YEAR 2 – Annual Evaluation Report for Parkland College Precision Agriculture Curriculum Enhancement (PACE) Project Parkland College, IL NSF ATE DUE# 1601473

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EXECUTIVE SUMMARY

The goal of the Precision Agriculture Curriculum Enhancement (PACE) project is to prepare precision agriculture technicians and program graduates for expanding job opportunities in agricultural active areas of the Midwest. This goal is being achieved through current program modification and enhancements, better career awareness by leveraging partnerships with regional high school agriculture programs, and improved articulation models with regional and state universities to create career pathways for precision agriculture program graduates from Parkland College. The process and partnerships being tested are to serve as a potential national model for other schools looking to expand and grow viable career pathways for the precision agriculture industry. Long term goals could result in resources and models leading to an educational approach that can be adopted by other institutions nationwide exploring how best to grow a viable precision agricultural program linking high schools, community college, universities, and industries together as a career pathway.

Year-2 project goals targeted the implementation of modified and new curriculum specific to Parkland's Precision Agriculture Program. Specific benchmarks for the project are highlighted in relation to student enrollment trends within the courses and for the overall program for goal 1. Outreach events and marketing activities highlighted year-2 work that focused on increasing interest among educational partners. Activities and topics included program awareness with students/parents, gender inequities with females in precision agriculture, and specific partnerships designed to develop career pathways between regional high schools and Parkland's Precision Agricultural program. The following list of outcomes highlights year-2 activities for measurable gains by project goal, lessons learned by project team, and potential challenges facing the grant team:

- One new course, AGB219 – Precision Ag hardware, was offered for the first time in fall 2017;
    - First time offering resulted in 11-students registered for the class;
- One modified course in the program, GIS115 – Remote Sensing in Agriculture, was offered in both spring 2017 and 2018;
    - Enrollment numbers for both sections were healthy: (12) and (14);
- The grant team produced and got approved from the Illinois Community College Board a new certificate in Precision Agriculture using Advisory Board input on industry needs to become active in fall 2018;
- The Precision Agriculture Program in year-1 had 19 students with only two students dropping with a current program enrollment of 17. This resulted in a retention rate of students between fall 2017 and 2018 semesters of 89%;
- Outreach events targeting female student recruitment into precision agriculture careers suggest limited awareness about the emergence of the industry (66%), and also no knowledge about Parkland's Precision Agriculture Program options (83%);

- The project team's outreach events have produced the following gains with broadening awareness with different student populations and educational partners to market career potential within precision agriculture:
    - The dual credit course, Intro to Precision Agriculture AGB-110, is meeting and exceeding grant goals of having over 10-students per year register for the class (2016 to 2017 – 24) and (2017 to 2018 – 28)
        - The project team has tracked six of the students who completed the AGB-110 and subsequently transferred into Parkland's Precision Agriculture Program after high school graduation;
    - High school faculty professional development events for introducing and integrating precision agriculture resulted in high response rates through post conference surveys indicating the following (30-teachers were mentored within two different workshops):
        - 100% workshop participants indicate measurable gains with understanding the precision agricultural industry;
        - 70% of the workshop participants planned to integrate workshop modules on precision agriculture and (UAS) technology into their existing courses;
        - 100% of participants reported both interest to attend another workshop event at Parkland College on precision agriculture, but as well indicated they would recommend the program at (PCC) to their high school students;
        - One of the high school faculty participants is now partnering with the project team to help redesign the dual credit course to enhance the experience and curriculum of the course content for high school student populations.
    - The project team is evaluating and processing feedback from both industry and students about articulation agreements with university precision agriculture programs. Early indicators are moving the grant team to redirect the articulation agreements from degrees to certificates. Smaller certificate packages of courses and technical specialization appears to both support easier articulation with bachelorette programs and enhanced job readiness for students.

These findings indicate the grant team is learning and processing results to address year-3 grant activities. The following year-2 outcomes are impacting and targeting grant resources to assist the grant team meet grant goals:

1. Student outreach efforts are identifying clear indicators that are resulting in low enrollments for ALL students in precision agriculture. The lack of awareness of industry/job opportunities in precision agriculture, and limited student awareness of Parkland's Precision Agriculture Program are major challenges to growing enrollments.
2. The grant team is developing academic partners to actively engage and use grant resources and training to help broaden awareness of precision agriculture in regional high schools. Using year-2 findings the grant team is targeting and developing new tools to engage students and parents digitally with tools like Geofencing.

3. The precision agriculture courses and program are beginning to see and measure incremental gains with enrollments. Projections for year-3 are more ambitious as evidence of student awareness and contact with grant resources has increased across the region.

INTRODUCTION

Goal 1 (Year-2 Objectives): Improve and expand precision agricultural education for two year colleges.

- Associated deliverable: Offering of new course (Precision Agriculture Systems Hardware AGB 219).
- Associated deliverable: Offering of the two existing courses in current program (Precision Data Analytics AGB 252 and Remote Sensing GIS115) using new and modified curriculum from industry advisory board input from year 1 on the project.
- Associated deliverable: Verify curriculum and creation of new certificate that meets industry standards through Precision Agriculture Advisory Board feedback.

Goal 2 (Year-2 Objectives): Improve and expand precision agriculture education opportunities at area high schools.

- Associated deliverable: First year of the grant a new dual-credit course, Introduction to Precision Agriculture (AGB110), was introduced to local high schools as a dual enrollment opportunity. Year two activities involved more detailed tracking trends with student enrollment and professional development events to increase awareness of the course with local, regional, and state high schools.
- Associated deliverable: Parkland College hosted two annual conference for high school faculty targeting emerging technologies in agriculture as both professional development and outreach marketing to improve career awareness opportunities in precision agriculture. The first event was offered at the end of year-1, and results of the events will be reported in year two to evaluate overall impacts on teacher satisfaction, awareness gained of precision agriculture, and overall teacher interest to promote the industry and to make Parkland's Precision Program aware to students.
- Associated deliverable: Improved high school outreach through a series of site visits to high schools, tours of Parkland's agriculture facilities, and the production of marketing materials to improve awareness to local high school faculty/students on precision

agriculture program at Parkland. This work was maintained in year-2, but increasing efforts were made to quantify and measure the effectiveness of the events to promote awareness and marketing of Parkland's Precision Agriculture Program.

- Associated deliverable: Increasing effort to target growing enrollments of females into Parkland's dual credit/enrollment class to target this historically underserved market in the precision agriculture industry. Year-2 related work will summarize early indicators and enrollment trends to track this outcome. Specific partners and plans will be outlined within report to suggest the project team has actions and partners in place to address these challenges to attract more females in the historically underserved industry of precision agriculture.

Goal 3 (Year-2 Objectives): Improve compatibility between two-year college and 4-year university precision agriculture curriculum within Precision Agriculture Programs and broader curricula.

- Associated deliverables: Update articulation agreements with Parkland and existing 4-Year state institutions relating to precision agriculture programs and curriculum. This goal is currently in a holding pattern in year 2. The project team is reevaluating the need for 2+2 articulation agreements with 4-year universities in Illinois; whereas, a certificate in precision agriculture might be more marketable for 4-year degree seeking students to fulfill industry needs. The project team is evaluating articulation agreements with 4-year universities outside of Illinois and will continue to work on with state universities in year-3.

FINDINGS

Goal 1: Improve and expand precision agricultural education for two year colleges.
Associated deliverables: 1) Creation of new course, Precision Agriculture Systems Hardware, to support the growing demand for technicians to support variable rate technology (VRT); and, 2) modify and enhance two existing courses in the program, Precision Data Analytics and Remote Sensing, to reflect new innovations and mapping technologies impacting agronomic field management issues for technicians.

Objective 1.1 – Enhance Parkland Agriculture Curriculum Based on Industry Needs
In year-2 the project team implemented program modifications by offering both new and modified courses using advisory input in year 1. The new course, AGB219 – Precision Ag hardware, was offered for the first time in fall 2017. The modified course, GIS115 – Remote Sensing in Agriculture, was offered in both spring 2017 and 2018.

Please see attached Parkland Report, **Page 2: Enrollment Statistics** for the full of course enrollment trends with Parklands Precision Agriculture Program.

The approval of Parkland's new Precision Agriculture 17-hour Certificate using advisory board input was completed in year-2. This certificate was approved by the Illinois Community College Board and is planned to be offered in fall 2018.

Please see attached Parkland Report, **Appendix 1: Agriculture Business: Precision Ag Technology** for the program layout with course and hour requirement.

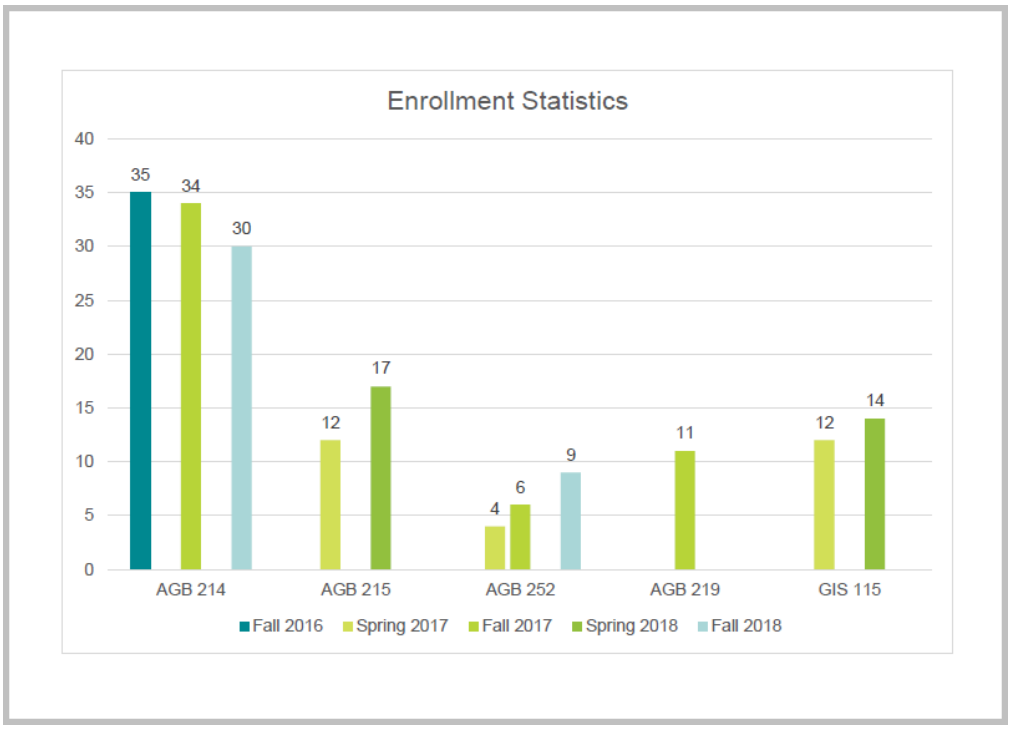
This new certificate highlights the project team's ability to leverage advisory board input and suggestions on connecting Unmanned Aerial System (UAS) into the precision agricultural curriculum.

Please see attached Parkland Report, **Appendix 2: Helena Agri-Enterprises, LLC** for specific recommendations and support for the need for more precision agriculture technicians.

Objective 1.2 – Increase the Number of Students Enrolled in Parkland Precision Agriculture Program

Indicators at the course level within the program suggest small to marginal gains from the fall 2016 semester.

Figure 1: Course Enrollment Trends Fall 2016- Spring 2018



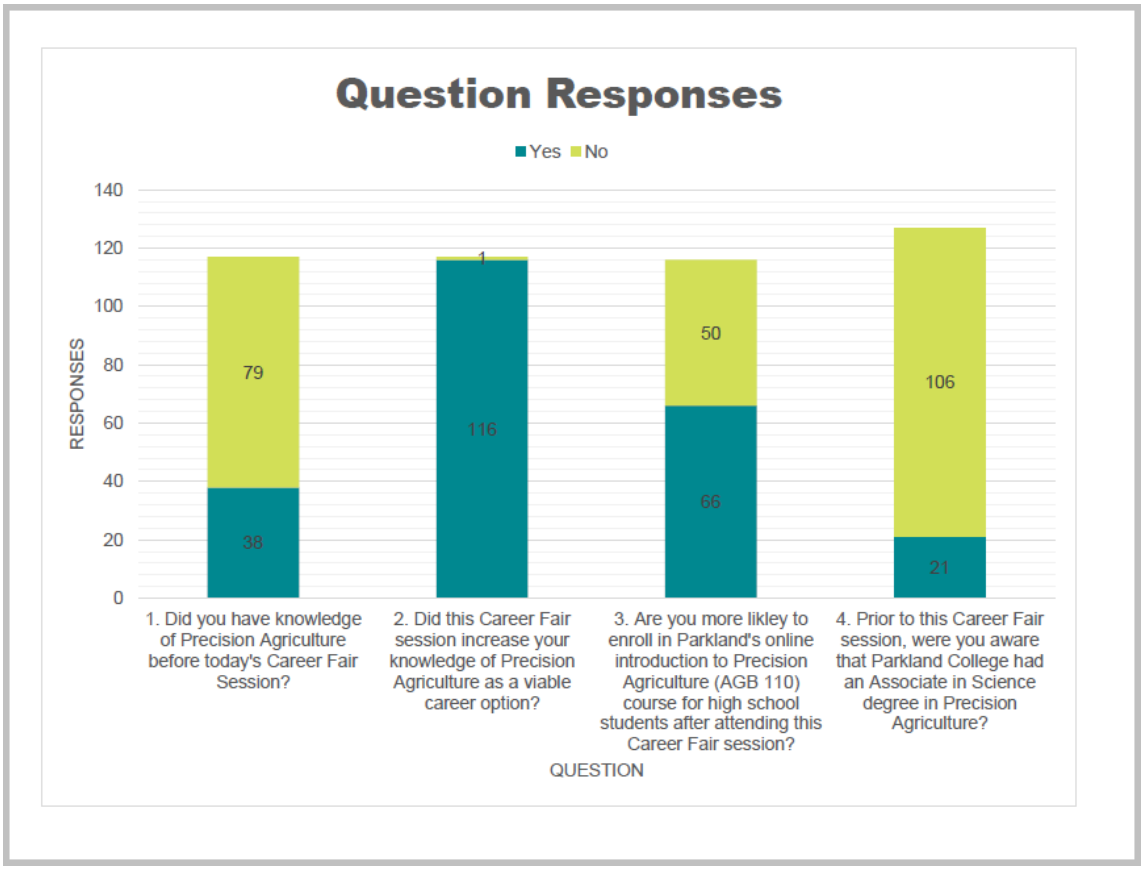
At the program level, Parkland's Precision Agricultural Program had 19 students enrolled in the new program in the fall of 2017. Only two students dropped out of the program for the inaugural year indicating a retention rate of (89%). The current program (N=17) has a demographic profile of 13 males and 4 females. These findings, which are positive for newly revised program, have the potential to dramatically increase over the next 2-3 years. The project team, as indicated with verbal interviews, suggest early outreach work with high school teachers and students is likely to produce a bump in future program enrollment. This work, which relates to goal-2, will be highlighted later in the report indicating early success stories of partnership development with career pathway development and increasing awareness to integrate precision agriculture into regional high school agriculture courses.

Objective 1.3 – Increase the Percentage of Women Enrolled in Parkland's Precision Ag Program

The project team was very ambitious with collecting data and participating at the event, Women Changing the Face of Agriculture, at the University of Illinois on March 9, 2018. Manning a

booth the team presented to 117 participants over ~~a~~ 5-20-minute sessions. Findings and results from this career awareness session indicates some positive trends on evaluating the effectiveness of outreach event like this in the future.

Figure 2: Female High School Student Survey on Precision Agricultural Career Awareness



These findings were very helpful to the project team in understanding how best to market and recruit females into precision agricultural program. Simply put, most high school students were not aware of the emerging field of precision agriculture and also has limited to no awareness about Parkland Colleges' Precision Agriculture Program. These findings combined with the results that the female students indicated they would be much more likely to take Parkland's Online Precision Agriculture Dual Credit Course (AGB 110) supports the value of attending events like this. The project team projects these findings should produce downstream impacts on the program as these students look to take dual credit courses or look for program majors as they graduate in 1-2 years.

These findings and results indicate the project team is using data driven strategies to leverage grant resources and their time to support the program. Findings for year-2 indicate that the program is growing marginally, but more importantly they appear to see and understand what challenges/barriers are facing them relating to goal-1 objectives. It appears with strong industry support and input combined with strong outreach efforts the team is moving the program, courses, and outreach efforts in the correct direction to continue to build a viable precision agricultural curriculum/program.

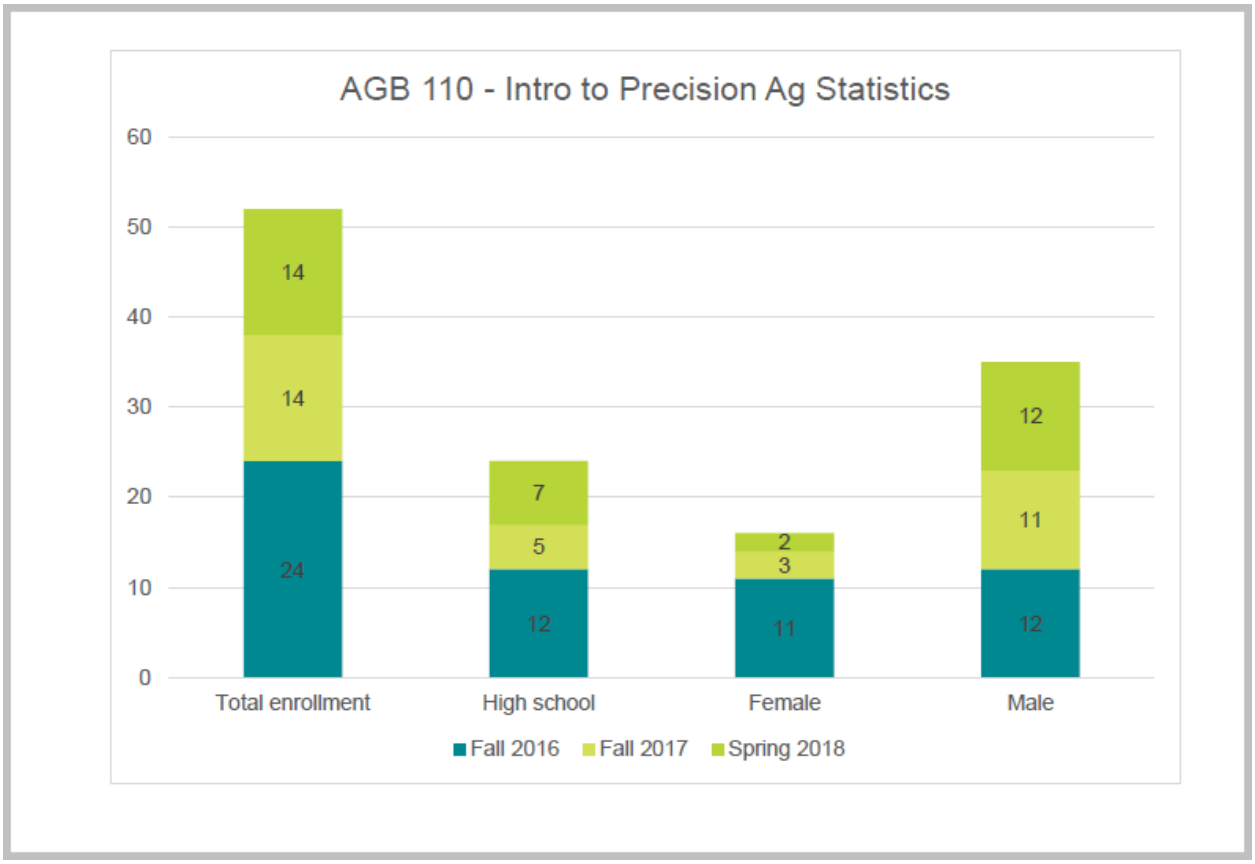
Goal 2: Improve and expand precision agriculture education opportunities at area high schools.

Associated deliverable: 1) Creation of new dual credit course, Introduction to Precision Agriculture, targeting at least 10 students registering each semester's offering of the course 2) creation of high school teacher professional workshops on precision agriculture concepts and career opportunities for students by serving at least 10 teachers 3) increasing high school outreach through the creation of high school outreach events through tours of Parkland's agriculture facilities, site visits to high schools, and development of new marketing materials producing projected enrollment gains in dual credit course annual enrollments from 50 to 65 students over the life cycle of the grant 4) improving recruitment of females into dual credit course through utilizing existing ATE resources on STEM recruitment strategies helping to attract females leading to enrollment gains of course demographics to reaching 50% female by the end of the grant cycle.

Objective 2.1 – Enhance and Expand Precision Agriculture Opportunities at Area High Schools

The signature piece of objective 2.1, Parkland's Introduction to Precision Agriculture Course (AGB110), is offered as a dual credit and online to serve both high school and college student populations. Currently, this class had been offered three semesters with the collected data on students registered and demographics associated with the offerings.

Figure 3: Students Registered for Introduction to Precision Agriculture (AGB110)



These findings indicate the project team is meeting and exceeding projected goals of serving a minimum of 10 students. The project teams suggest through verbal interview and later outcomes with goals 2.2, 2.3, and 2.4 that new partnerships and collaborations with high school faculty are projected to lead to increasing enrollments. In addition, the project team has already noticed some additional benefits from these dual credit offerings into the overall program itself. The course, Introduction to Precision Agriculture (AGB110), has begun to produce an impact on driving more students into the formal program after course completion. The project team has tracked 6 students moving into the formal program upon high school graduation, and one student changed their major on campus into precision agriculture upon completing the course. These findings suggest that this course, to some degree, is beginning to serve some role in elevating student interest with the program.

Objective 2.2 – Creation of High School Professional Development Workshops on Precision Agricultural Concepts and Career Opportunities for Students by Serving at Least 10 Teachers

Two high profile events highlighted the project team efforts with reaching and expanding precision agriculture professional development with high school faculty in year-2. The first event, Emerging Technologies High School Workshop, was offered in Bloomington, IL on June 19, 2017. This event had 17-faculty for a half day event covering introductory topics to precision agriculture, technologies used, job market potential for students, and overall awareness about Parkland's emerging Precision Agriculture Program. The team collected both instructional data about teacher awareness before and after the work shop, and as well longer-term impacts on the faculty relating to a 6-month follow-up survey. The 6-month follow-up survey resulted in 13 completed for a response rate of (76%).

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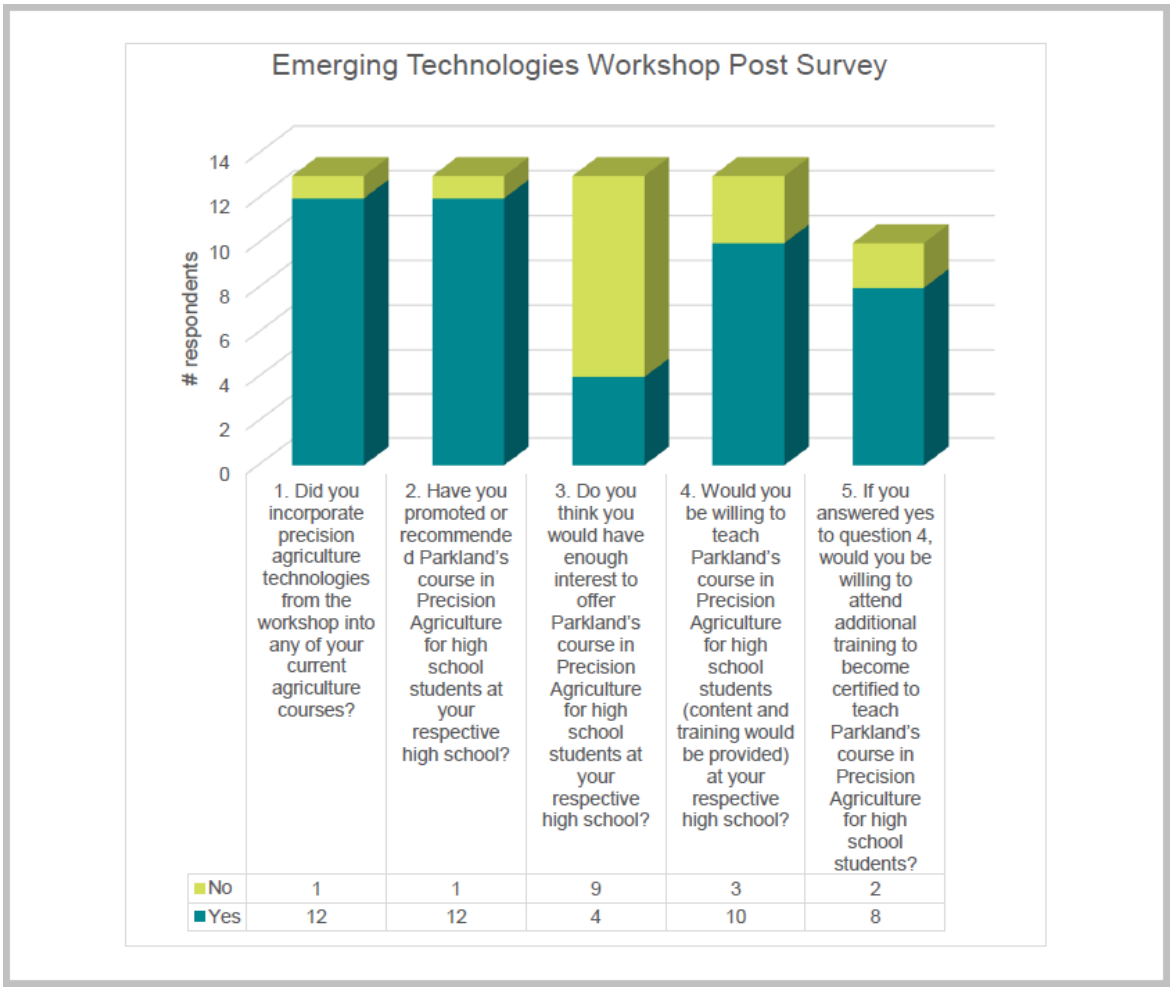
Table 1: Emerging Technologies Workshop Survey Pre-Post Knowledge

Precision Agriculture Teacher Workshop Pre/Post Knowledge Test

Prior to Workshop Skill Level				Skill Level 1: No knowledge of subject matter. Skill Level 2: Basic understanding of the subject material. Skill Level 3: Good understanding of the subject material. Skill Level 4: Complete and thorough understanding of the subject material.	After Completion Skill Level				Prior to Workshop Average	Post Workshop Average
1	2	3	4		1	2	3	4		
2	9	5	1	I can define Precision Agriculture.	0	0	9	8	2.3	3.5
5	10	2	0	I understand the technologies on the market today that are associated with precision agriculture.	0	1	13	3	1.8	3.1
3	11	2	1	I know the primary methods and procedures of soil sampling and field boundary mapping.	0	1	5	9	2.1	3.5
11	5	1	0	I understand the rules and regulations of UAV's.	0	4	8	5	1.4	3.1
5	8	4	0	I know the job market/outlook in precision agriculture.	0	2	9	6	1.9	3.2
6	11	0	0	I have an understanding on how I can incorporate precision agriculture technologies (UAV's, soil sampling, software) into my classroom.	0	1	11	5	1.6	3.2
10	3	3	1	I'm aware of the Precision Agriculture degree available at Parkland College.	0	2	10	4	1.7	3.1
11	5	1	0	I'm aware of Parkland's dual enrollment course in Precision Agriculture for high school students.	0	3	10	3	1.4	3.0

Figure 4: Emerging Technologies Workshop 6-Month Follow Survey



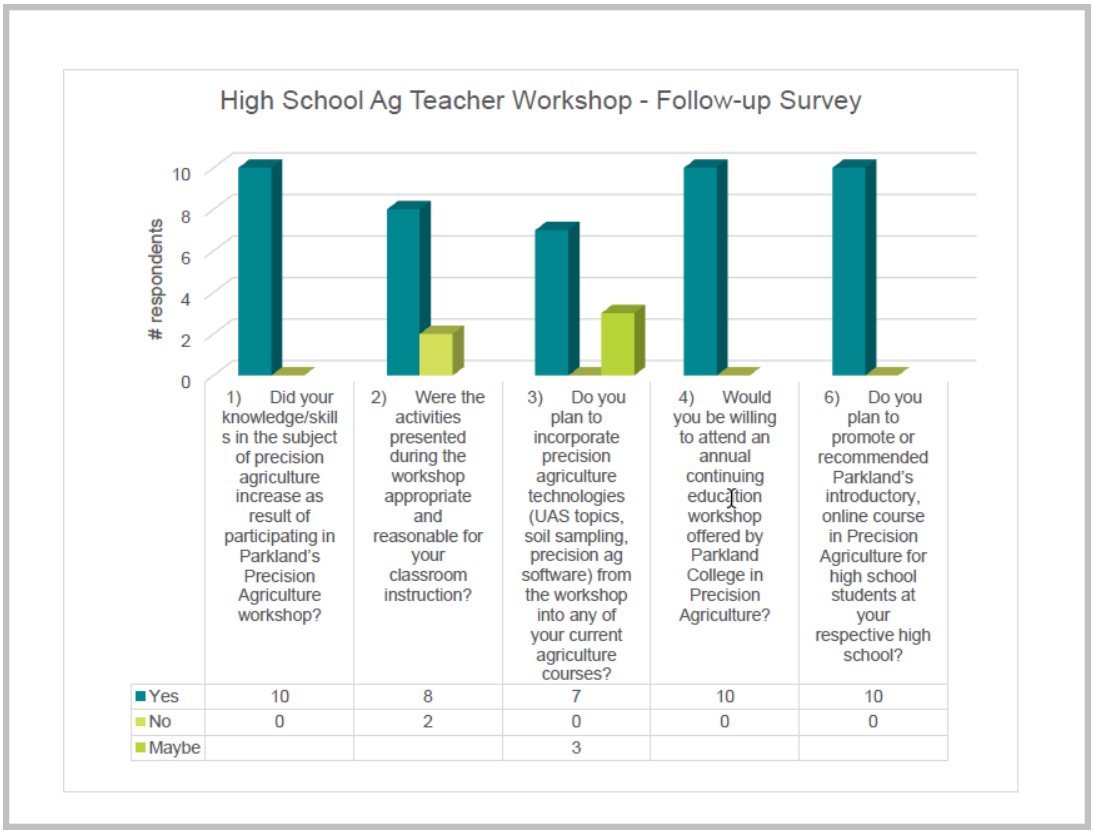
Some notable information and resources were gained from these surveys as indicated from the project team. Specifically, the team was very happy with the measurable gains with teacher understanding and potential educational benefits of introducing precision agriculture into high school curriculum. In addition, a number of faculty indicate some sort of long term use of workshop materials within their high school curriculum within the 6-mnoth follow-up survey, however, no specific materials were collected to evaluate the implementation reported by the faculty. One of key resources and outcomes of the event related to one of the participants

wanting to take an active role in helping the project team restructure their dual credit course, Introduction to Agriculture (AGB110), to readily implement into current high school agriculture/STEM curriculum.

Please see attached Parkland Report, **Appendix 3: Faculty Support Letter** for assisting the project team with redesign of the dual credit Precision Agriculture Course (AGB110)

The second outreach event for high school faculty, Precision Agriculture and UAS Workshop for High School Teachers, was held on May 3, 2018 at Parkland College. Thirteen participants attended the half day event using precision agriculture software and UAS simulators for drone flying. A follow-up survey was conducted to evaluate the impact and potential long term support the faculty participating had towards Parkland's precision agriculture and UAS technology programs.

Figure 5: High School Ag Teacher Workshop Survey



	1) Did your knowledge/skills in the subject of precision agriculture increase as result of participating in Parkland's Precision Agriculture workshop?	2) Were the activities presented during the workshop appropriate and reasonable for your classroom instruction?	3) Do you plan to incorporate precision agriculture technologies (UAS topics, soil sampling, precision ag software) from the workshop into any of your current agriculture courses?	4) Would you be willing to attend an annual continuing education workshop offered by Parkland College in Precision Agriculture?	6) Do you plan to promote or recommended Parkland's introductory, online course in Precision Agriculture for high school students at your respective high school?
Yes	10	8	7	10	10
No	0	2	0	0	0
Maybe			3		

These findings were very supportive indicating knowledge/awareness gained, high response rates for likely technology integration into high school curriculum, and 100% response rates for recommending Parkland's dual credit course in Precision Agriculture (AGB110). One of the faculty even sent formal feedback relating to workshop resource integration into their Agriculture Mechanization course.

Please see attached Parkland Report, **Appendix 4: Faculty Support Letter** for integration of workshop materials into high school curriculum.

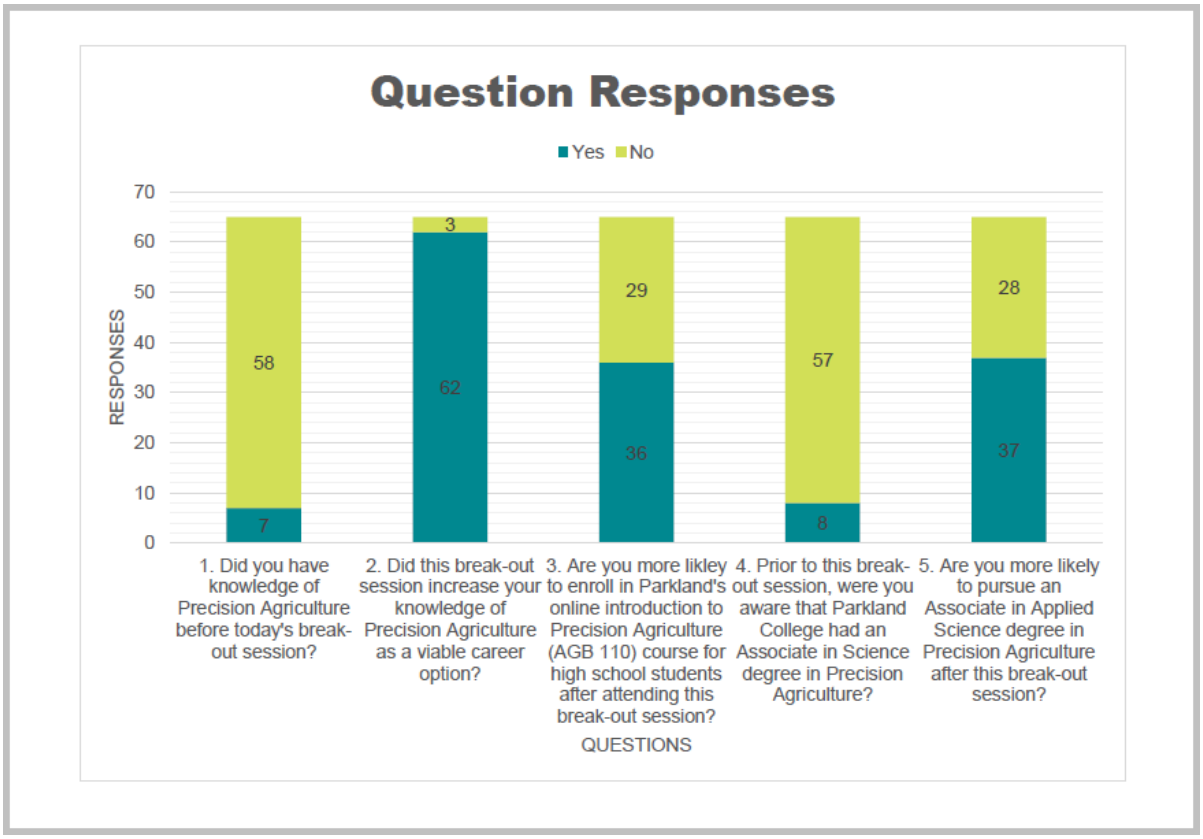
Objective 2.2 – Increase the Number of High School Students Interested in Precision Agriculture

A key outreach events to serve high school students, the Clark County Farm Bureau Agriculture Career Day, was held on February 22, 2018. This event attracted high school students from three different high schools with 65 students attending the project teams' session on precision agriculture.

Please see attached Parkland Report, **Appendix 5: Workshop Agenda** for outlining topics and themes for session with students.

A series of sessions and topics relating to student awareness of precision agriculture, specific awareness of Parkland's Precision Agriculture Program, and increased interest with pursuing degrees from community colleges in precision agriculture were measured with a post workshop survey.

Figure 6: Clark County Farm Bureau Student Career Day in Agriculture



Survey evidence indicates strong gains in overall student awareness and growing interest to pursue degrees in precision agriculture. In addition, one of the host agriculture teachers from a local high school expressed interested in wanting to offer Parkland's Dual Credit course at their institution to promote the new career possibilities with students.

Please see attached Parkland Report, **Appendix 7: Faculty Support Letter** for offering Parkland's Dual Credit Course, AGB 110, at their institution to promote precision agriculture.

Findings with goal-2 indicate major strides were taken in year-2. Specifically, the project team has fine-tuned their data collection process and are now targeting events leading to measurable outcomes and effectiveness measures. The grant team through verbal interviews now indicates

how their data collection process, in theory, is now informing new strategies and focus on the grant. For example, the team regularly notes that increasing career awareness in precision agriculture by high school faculty, students, and counselors is of great importance for attracting students to the programs. These findings are now informing the team about new ways and technologies needed to promote the program through videos, website demonstrations and marketing outreach approaches to communicate career awareness facts about precision agriculture career options.

Goal 3: Improve compatibility between two-year college and 4-year university precision agriculture programs.

Associated deliverables: 1) Conduct outreach events with regional and state universities to improve and update articulation efforts with PCC's updated precision agricultural curriculum and program.

The grant team in year-2 is continuing to pursue collaborations and articulations with universities about precision agriculture curriculum. However, based on industry and student feedback, the grant team has developed precision agricultural certificate which was recently approved by the Illinois Community College Board. From an industry perspective, the grant team feels confident the certificate will compliment 4-year universities agriculture degree programs as well as serving current Parkland students seeking specialized training in precision agriculture.

Please see attached Parkland Report, **Appendix 1: Agriculture Business: Precision Ag Technology** for the program layout with course and hour requirement.

CONCLUSIONS

The Project Team is to be commended for their dedication to this project in year-2. They have worked diligently to achieve —and exceed— most, if not all, of year-2 goals. This year has been a building year for effectively growing, measuring and leveraging outreach events associated with goal-2. These positive outcomes, in theory, will help drive and grow course and program enrollment to address challenges in goal-1 by year-3 in the grant cycle. The grant is beginning to build a data driven culture and using survey findings to measure and model future decisions with grant directions. The following list of achievements documents some of these success stories in year-2 for the PCC grant team:

- New website to summarize and disseminate grant related resources https://parkland.edu/Main/Academics/Departments/Agriculture-Engineering-Science-Technologies/Areas-of-Study/-Agriculture/Precision-Ag;
- Plan to host conference, Women Changing the Face of Agriculture (WCFA), planned for Fall 2018;
- Developing new Geofencing technology utilizing digital marketing technology to communicate program awareness about Parkland's Precision Agriculture program through smart phone technology;
- Continued support from a number of industry partners supporting Parkland Precision Agriculture Program.
    - Please see attached Parkland Report, **Appendix 2: Industry Support letters** for specific recommendations and support for the need for more precision agriculture technicians.

SUMMARY

1. Outreach events were significantly improved relating to tracking event effectiveness to reaching goals of improving awareness and overall understanding of Parkland's Precision Agriculture Program. A number of events targeting high school teachers documented indicators that the teachers were using or planning on using resources from professional development events. Discovering answers to the following questions would be very helpful in measuring the success of these outreach events with local high school teachers and how the workshops are impacting agricultural classes:
    - How exactly are workshop resources being used or implemented into high school courses?
        i. Course Integration;
        ii. New course development;
        iii. Did the teachers formally modify any course syllabi to add precision agriculture into the curriculum;
        iv. Documenting any formal evidence would be helpful to quantify the exact impact of these outreach events into high school curriculum.
2. Industry partners have indicated their interest in supporting the project through a variety of mechanisms to help market the program. The Team is encouraged to explore all options with industry for providing financial support for students who choose the precision agriculture program of study (Industry partners report a shortage of skilled precision agriculture technicians), for support and help with marketing brochures, video

testimonials, and guest speaker roles to help communicate the importance of growing PCC's Precision Agriculture Program to meet local labor market demands.

- Please see attached Parkland Report, **Appendix 2: Industry Support letters** for specific recommendations and support for the need for more precision agriculture technicians

3. The grant is still challenged and debating issues relating to goal-3 and career pathway development with universities. Articulation agreements with four year partners and the College's newly, updated Precision Agriculture A.A.S Program is under discussion and needs to be addressed relating to meeting grant goals. The grant team will need to research and formally make decisions with their grant goals on the best options to serve students and meet industry demands.
4. The working relationship between PI and Co-PI appear very strong and collegial. They understand their roles and their division of labor is very clear relating to responsibilities on the grant. They took and accounted for many of the recommendations in the year-1 report relating to pending challenges and issues facing them early in the grant process. This team is positioned well to see major gains with program and course enrollments as year-2 work had produced some very successful outreach events to produce increasing awareness of precision agriculture careers and degree options at Parkland College to serve student needs.