoolwork
- PFW Events are not well communicated to students

### Physical Environment

- Wall colors vary in each classroom
- Small desks make it difficult to place laptops and other materials on

### Behavioral Environment

- Different set of policies for each class based on professor
- Strict attendance policy of only a few absences for each class

### Teaching Environment

- Professors moving too quickly and using complicated language
- Professors being unfamiliar with how to work with students with special needs

### Evaluation and Grading Environment

- Students feeling unfamiliar with their professor's style of written assessments
- Majority of grades determined by performance on assessments

## Results – Adaption Ideas

### Socio-Emotional Environment

- Allowing students to walk out of their class for certain reasons
- School newspapers or sidewalk advertisements to inform students of PFW events

### Physical Environment

- Neutral wall colors in classrooms
- Larger table space on desks or long tables with separate chairs

### Behavioral Environment

- A set list of rules for all classes provided by the university and professors adhering to rules specific to their class
- Policy where professors cannot give absences for factors that the student does not have a control over

### Teaching Environment

- Student-Centered Learning where students help teach the lessons
- Assistive technology for students with special needs

### Evaluation and Grading Environment

- Practice quizzes for students
- Final grades based not only on assessments, but other activities

## Limitations and Implications

- In order to triangulate the views, interviewing other students on classroom environments would be needed in the future ethnographic essay.
- With the gathering and knowledge of these different learning environments through the perspective of both the faculty and students, the student researcher was able to better understand the PFW environment and support the faculty advisor to adapt each of the environments to students.
- By knowing unique needs of students, the student researcher could understand how the classroom effects students and adapt the classroom environment so that college students can stay engaged and understand what they are being taught.
- Through a research focusing on PFW environment, the student researcher in the elementary education major could reflect on effective learning environment for elementary school students with and without disabilities.

## Conclusion

Students at PFW need various supports for their learning. The classroom environments (socio-emotional, physical, behavioral, teaching strategies, and evaluation/grading) that are critical for the learning of K-12 students are also key success factors for college students.

Classroom environments affect students' learning experiences at Purdue University Fort Wayne no matter what their race, age, grade, or the diagnosis of a disability are.

By recognizing students' needs and possible adaptations to meet these needs, we can change our perspective of how we teach which can then help our students to succeed in their academic life in college.

2019 Alliance Faculty and Student Showcase

# CREATIVE OPPORTUNITIES FOR STUDENT RESEARCH INVOLVEMENT: SHARING THE RESEARCH EXPERIENCE WITH STUDENTS AT ALL LEVELS

NAOMI GUREVICH, PHD, COMMUNICATION SCIENCES AND DISORDERS

## Strategy

Student involvement in research transforms the static nature of reading about research into the active and dynamic nature of creating research. The researcher and the student both benefit from such a relationship. **But are these opportunities afforded to all students?**

Opportunities abound for academically successful honors students and motivated self-learners. Desire or motivation can be fostered to grow the number of students who would benefit from hands-on mentorship and participation in scholarly exploration.

- Make the process accessible to students with a range of academic skills and goals.
- Share your love & enjoyment of the research process with undergraduates who never saw themselves as potential researchers.
- Focus on individualized ways to provide a positive learning experience, shaving off pieces of bigger projects into manageable tasks.
- Reduce anxiety and self-doubt and help inspire student participants to be invested in the outcome and to get excited about how their project will shape future decisions and clinical practice.

**No thesis:** not honors; transfer student can't fit thesis in schedule; out of reach and complex; no opportunities;

**No problem:** participate in stages, learn about the full process from own contribution.



## Student Projects

### Student 1

**Prior research:** Important, but out of reach

**Project title:** Barriers to Recruitment of Racial Minorities into Communication Disorders

**Involvement:** Research question and design development, literature review, data collection and interpretation, dissemination (poster preparation)

**Timeline:** >1.5 years

### Student 2

**Prior research:** None

**Project title:** Barriers to Recruitment of Racial Minorities into Communication Disorders

**Involvement:** Data entry and analysis; potentially data collection and interpretation

**Timeline:** 1 semester (possibly 2)

### Student 3

**Prior research:** General interest but no time, no opportunities

**Project title:** Intelligibility Evaluation System

**Involvement:** Stimuli (word-list) analysis & transcription; potentially data interpretation

**Timeline:** <1 semester

### Student 4

**Prior research:** Interested but didn't know if was eligible (not honors), or if had time (transfer student)

**Project title:** Dysphagia management and interprofessional practice (IPP) between nurses and SLPs in healthcare with respect to diet modification decisions

**Involvement:** Literature review, data interpretation, and dissemination (poster preparation)

**Timeline:** 1 year

*Current Projects (fall 2019)*

## Student Stories

*Students can be inspired by their own potential...*

"I'm interested to know the findings and I would love to continue to be part of research to create new knowledge"

"I believe research allows us to challenge and test new ideas, and new possibilities"

"It can be challenging, but it's rewarding"

"I hope that we will be able to expand this research in the future, because it is such an important topic"

"I do find myself thinking about how this research is related to other questions in the field"

"I think my lack of interest [in research] came from a lack of experience"

"It really helps being so fascinated with what we're doing! I haven't second-guessed my decision to start this research with you"

"Before working with you I would have assumed my lack of academic excellence would exclude me from working on research with a faculty member"

"Working on this research opens up academic avenues that were otherwise closed off to me"

*...and help inspire us*

## Student outcomes

**Manageability of project:** very, but does require active balance of school and work

**Interest level:** extremely interesting; addicting; important work

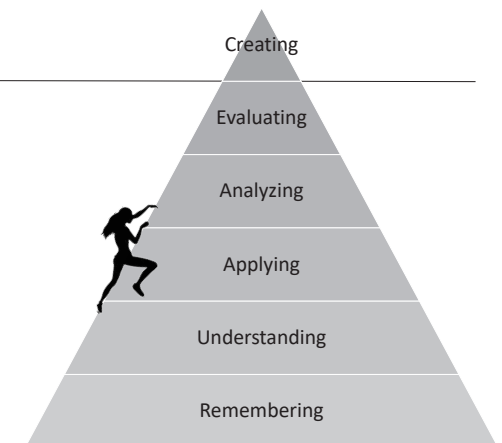
**Generalizing the work:** interest in eventual results; implications for the field & impact on health of patients; thinking about bigger pictures and future research questions relevant to current work

**Dissemination:** student-authored posters (2), contributions to manuscripts, acknowledgements

**(Concrete) things Learned:** expanding interest in sub-areas in our field & commitment to CSD; learning to manage time; learning to see patterns in data

**Specific benefits:** practice transcription; increase vocabulary; master spreadsheets; academic development; prepare for grad school; help with grad applications; opportunity to present

**Future involvement:** would like to continue involvement in this project; will look at future opportunities





# PASSIONATE POETRY AND LEADERSHIP PODCASTS?

## IT'S ACTIVE LEARNING!

Created by Dina Mansour-Cole, Ph.D.  
Associate Professor, Organizational Leadership  
for  
Fall 2019 Alliance Teaching Showcase



## Why use poetry?

In our organizational leadership (OL) classes I use poetry to easily put the A (for Art) into our STEM discipline in an inexpensive and non-messy but still active way. The resulting active learning for the students was...well, STEAMY. In the book jacket for Why Poetry, the publishers call the text an engaging and “passionate argument for the necessity of poetry in an age when information is constantly being mistaken for knowledge.” Since our OL students are influencers and storytellers, the arts and poetry are critical to their creativity. In many of our disciplines we can use some reading and writing of poetry! Read, think and enjoy!

Matthew Zapruder (2017). Why Poetry. <https://www.npr.org/2018/11/15/662070097/starting-your-podcast-a-guide-for-students>  
HarperCollins Publishers, New York, NY.



## Reading Poetry- In your discipline?

Zapruder tells us that to learn to read poetry is to forget many incorrect things you learned about it, particularly *what* poetry is in favor of why poetry is written and *what it does*. This idea is similar to how we talk to leadership students about reading and consuming previously published change models.

In the senior level OLS 49600 Leadership Theory and Change class a *collaborative assignment* requires three successive parts throughout the semester. I had students first review previously published poems or song lyrics that provided information and emotional connection to the change process. Students are expected to include more than implementation issues and address the external environment, fairness and justice, multiple stakeholder needs and more. Using the same 10 questions I use when I grade the student group's original models, my collaborative groups answered these 10 questions for a change embodied in the poem or other previously recorded work about change. How? By creating their own Podcast. *The podcast is a relaxed presentation environment that requires students to think about the issue* (in this case, song lyrics or poem) and how it relates to organizational change. *Original model podcasts were due October 18 (so see me if you want to hear them) and include a melting wax candle metaphor and a multiple ladder model.*

### Student Reaction

In semesters where I provided poetry (or song lyrics- thank you Nobel Prize winners Tagore and Bob Dylan!) the original models provided by students were more creative and included a visual that was more engaging. Student outcomes would include poetry of course, but also change models looking like cartoons or song lyrics among other art forms. The best project to date is a 3 Person Play which was acted out in class. It included many of the items we want in a good change model, and provided a memorable way to begin to think about planned and unplanned change.

*A single parent comes home to her son who is on the floor playing with a Jack-In-The-Box. She is having a tough time making the transition from her organization where they are facing several changes (some large and some minor) to home. As she also laments that this transition also requires a change in her role, she realizes that every time Jack pops up, her son seems surprised AND eventually delighted. She then begins to see that each change could be visualized as a cranking and then pseudo-surprise entry of Change Implementation!...*

## Writing Poetry in OL?

Leadership students need to find ways to influence others. In OLS 35000 I always include creative ways to *write for influence*. I had students in the class collaboratively write a poem.

**How?** Since they were not English majors, this could have been a hard sell. I begin by appointing one student facilitator who has a list of 8 questions. She has classmates consider the questions, one at a time, and write the answers to each question. For the example in this poem, after she asked the first question, our facilitator had the class go outdoors and fly kites I had purchased at a 'dollar store'. After we came in, each student contributed a line from their answer set and we wrote a poem that included every student's comments. Finishing off with additional lines and rearrangements of course, we titled the poem. Every semester the students are so impressed with the results of their own writing – in the example poem they wanted to have the poem published (so I did enter it into a small competitive process -with English majors and even English professors- but they did not place)!

The American poet and insurance executive Wallace Stevens wrote about the role of the poet.

*“What is his function? Certainly it is not to lead people out of the confusion in which they find themselves. Nor is it, I think, to comfort them while they follow their readers to and fro. I think that his function is to make his imagination theirs and that he fulfills himself only as he sees his imagination become the light in the minds of others. His role, in short, is to help people to live their lives.”*

When commenting on the Steven's description of a poet's life, Zapruder reminds us that poets take familiar language and use it to build space of both contemplation and collaboration- experiencing “a great attention charged with the possibility of new and elusive connections.” (quote on page 84).

Our OL students are not poets, but they do not only write instruction manuals either. Their objective is often to individually or collectively encourage others around them to critically think and come up with conclusions that fit various environments or situations. The creative stories, poems, plays and other art pieces they write-similar to their arguments, cases and position papers- can and do influence the thinking of others... as they should.



Podcast #1s are up on Blackboard! Enjoy! If yours is missing, please resend in email asap. If you want to change the title of the podcast as I have typed it in, please let me know via email. All of us can check these out. You will note that there are a variety of file formats, and that is okay since I can hear all of these. And while some voices are stronger/louder than others, you all avoided distracting background noises (thank you).

Remember that this first assigned podcast asked you to use 10 questions about change models to assess the existing model you found. Some podcasts are short and to the point, while others are more casual and relaxed. Not all persons in our class were taped, and this was not necessarily a requirement to get your voice on tape for presentation- you did all have to help each other learn the material however.

As you look at these, there are three “now what” or future items to remember for all of us:

1. Listen to these critiques of current models. They will help you form ideas about what is important to include in a good change model (not a model for good necessarily). You will also get clues about what you want to emphasize in the future, what is confusing and what you should avoid.
2. Since these same ten questions are the ones I use when I grade your CREW's own change model that you present in Podcast #2, I hope you learn a lot from Podcast #1!
3. For your final individual paper due at the end of this semester, you can break from your CREW's favorites and propose your own ideas. Most of you will use pieces of several different models to create a change that seems fair, just and compelling to many stakeholders! Read about your individual paper again later this week.

And remember: after Podcast #2 each class member will post reactions and reflections on the BB discussion board (see our schedule).



### Are your toes painted?

Personally I was anxious because of my dress and the wind.  
Sunny. Windy. Perfect.  
Are your toes painted?  
I saw some failed attempts.  
I heard laughing.  
Laughter and words of encouragement.  
Do my feet smell?  
Neutral.  
I wasn't sure what to expect.  
Kites, obviously. Sunshine and bonding.  
Tired.  
Happy adults.  
I guess, younger.  
Entertaining. Fun. Happy.  
Movement and smiles.  
I felt physically happy because we just got our kite in the air.  
Happy. Competitive. Excited.  
I feel totally excited. Totally.



## CREATING AND IMPLEMENTING THE USE OF VISUAL METAPHORS TO TEACH NEW MEDIA USING VIRTUAL REALITY AND AUGMENTED REALITY

THE RESOURCES UTILIZED IN THESE TEACHING STRATEGIES WERE PROVIDED BY "THE WEDDING CHAMBER," PROJECT THAT IMPLEMENTS THE VIRTUAL DECONSTRUCTION OF THE EMINENT FRESCO OF ANDREA MANTEGNA LOCATED AT THE SAINT GIORGIO CASTLE, IN MANTUA, ITALY.

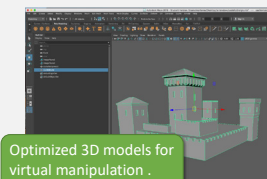
ANDRES MONTENEGRO, ASSOCIATE PROFESSOR OF COMPUTER ANIMATION, DEPARTMENT OF ART AND DESIGN.  
ASSOCIATE CO-RESEARCHER, PROFESSOR AUDREY USHENKO, DEPARTMENT OF ART AND DESIGN

### THE IMPLEMENTATION OF AUGMENTED REALITY AS A LEARNING AND TEACHING EXPERIENCE

3D models with texture information.

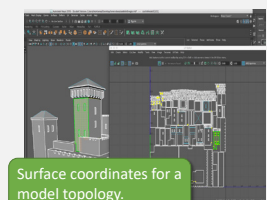
3D models emerge when a device camera or sensor spots the image target.

#### "THE IMAGE TARGETS"



Optimized 3D models for virtual manipulation.

#### "THE OVERLAY." 3D MODELS



Surface coordinates for a model topology.

#### "THE SURFACE." MAPPING AND TEXTURING

Augmented reality allows the use of multiple "subtext," and its organization can be displayed through a hierarchical order.

TEACHING RESOURCES UTILIZED: IMAGE TARGET AND ANIMATION

A metaphor that epitomizes a direct augmented reality experience is the "image target." 3D content is glued to a physical object or image to be overlaid or displayed digitally in the real world.

Augmented reality requires 3D models. In order to produce a meaningful experience, the user has to manipulate the model. The model must have a low poly count in order to display an effective interaction.

The most important component for a dynamic visualization in augmented reality is the texturing and UV mapping deployment. AR interaction creates a compelling experience due to the realism of the models.

Teaching new media such as Virtual Reality and Augmented Reality involves the use of a number of computing abstract definitions and processes that are not always easy to grasp. This work expose how visual metaphors can help to understand this language, and how those can be implemented for an effective teaching methodology.

### THE USE OF VIRTUAL REALITY AS A LEARNING AND TEACHING EXPERIENCE

The virtual reality project "The Wedding Chamber" is a research/creative endeavor instance where teaching has obtained a direct benefit from the active deconstruction of its components. A number of metaphors have surfaced as a result of the application of 3d modeling and mapping to display the content of the fresco. The more outstanding ones are: "The open room," "The Vaulted Ceiling," "The Small Models," "The Piazza," and "The Inspector."

These metaphors have a double value:

- Facilitate the understanding of the historic context of the fresco.
- Enable the configuration of a virtual space to teach the composition of the fresco.

A virtual reality immersive experience can be implemented through these metaphors as building blocks of meaningful experience. The students then will approach a future project or content by:

- Laying out the conceptual and abstract artistic language into a 3D space.
- Using concrete objects to convey complex computing language and functions.

### THE IMPLEMENTATION OF METAPHORES TO ACHIEVE LEARNING EXPERIENCES

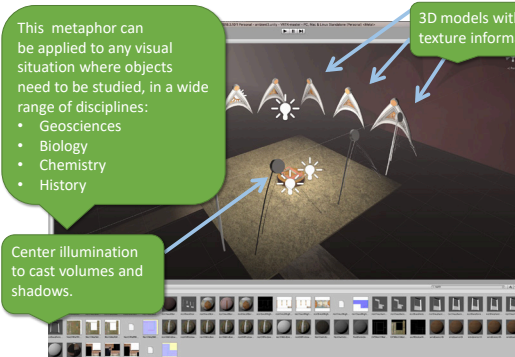
Viewers are used to manipulating intuitively common computing metaphors such as *Window*, *Desktop*, or *Recycle Bin* among others. However, the creation of brand new metaphors will customize learning experiences through a hierarchy of navigation. In this specific case the contact with the subject is very close, in which then the object will display call outs, tooltips, roll overs, and visual cues as hypertext.

TEACHING RESOURCES UTILIZED: INTERACTABLE OBJECT AND HAPTICS

This metaphor can be applied to any visual situation where objects need to be studied, in a wide range of disciplines:

- Geosciences
- Biology
- Chemistry
- History

Center illumination to cast volumes and shadows.

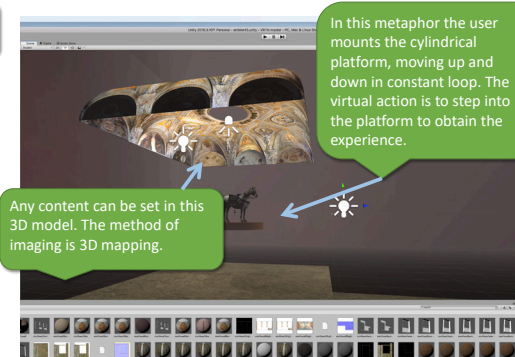


#### "THE OPEN ROOM"

This metaphor was conceived to understand the architectural component of the myth narrative associated with the events taking place in the main fresco.

This can be understood as a teaching device where the 3D models can be studied in an immersive space. In the open room the user can move or teleport to study each element.

TEACHING RESOURCES UTILIZED: TELEPORTING AND PHYSIC ANIMATION



Any content can be set in this 3D model. The method of imaging is 3D mapping.

In this metaphor the user mounts the cylindrical platform, moving up and down in constant loop. The virtual action is to step into the platform to obtain the experience.

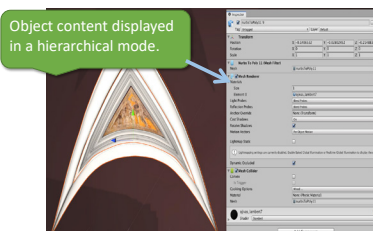
#### "THE VAULTED CEILING"

This is the deconstruction of the ceiling of the fresco. In this specific case, the immersive experience of exploring from below, facilitates the understanding of a complex geometric layout.

This can be understood as a teaching device where the ceiling can be studied through accurate observation.

TEACHING RESOURCES UTILIZED: RAYCAST, TELEPORTING AND ANIMATION

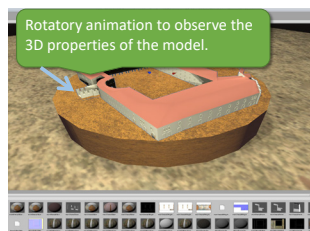
Object content displayed in a hierarchical mode.



#### "THE INSPECTOR"

This is a standard user interface metaphor in computer graphics, however, it can be used in multiple functions to display levels of content.

Rotatory animation to observe the 3D properties of the model.



#### "THE PIAZZA"

In this case the metaphor is based on a rotatory action. Users can appreciate precise details.



Models set for grabbing and closer manipulation using hand controllers or hand tracking sensors.

#### "THE MINIATURES"

In this case the metaphor is activated by the interactive object status of the small models.

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## A Successful Project-Based Learning Experience: Case Study of Fort Wayne Metal Research Project

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### Introduction

- ❑ Project-based learning is an instructional approach planned to provide students with the opportunity to develop knowledge and skills through engaging projects set around the challenges and problems they may tackle in the real world.
- ❑ Such a technique presents opportunities for deeper learning in-context and for the development of important skills tied to college and career readiness (Shaffer et al., 2014; Alves et al., 2012).
- ❑ Students' involvement in research projects is attracting more attention in the last decade (Shaffer et al., 2010; Harrison et al., 2011; Gavin 2011).
- ❑ Such experience allows students and instructors to collaboratively bridge the research and classroom and provide research experiences for students relative to traditional individual mentored research.
- ❑ Students who are engaged in research projects report cognitive gains such as a) learning to think and analyze, b) affective gains such as delight, c) psychosocial gains such as belonging to a team, identifying as an effective engineer, and d) behavioral gains such as motivations to pursue graduate education or careers in engineering (Downing et al., 2011; Amamou and Cheniti-Belcadhi 2018; O'Sullivan 2013).

### Objectives

- Improve the students' self-efficacy (like self-confidence and responsibility)
- Improve the students' attitude towards measurement techniques
- Enhance the students' understanding of the relevance of subject matter to life and society
- Improve the student's ability in decision making, problem solving skills, and applying concepts
- Enhance the ease of learning the subject matter for the students
- Enhance team working for the students
- **Second Project:** Students focused on an innovative idea to design, make, and test 3D printed fabrics to be used as a flexible skin for future spacecraft, spacesuits, or for deployable antennas.

### Study Area & Problem Definition

- ✓ In Spring 2016, faculty asked students to apply one of course techniques on a numerical example as a course project while in the Spring 2018 the faculty decided to engage students in a real research project to apply an effective technique "Design of Experiment (DOE)" to solve a real problem in industry.
- ✓ Graduate student involvement in a research project to improve cutting glass process in an Auto-glass manufacturing company in IT 507 (Measurement and Evaluation in Industrial Technology) course in Spring 2018.
- ✓ The research projects provided an opportunity for the students to work in teams, enhance professionalism, and knowledge of contemporary issues – creating 'well rounded' and 'job market ready' engineers upon graduation. The research projects somehow improved students' understanding of measurement techniques, making over some other approach.
- ✓ **First Project:** Cold drawing is widely used metal forming process with integral advantages such as closer dimensional tolerances, better surface finish and improved mechanical properties as compared to hot forming processes. A team planned to focus on improving the ultimate tensile strength of L-605 ® wire by determining significant factors. L-605 ® wire has a number of applications in the aerospace industry and medical industry due to the fact that it maintains moderately high strength even in high temperatures. The cold drawing process has many variables that should be controlled to produce consistent wire properties. Their research focused on evaluation of the effect of speed, tension, and lubrication temperature on the ultimate tensile strength of the cold drawn L-605® wire via the design of experiment technique. The data analysis verified that speed and tension factors, along with the interaction of speed and temperature, have significant effects on the ultimate tensile strength of the drawn L-605 wire.

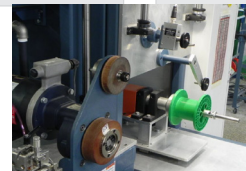
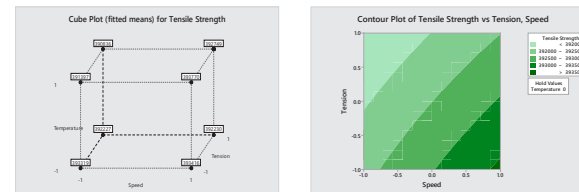


Figure 1. Using Measurement techniques (Contour plot and cubed plot) to analyze data.

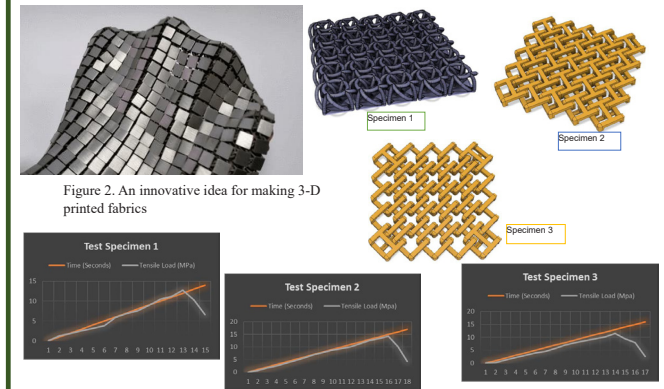


Figure 2. An innovative idea for making 3-D printed fabrics

Figure 3. Using Measurement techniques (Tensile test and statistical analysis) to analyze data.

### Results, Discussion, & conclusion

Table 1. Post Survey Comparison between Course Offerings (Scale Likert 4 points)

Question	Spring 2016		Spring 2018		t Test Statistic	H1 Hypothesis at the 95% Confidence Level
	Mean	Std. Dev.	Mean	Std. Dev.		
1. The instructional materials, class activities, labs, assignments, and the research project were integrated in a way that made my learning easier.	2.86	0.89	3.89	0.73	2.69	Accepted
2. The instructional materials and research project emotionally engaged me in learning the course topics	2.54	0.99	3.62	0.76	2.34	Accepted
3. The instructional materials and research project involvement increased my self-confidence.	3.14	0.78	3.82	0.74	2.56	Accepted
4. I achieved a sense of accomplishment in learning by using the instructional materials and working on a research project with teams	2.16	0.94	3.69	0.72	2.27	Accepted
5. The instructional materials and involvement in a research project helped me assume a greater responsibility for personal learning	2.56	0.88	3.86	0.8	2.62	Accepted

Year	Mid-Term Exam		Final Grade	
	Average	Standard Deviation	Average	Standard Deviation
2016	81.3	6.9	85.6	4.2
2018	89.6	5.2	91.2	3.9

### Selected References:

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