



Instructional Resources to Teach Science Concepts While Promoting Careers in Horticulture

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Context

- Limited awareness of horticulture and its diversity of careers (Meyer, 2015)
- 59,700 agriculture sector job openings annually, 35,400 U.S. students will graduate with a B.S. or higher to fill them (Goecker et al., 2015)
- Decline of students enrolled in horticulture baccalaureate programs across US (Dole, 2015)



Introduction

- Our SPECA Project
 - Secondary Education, Two-Year Postsecondary Education, and Agriculture in the K-12 Classroom Challenge Grants Program
 - Creation of web based online instructional units focusing on STEM and encouraging careers in horticulture
 - Science and Technology in Horticulture
 - Hydroponic Food Production
 - Light Quality and Plant Responses
 - Support high school Science and Agriculture teachers
- Assessing teachers' likelihood to adopt curriculum
- Assessing youths' understanding and enthusiasm for STEM and careers in horticulture

Project Goals Support National Initiatives

- Supports national initiative *Promoting Horticulture in the United States*
 - *Seed Your Future*
 - ASHS
 - AHS
 - APGA
 - NJHA
 - Longwood Gardens
 - AmericanHort
- Online national survey showed 54% of respondents consider Horticulture Education/Awareness the biggest challenge facing the horticulture industry (Meyer, 2015)



Project Scope

- Survey Agriculture and Science teachers
 - Also surveyed FFA youth who competed in State Floriculture CDE
- Develop content for instructional units
 - Science and Technology in Horticulture
 - Hydroponic Food Production
 - Light Quality and Plant Responses
- Implement pilot testing with a select number of high schools
- Release and promote web-based units for national use
- Follow-up and evaluation



Surveyed User-Groups

- Students (n=30 pre and post)
 - Kansas FFA Floriculture CDE
 - Additional Career Development Activity
 - Toured hydroponic systems at KSU greenhouse
- Educators (n=75)
 - Agriculture Teachers (n=62)
 - Kansas Association of Agricultural Educators Winter Conference
 - Pre-existing interest in horticulture, tasked with teaching agriculture/horticulture concepts
 - Science Teachers (n=13)
 - Kansas Association of Teachers of Science (KATS) Kamp
 - Presented workshop on Hydroponics and Light Quality
 - Not specifically interested in horticulture
 - Queried barriers and incentives to adoption of learning units

FFA High School Youth

Statement (n=30)	Pre-Survey Mean ¹	Post-Survey Mean	Significant Change ²
Interested in career in horticulture	3.47±0.94	3.87±1.01	**
Understand skills in mathematics required	3.73±1.05	4.17±0.91	**
Interest in learning mathematics	3.80±1.19	3.83±1.12	NS
Understand skills in engineering required	3.37±0.96	4.37±0.72	***
Interest in learning engineering	3.20±1.13	3.53±1.04	NS
Understand skills in technology required	3.77±1.07	4.33±0.80	***
Interest in learning technology	3.56±1.14	3.60±1.10	NS

¹ 1=Strongly disagreed, 6=Strongly agreed. ² NS = Not significant; ** P < 0.01; *** P < 0.0001

Teachers' Interests

Statement	Response Mean ¹	Response Mean		
Currently teach...	...about careers in horticulture	...content related to cutting-edge tech. in horticulture		
Ag Teachers (n=63)	5.03±1.13	3.90±1.14		
Science Teachers (n=12)	3.10±1.29	2.70±1.49		
Instructional activities most likely to use...	...Hands-on Activities	...Video Clips	...Demonstrations/ Experiments	Complete Unit of Online Instruction
Ag Teachers	5.67±0.54	5.31±0.84	5.25±0.97	4.79±1.16
Science Teachers	5.82±0.40	5.64±0.50	4.91±0.70	4.09±1.35

¹ 1=Strongly disagreed, 6=Strongly agreed.

- All teachers “somewhat to strongly agreed” that they’d be interested in teaching about the use of drones, artificial intelligence, and robots

Teacher Comfort Levels

Statement	Agriculture Teachers Response Mean ¹ (n=63)	Science Teachers Response Mean (n=12)
Familiar with greenhouse operations	4.52±1.25	3.83±1.47
Confident about building a hydroponic system	4.15±1.22	4.33±1.56
Confident about teaching students how to manage nutrient solutions in hydroponic systems	3.87±1.18	3.82±1.66
Know a few different ways in which color of light affects plant growth	4.00±1.08	4.67±1.30
Would like to incorporate the use of LED lights into instruction	4.48±0.98	5.17±1.03

¹ 1=Strongly disagreed, 6=Strongly agreed.

Science Teacher Motivators

Statement (n=12)	Science and Technology in Horticulture ¹	Hydroponic Food Production	Light Quality and Plant Responses
The proposed instructional unit would be innovative and novel	5.18±0.60	5.27±0.65	5.50±0.52
Easy to adopt	4.40±1.51	4.36±1.50	4.92±1.16
Fit well with the Next Generation Science Standards	5.18±0.98	5.36±0.67	5.50±0.52
Relevant to students' everyday lives	5.55±0.52	5.36±0.67	5.42±0.51

¹ 1=Strongly disagreed, 6=Strongly agreed.

- Science teachers somewhat agreed (**4.52±1.25**) that they were familiar with careers in horticulture in which the knowledge of STEM concepts is critical

Science Teacher Barriers

- Workshop presentation appeared to increase teachers' perception of barriers as to whether or not they could adopt this content (pre: 3.88 ± 0.22 and post: 4.63 ± 0.16 ; NS)
- Barriers participants listed on surveys include:
 - Space
 - Money
 - Teachers' time
 - Time needed to get results with plants
 - Equipment
 - Natural light

Conclusion

- Science and agriculture teachers have different:
 - Content knowledge bases
 - Motivators to adopt instructional units
 - Barriers to instructional unit adoption
- Team needs to consider:
 - How youths' desires to learn technology, math and engineering mesh or don't mesh with instructional units' content
 - Differences and similarities among teachers
 - How to thoughtfully and strategically address science teacher barriers to adoption
- Two especially important takeaways:
 - Moving from module or unit design to resources that support standards for science and agriculture teachers
 - Need solid strategy to reduce barriers for science teachers