

Curriculum Review

Mapping New Careers in Geospatial Technologies

August 16th (PA) & October 21st (GIS), 2016

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Introduction:

The following document serves a dual purpose of reviewing the curriculum specifically and the Southeast Community College (SCC) Precision Agriculture (PA) and Geographic Information Systems (GIS) Certificate programs generally. It is documentation to the U.S. Department of Labor's TAACCCT (Trade Adjustment Assistance Community College and Career Training) project on what is going well with the programs and any challenges that might arise during their development and implementation. A team of two highly qualified external evaluators helped to plan and facilitate the evaluation process: Dr. Michael Shain, President of Shain Evaluation & Consulting, LLC, and Dr. Neal Grandgenett, STEM Professor and Haddix Community Chair of STEM Education with the University of Nebraska at Omaha (UNO). Both are research professionals who have demonstrated expertise for numerous project evaluations and have successful experience providing evaluation studies for a wide range of federally funded

grant projects, including the US Department of Labor (DOL), National Science Foundation (NSF), and the US Department of Education (DOE). Dr. Shain has extensive evaluation experience with federal workforce training projects, through private practice and a decade of service as the Director of Evaluation Services at the Applied Information Management Institute (AIM). Dr. Grandgenett shares strong federal grant evaluation experience, with an emphasis on Science, Technology, Engineering, and Mathematics (STEM) instruction, problem-based learning, and technology-enabled workforce training, having more than 130 publications related to STEM learning and program evaluation. They have several years' experience working collaboratively on project evaluation, with Dr. Shain's focus on qualitative analyses and Dr. Grandgenett's focus on quantitative analyses. Drs. Shain and Grandgenett had no financial interest in the outcome of the evaluation; they were not involved with the development of the project, and did not have any affiliation with the management of the grant, consistent with DOL guidelines.



In addition to Drs. Shain and Grandgenett, a specialist in curriculum design and STEM education also participated. Dr. Elliott Ostler is a Professor of STEM Education in the College of Education at UNO, where he teaches courses in curriculum design, interdisciplinary STEM instruction and research. He is a well-respected curriculum and evaluation expert who is on the College Board National Consultant Advisory Panel and is College Board Trainer for Pre-Advanced Placement Vertical Teams and Advanced Placement Assessment. He has published nearly 100 journal articles and



papers related to STEM curriculum, including four textbook resource publications. He also holds a United States Patent (#D506938) for an *Improved Ruler Set and Curriculum* for Mathematics Instruction, which is an original Invention for middle and secondary level mathematics education. He is a frequent NASA product review consultant for NASA education products in the *Institute for Global Environmental Strategies* (IGES) and a periodic reviewer of National Science Foundation curriculum-based grants.

August 16th, 2016 (Curriculum Review – Precision Agriculture)

The program has a number of activities and services that are progressing well. Among them are outreach and recruiting, with the development and distribution of marketing materials. Classes have been well received, with the first hybrid class on Soils (four to eight students in the winter quarter, taught by a high school teacher who came in on Saturdays to conduct the labs). The college is ready to begin the five-week Ag Tech class in November 2016 and another in January 2017 (“hybrid is 51% online and then a “hands-on” section in four-to-eight hour blocks on weekends). The online portion is through Moodle. The Crops class is all online and the Ag Tech and four other classes are hybrid. In addition the college offers “traditional” class for SCC students (in modules). The college offered classes in the Spring 2016 but only Soils had students. The class was also offered to high school students (creating a “pipeline” for future growth, since they cannot be counted as participants). In addition Ag Tech was offered for dual enrollment; both were taught online by SCC instructors. Three high school teachers taught Crops (the high school instructors were required to apply as Adjunct Instructors and trained in the use of Moodle).

The Soils course is going well, according to the Instructor, with both online and hybrid approaches. The students register for Soils and go online to set up a program to gain access to

course material and communicate with the Instructor. The course was developed in the Fall of 2015 and rolled out in January 2016. There was an introductory meeting (Saturday from 8:00 am – 12:00 pm) where the students had a lab and were presented with the syllabus. They then read a chapter and completed a chapter quiz. A week later was another lab and various activities. This process continued through January and February 2016. The Instructor used power points with voiceovers, quizzes, survey lessons, and a final exam (students from Northwest Missouri State University included).

The Precision Tech course was also offered as a hybrid, with a syllabus, overview, readings, discussions, tutorials and an online textbook, with assignments that were downloaded. The textbook is being updated (and SCC is asked to review it!). The Instructor created videos as instructional “tools” in SMS Advanced (software) based out of Iowa State University. She is using “Ag Leader” software, with visual and voice instruction. Ag Leader also has produced videos. She is using data from the college’s 900 acre farm that would make the instruction more personally relevant and help students by answering any questions they might have.

The program is using a variety of activities for outreach/recruiting. A new Recruiter/Success Coach was hired in August 2016. The SCC Agriculture program is celebrating its 40th anniversary, which creates an opportunity to enhance outreach. The program had a display at Husker Harvest Days, with their trailer. The trailer has interactive functions, with tables for conducting classes. They also were present at Aksarben, with the River City Rodeo, where they again displayed their trailer. The Instructor will present at the Central Community College Ag Summit on the use of drones. The State Future Farmers of America (FFA) had SCC logos on their t-shirts, and a full-page ad was placed in the Nebraska State Fair Gatebook. During Discovery Days, the Instructor talked with high school Ag teachers and assembled a packet of

resources for this, such as “soil buckets” and mini-drones. She received a half dozen responses from them inquiring about other resources, such as classes on drones and other Ag-related topics.

The SCC Precision Agriculture (PA) program has several challenges. An Instructor resigned in March 2016; they hired a new Instructor and brought him up to speed. This new Instructor was quickly introduced to the content and technology (with the assistance of the former Instructor). After two quarters the Project Manager is again in the process of hiring another Instructor, since this last hire ended up not meeting the needs of the project. An ongoing challenge is the rapidly changing content in the field of Precision Ag, in addition to the expansion of new technologies for both PA and the instruction of the content. However many of the applications are free online. An additional “technology-related” challenge exists with the students, who have older computers or outdated internal services. Further it appears that many of the younger students can operate a smart phone or iPad but either don’t have a computer or don’t know how to effectively utilize a computer.

Another emerging technology is the use of drones, which require passing a tough assessment (41 questions for certification); there is also the question of insurance, training, and certification. The college is working with a “drone” attorney. There are three different types of drones for different purposes: quad, fixed wing and single rotor. As with all of the drone and PA technologies, as soon as the college acquires the equipment, a new model comes out with enhanced capabilities and new applications.

Another challenge from the instructional and curricular perspectives is having sufficient instructors. If the principal Instructor is not available, there is no one to handle curriculum updating, software, and actual instruction (there is a need for “back-up” on staff, possibly enhancing the Adjunct Instructor’s skillset?). There would be the possibility of reaching out to

high school staff or those in the Ag field who could become Adjunct Instructors for hybrid courses. Another possibility is to build the capabilities of another Instructor in the Agricultural Business and Management Technology Department.

The college has an advantage regarding sustainability; an Adjunct Instructor was hired full-time and not on “soft” money. SCC’s budget for 2015-2016 had additional money to hire a full-time Ag Instructor. The college used that money to hire a full-time position. Then they added another position to the present year’s (2016-2017) budget, so the primary Instructor is also full-time. The college is also working with high schools in their catchment area regarding dual enrollment classes for juniors and seniors. As they graduate, they would be encouraged to move into full-time status within the PA program at SCC. The PA program is also working with the continuing education department at SCC setting up workshops to get the general public involved. The college has six learning centers where these continuing education workshops could be held. In addition they have reached out to the Nebraska Agri-Business Association with the potential of offering CEUs for their employees. The PA program is moving more and more toward the “wave of the future” – hybrid courses.

The SCC PA program utilizes its Advisory Committee well, with quarterly meetings. The board is recommending expansion of the coursework to include electronics and hydraulics classes and other hardware classes, to broaden the students’ knowledge for those who want to become technicians. In addition five-to-ten years in the future the college could offer Drone classes, with instruction on technology, licensing and operation. They have also addressed the expansion of the PA program into an Associate of Applied Science (AAS) degree, with GIS as part of the certificate. To address the lack of students getting the certificate for the PA, the college has waived the \$25 fee for the certificate and is reminding the students to apply the

quarter before they complete the certificate. They are exploring ways to dovetail the program into established programs to increase the sustainability possibilities. They are also expanding their outreach to all departments in the college, including admissions, student services, advising and remediation services.

October 21st, 2016 (Curriculum Review – Geographic Information Systems)

There was a conversation about what constituted a “participant”; according to TAACCCT’s latest convening, a participant was someone who signed up for the GIS Certificate with no remediation issues or is enrolled in a GIS Certificate class. But the phrase “and other activities funded by the grant” might mean that anyone who participates in a workshop or other grant-funded activity might be considered a “participant” and data would need to be gathered on those individuals. An example would be the “Power of Data” workshop for 6th – 12th grade teachers, since the training at Northern Arizona University for the primary GIS Instructor was funded by TAACCCT. The workshop would assist the teachers to incorporate data into their instruction. An intake form would need to be completed on each teacher; in turn they would be considered participants, impacting in a positive way the number of overall participants but negatively affecting the completion count (ie. the number of participants who successfully complete a GIS Certificate). They would be classified as “incumbent workers” in the spreadsheet. A larger pool of TAACCCT-eligible potential participants might expand in the grant’s catchment area with several larger companies, such as Verizon, planning to close their facilities in the near future. In addition ten (10) students from cohort 1 and cohort 2 did not sign or opted out of signing their intake forms; the Project Manager and Recruiter/Success Coach are encouraged to locate those students to see if they would reconsider releasing their data. It might

increase the number of completers. Also the Project Manager might consider counting participants up to the cutoff that was expanded six months (March 31st, 2017).

Data were collected on the Transitions Lab (T-Lab) participants. The question is: is this information necessary for the quarterly and annual report to the DOL and for the external evaluator's report? A cursory review of the accepted proposal showed no indication that the federal reporting requires it; however the information would be useful to SCC as they consider sustaining the T-Lab beyond the scope of the grant. A more exhaustive report would be considered for the benefit of the college. There were also concerns about how many PA and GIS students are using the T-Lab. It appeared that there was not a good connection between the program and the Transitions Lab. The question was: what was the process of involvement for the Transitions Lab coach with the program and the Instructors? Instructors needed to facilitate the use for students. When students wanted to graduate, they realized there is an issue with "general education" course requirements that they were not aware of. This potentially delayed their graduation or they would consider leaving the program with no degree. This issue was corrected immediately by having the Advisors attend Advising Day with students and the Instructors, all in the same room.

The research questions were considered, particularly the question: how has the grant impacted the college? The Precision Agriculture (PA) program is being revised, with courses streamlined, with PA strong enough to be a stand-alone program. The question came up about the number of students who aren't considering the GIS Certificate. They might be Land Survey or Academic Transfer students who are taking GIS-related courses for an elective or as a Social Science credit course. Their involvement will be added to the narrative in the external evaluator's report. Institutional-wide, students are taking GIST 1000, a General Education course

for Social Science credit, which is co-listed. The Instructor is part of the Social Science Department. This course might interest non-certificate students to think about the GIS Certificate as an option. The external evaluators were strongly recommending that the Project Manager and the staff begin to address all of the research questions by jotting down “bullet points” that begin to answer those questions. This process would greatly facilitate the writing of any final reports, both for the Project Manager and the external evaluators.

All five courses are being offered; the Instructor is beginning to revise the coursework since the textbook has been updated. With the expansion of content within the GIS world, there is a consideration of expanding it into a full AAS degree. Many students have asked about potential diplomas or AAS degrees beyond the five-course certificate. The following are the potential courses that the Instructor has brainstormed:

Introduction to GPS and Maps

An introductory course in the fundamental concepts and use of GPS technology and map interpretation. Students will gain knowledge and skills in reading and understanding maps and coordinate systems. Students will participate in field work to collect data using GPS enabled devices.

Remote Sensing

This course is an introduction to remote sensing of the Earth. Topics include the physical principles on which remote sensing is based, history and future trends, sensors and their characteristics, image data sources, and image classification, interpretation and analysis techniques.

Geographic Web Applications

The course involves the design, creation, configuration, optimization of geographic servers and applications to deliver content across the Internet. Students will be introduced to the design, optimization of geographic servers, and maintenance of basic geographic web services and applications. The course includes an introduction to browser and mobile enabled interactive applications.

GIS Programming

The geographic industry needs professionals trained in automation of geoprocessing functions using the programming language of Python for GIS and other geographic technologies. The course will cover the fundamentals of Python scripting to meet

industry needs. Topics include: basic concepts using Python, creating and writing Python script for geoprocessing, and customizing and automating Python in GIS.

Open Source GIS

An introductory course that describes Open Source software for both desktop and internet GIS applications. Students will learn the concepts of Open Source software, and the leading desktop and web mapping Open Source software packages such as Quantum GIS (QGIS), GRASS GIS, Google Maps, OpenStreetMap, and CartoDB. Students will apply technology in lab exercises using real-world data.

As a follow-up, the external evaluators would talk with students who are in or have completed an internship and survey students in general for their ideas on the existing courses and potential coursework.

The outreach activities have progressed with the hiring of a Recruiter/Success Coach. GIS Day, November 16th, is held annually and is an opportunity to share what GIS is with people during Geography Awareness Week. A number of different event ideas were discussed before the Recruiter/Success Coach decided on a possible approach using “story-maps.” Contact cards would be collected with name and place of birth of both students and staff and a story map developed that would actively involve students and staff in something that has an outcome and is relevant. One use would be “home of record.” This activity merits further discussion and development. The Placement Specialist will be setting up a table at the GIS-LIS Association’s Interactive Map event at the State Capitol and will be presenting the certificate program information to the general public and those involved in the maps display from the State of Nebraska and the City of Lincoln. There are also other outreach activities, with the website and information via Facebook, Twitter, GIS Lounge.com and other social media. In addition the Project Manager and staff are making further connections with departments within the college, such as admissions.

Regarding quantitative data, there were a few areas for “clean up,” but on the whole the spreadsheet reflects relevant data. The Control column might be eliminated – since existing data on who enters the program, who completes the program and those in between would provide sufficient information. The Nebraska Department of Labor (NDOL) has provided aggregated employment, retention and wage data. The Project Manager and the external evaluators will work with those data. In addition the grant staff will conduct phone interviews to gather the same anecdotal data from completers and non-completers. These data will be triangulated with NDOL data.

The GIS Certificate program has lost a few students because they are not computer literate; they are lacking computer skills. The Instructor asked about requiring an entry exam for computer skills. These fundamental skills necessary to access the curricular content are not being addressed. This should be put “on the radar” as something that needs to be addressed. Students seem to be adept using cell phones and iPads but not basic computer software, such as Word, Excel and Power Point. The Instructor suggested an assessment that many business technology areas are using to find the students’ level of competency. This was addressed but rarely followed.

Final Thoughts

In both of the curriculum review focus groups, the curriculum development, refinement, and implementation process for the Mapping New Careers in Geospatial Technologies Project, it appears that a strong and conceptually appropriate curriculum was indeed created. A broad range of experienced professionals have provided a strong foundation of expertise and enthusiasm, and truly innovative Precision Agriculture (PA) and Geographic Information Systems (GIS) curricula have been created, with program options including certificates, courses,

activities, and support strategies that will continue to be both effective and engaging. Southeast Community College (SCC), as well as its partners and stakeholders, appear to have worked together relatively well, and the project is most likely to achieve its curricula-related objectives. Getting different partners to collaborate on any shared curriculum endeavor is really a difficult task, and it is a testimonial to the commitment of the leadership team that they have generally been able to pull this off effectively, and within two contexts, that of PA and GIS. The PA and GIS curricula appear to be steadily refined, and will increasingly integrate into the cultures of the college as the project moves toward sustainability.

It is thus believed by the facilitators of this curriculum review process that the project's curriculum development and refinement process is well on track for ending this shared journey as a promising national model. Progress to date on the project and its challenging curriculum has been encouraging. The external facilitators applaud the strong curriculum efforts that have been undertaken and that continue to be underway in the project, and we look forward to continuing to assist as desired as the project moves toward institutional sustainability.

Submitted by:

Dr. Michael Shain
Dr. Neal Grandgenett
Dr. Elliott Ostler

Appendices:

The process of the curriculum review also followed the current literature for curriculum reviews. In addition to the report, several appendices are included for reference. Appendix 1 overviews the definitions used within the context of the review, and Appendix 2 is a review checklist. Both items come from researchers at the nearby Iowa State University, in Ames, Iowa. Appendix 3 has additional references related to curriculum reviews. These appendices include the following:

- Appendix 1: Curriculum Review Definitions
- Appendix 2: Curriculum Review Checklist
- Appendix 3: Curriculum Review References

Appendix 1: Curriculum Review Process Definitions (From Iowa State University)

The following is the curriculum definitions, which were developed by Iowa State University, Ames, Iowa, and used to support the PA and GIS curriculum review process.

Curriculum Review Process Definitions – ISU Extension and Outreach

Program:

A coordinated set of learning experiences designed to achieve predetermined outcomes. Programs follow a continuum – starting with an initial environmental scanning, followed by application of the learning experiences, and resulting in changes in knowledge, behavior, and condition (as stated in the ISUEO program development process).

Program Review:

The assessment of the program environmental scanning process, program development, and reporting impacts. A review includes an assessment of how the program will be evaluated to determine what it has achieved.

Curriculum:

A group of planned educational offerings including materials, exercises, and activities intended to create a change in knowledge, behavior, or action

Curriculum Review:

Evaluation of educational offerings, delivery, and evaluation of those activities designed for a specific audience to maintain consistent standards of quality and credibility

Peer Review:

A process conducted by colleagues knowledgeable in the content and educational practices to assess subject matter and curriculum or program quality

Evidence-Based:

Programs that have been found to be effective based on the results of rigorous evaluations (What Works, Wisconsin, Small et al.)

Evidence-Informed:

Research-based principles of program effectiveness are incorporated into current programs (Small, Cooney and Connor)

Best Practices:

Activities and behaviors that work most effectively, informed by research and experience

Research-Based:

Careful study of a given subject, field, or problem undertaken to discover facts or principles

Information:

The communication of facts, data, or evidence

Information Checking:

Reviewing documents for errors, accuracy, and format of data being presented

Appendix 2: Curriculum Review Checklist

The following curriculum review checklist, as developed by Iowa State University, was the basis of the focus group conversation on the PA and GIS curriculum.

Curriculum Review Checklist – ISU Extension and Outreach

Procedural

- Meets the curriculum definition. (See Curriculum Review Definitions.)
- Curriculum goals match program goals and ISU Extension and Outreach’s mission.

Content

- Information and materials are research-based.
- Curriculum is sponsored by, or approved by, a land-grant university or other reputable institution. Examples include: Federal and State agencies (USDA, DOE, HHS, Commerce, etc.) and non-Land Grant public universities.
- Intended curriculum outcomes focus on positive behavior changes leading to economic, environmental, civic, and/or social conditions.
- Non-original content is clearly and appropriately cited.

Readability

- Training materials and facilitator/instructor notes included.
- Teaching materials match intended facilitator/instructor knowledge and teaching skills while addressing specified learning objectives.
- Learning objectives are clearly stated and are developmentally appropriate.

Utility

- Curriculum has been piloted or previously used with clientele in a relevant context.
- Curriculum is learner centered.
- Learner materials are culturally appropriate.
- Educational, hands-on activities accommodate different learning styles.
- Intended curriculum audience has been involved in developing or shaping the curriculum.

Evaluation

- Program evaluation methodology and outcome evaluation tools and processes are included.
- Curriculum outcomes are realistic for the audience and context.
- Information and activities are easily replicable.
- Information and activities are easily adapted for changes in types of learners, learning environments, scope of educational learning experience, etc.

Appendix 3: Curriculum-Related Review Process References

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