# Effects of informal versus school-based field experience on elementary preservice teachers' self-efficacy for teaching science

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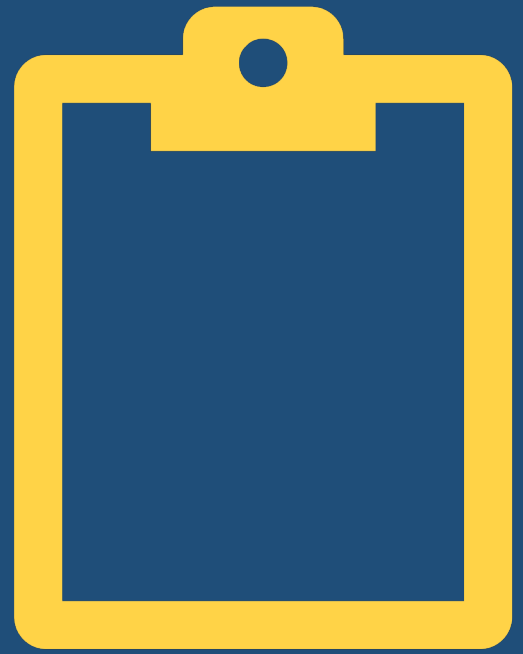
# Greenhouse Project Background

- Joint venture of the Engineering and Education departments at a mid-sized liberal arts college in south central Pennsylvania
- An internal grant largely funded the building of an automated greenhouse at a local K-8 school in a nearby urban district
- Additional funding was granted by a local non-profit organization
- Two overarching pieces
  - Construction of the greenhouse by senior-level Engineering students
  - Creation of accompanying curriculum by junior & senior-level Education students



# Goals of the Greenhouse Project

- Broaden the type of capstone experiences for Engineering students
- Provide training for preservice teachers in the Education department
- Address a pressing social & educational need within a local, urban school district

# Dorchester Elementary

- One of eight K-8 schools in nearby urban school district
- Student population
  - 655 students total
  - 90.5% of the students come from low-income families
  - 26.9% are English language learners
  - 24% receive special education services
  - 47.6% Hispanic; 27.6% Black
- Dorchester's population mirrors that of the district overall

Courtyard prior to greenhouse

# Greenhouse construction in progress

Front of completed greenhouse

Completed greenhouse interior

# Engineering Side

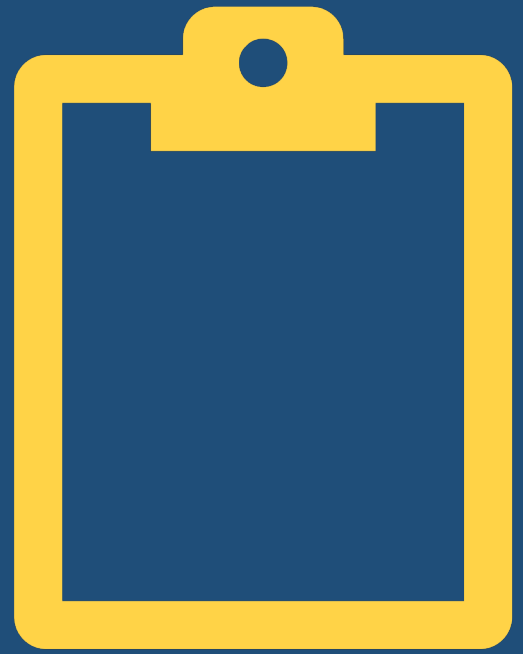
- All US based engineering programs accredited by ABET must include a culminating capstone experience
- Typically, students at our college participate in capstones that are more traditional, focusing on designing and competing an engineered system that may not be connected to solving a human problem (like building a racecar)
- Recent trends push capstones to be more connected to service learning that solves a real life problem
- Our greenhouse project fell under this project-based serving-learning model

# Education Side

- All students preparing to be elementary educators (grades PK-4) take ECH 330, a science teaching methods course
- Prior to fall 2017, preservice teachers (PSTs) enrolled in ECH 330 completed their field experience hours in mostly informal science settings (libraries, local state park)
- Beginning in fall 2017, all PSTs enrolled in ECH 330 completed their field experience in a formal classroom setting, mostly at Dorchester Elementary
- Initial study set out to compare informal settings to formal settings, using the greenhouse. However, construction delays formed a third group – formal settings without using the greenhouse
  - This study compares Cohort A (informal settings) to Cohort B (formal without the greenhouse)

# Existing Literature Says….

- STEM education in the US is lacking
- We should be starting STEM education in elementary schools (but largely are not)
- Many elementary level PSTs have a low self-efficacy for teaching science
  - This is linked to their own anxiety around science/math
- Feelings of low self-efficacy and high anxiety lead to an avoidance of teaching science – which leads to negative feelings among K-8 students, who grow up to avoid science and STEM careers
- To increase self-efficacy, PSTs need positive exposure to science teaching (from teacher educators in methods courses or student teaching)



# Research Questions

- Does the type of field experience placement, formal or informal, have an impact on overall self-efficacy for teaching science among elementary preservice teachers?
- Does the type of field experience placement, formal or informal, have an impact on self-efficacy for teaching science among elementary preservice teachers in two sub-categories: Personal Science Teaching Efficacy Belief (PSTE) and Science Teaching Outcome Expectancy (STOE)?
- What role does the type of field experience placement, formal or informal, have on elementary preservice teachers' perceptions about their self-efficacy for teaching science?

# Methods

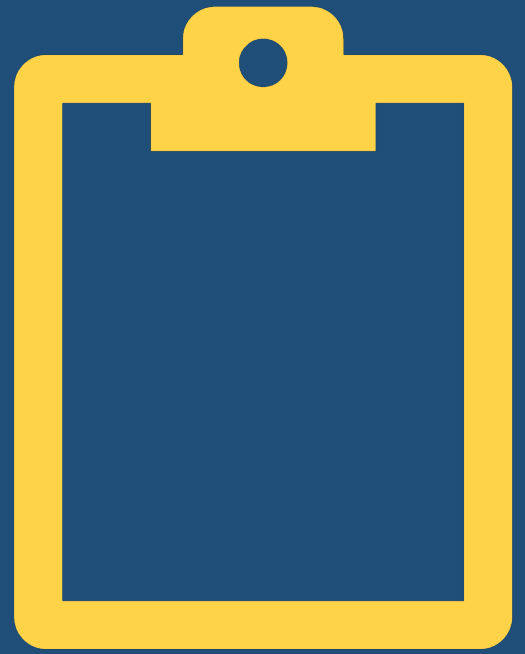
- Data collection began in Fall 2016 and includes data through Spring 2019
  - Data collection will continue through Spring 2021 and compare Cohort C (formal with the greenhouse) with Cohorts A and B
- Every semester, PSTs enrolled in ECH 330 were asked to complete the STEBI-B at the beginning of the course and again at the end of the course
  - The STEBI-B is a measure of self-efficacy for teaching science in preservice elementary teachers (Bleicher, 2004)
- Alpha-numeric codes were used for anonymity but still allowed for tracking
- STEBI-B pre and post scores were compared using various analyses on SPSS (more on this later)

# Methods, cont.

- A random subset of participants every semester was invited to participate in a focus group
- In fall 2017, students were asked to voluntarily submit responses to a set of questions about their field placement
- In fall 2019, some students mentioned Dorchester as part of another assignment and were asked for permission to use their comments
- Focus group transcriptions and written assignments were coded for patterns by the lead author and a student assistant.

# Participants by Semester

| Semester | STEBI-B *n* | Focus Group *n* |
|---|---|---|
| Fall 2016 – Cohort A | 24 | 6 |
| Spring 2017 – Cohort A | 15 | 4 |
| Fall 2017 – Cohort B | 26 | 6 |
| Spring 2018 – Cohort B | 24 | 5 |
| Fall 2018 – Cohort B | 9 | 8 |
| Spring 2019 – Cohort B | 12 | 5 |
| **TOTAL Cohort A** | **39** | **10** |
| **TOTAL Cohort B** | **71** | **24** |
| **OVERALL TOTAL** | **110** | **34** |



# Question 1: Does the type of field experience placement, formal or informal, have an impact on overall self-efficacy for teaching science among elementary preservice teachers?

- An independent samples *t-test* compared the difference in means of pre- and post STEBI-B results for Cohort A and Cohort B
- *p* value = 0.002, rejecting the null hypothesis

| Measure | n | Mean |
|---|---|---|
| Cohort A | 39 | 0.229 |
| Cohort B | 71 | 0.402 |

*Average difference in overall means for Cohorts A & B*

| | df | MD | t | p |
|---|---|---|---|---|
| Cohorts A + B Overall Scores | 108 | -0.174 | -3.215 | 0.002 |

*Independent-sample t-test comparing overall scores for Cohorts A & B*

# Question 1: Does the type of field experience placement, formal or informal, have an impact on overall self-efficacy for teaching science among elementary preservice teachers?

- A paired sample t-test compared the collective difference pre and post STEBI-B results for all participants
- Three t-tests were run – overall scores, PSTE, and STOE
- Highly significant differences were found on all 3 (all *p* value = 0.000) signifying a rejection of the null hypothesis

| Measure | df | Mean | SD | t | p |
|---|---|---|---|---|---|
| Overall Pre-Post | 109 | -0.341 | 0.282 | -12.660 | .000 |
| PSTE Pre-Post | 109 | -0.455 | 0.325 | -14.684 | .000 |
| STOE Pre-Post | 109 | -0.173 | 0.446 | -4.076 | .000 |

*Paired sample t-test comparison of pre and post-course overall and subscale scores*

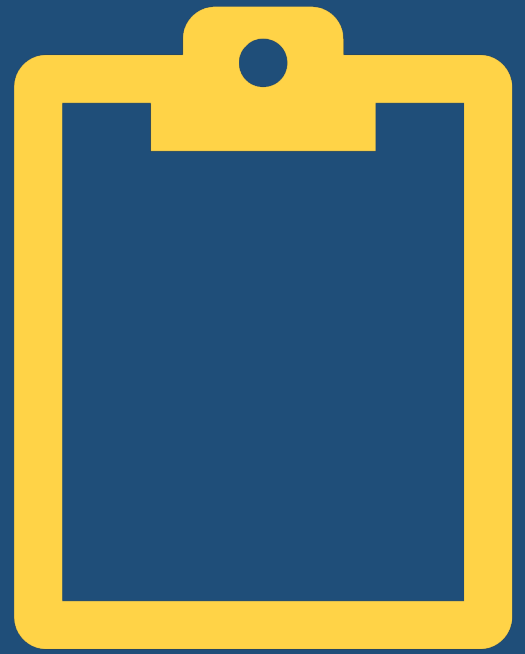
# Thanks for coming!

Questions can be directed to Nicole Hesson – nhesson@ycp.edu

Completed greenhouse interior

# Lab Safety Begins Before You Go to the Lab!

- (Use this space to list two things you should do before going to the lab.)



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# In the Event of a Lab Accident…

- (Use this space to discuss procedures to follow in the event of a lab accident.)

# At the End of Your Lab Time…

- (Use this space to discuss what should be done at the end of your lab time.)