

STEM Curriculum in Space Plant Course Content for Agriscience Educators

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Introduction

Within the next generation of researchers, NASA plans to conduct a human manned expedition to Mars. Scientists at University of Florida have explored how these important experiments can play a crucial role with life on Earth using both ground and airspace studies (Paul et al., 2017, p. 1). Taking care of plants during long duration missions, such as a journey to Mars, is important for Advanced Life Support (ALS) systems. Being able to monitor and predict plant health is an important aspect of growing crops. One of the ways scientists are able to measure plant health involves utilizing Normalized Difference Vegetation Index (NDVI) imaging to gather data relating to near-infrared exposure on plant physiology (Nouri et al., 2017).

With new data being gathered and analyzed from space plant research, grant funding from NASA has asked the University of Florida to develop STEM curriculum for public school use, specifically for agriscience educators. Curriculum for the Space Plant course is outlined around the Dick and Carey model, which is broken up into nine instructional components (Dick, Carey, & Carey, 2005). The curriculum also utilizes the ETL model to assist with sequencing STEM instruction. STEM curriculum, such as this program, will offer students access to technologies that are being applied in post-secondary research and by agronomists who currently use NDVI technologies using GPS and drone field monitoring.

How It Works

The purpose of the Space Plant course is to provide an educational opportunity in exploring plant response to abiotic stress and extreme environments using the scientific method. The Space Plant course is a hybrid online course, specifically designed for high school agriscience educators interested in integrating STEM curriculum into their classroom. After completing the course, learners will demonstrate the knowledge and skills to successfully utilize NDVI imaging. In order to access the curriculum, agriscience teacher contact the University of Florida Space plant lab for the curriculum. The University of Florida mails out the curriculum with a classroom set of the NDVI camera lab kits for use up to three weeks before mailing back the NDVI imaging systems. The curriculum includes a teacher manual, which contains a series of lesson plans that are aligned to state CTE standards relating to Agricultural Foundations and Horticulture courses.

The curriculum is broken into six modules, each containing 15-20 minute instructional video clips. Each module contains a specific learning objectives, essential questions, and additional resources. The modules cover a range of topics relating to photosynthesis and cellular respiration, plant responses to light, and use of NDVI technology in abiotic environments such as space or Antarctica. Learners utilize the lab aides in certain modules. In these particular modules, the learners will be able to utilize the lab aid kits to collect data on the plant health. It is anticipated that this technology be used to design experiments in school greenhouses. Learners may complete additional assignments that are provided to the instructor if the instructor feels that more instruction is needed.

Results

To date, the instructional videos and most instructional resources have been developed for the course. The curriculum was presented to agriscience educators at the 2018 Mid-Winter Conference. Agriscience educators were given the opportunity to try out the NDVI imaging systems at the conference. At the conference, program feedback showed that agriscience educators were highly interested in utilizing the curriculum. Many agriscience educators stated that the curriculum was an excellent way to integrate STEM concepts that are embedded in the state CTE standards. We currently have 20 NDVI lab aid kits created and ready to send out to agriscience programs. It is anticipated to have the final course modified and begin implementing the curriculum by March of 2018.

Future Plans

The program designer aims to share this curriculum at other teacher professional development conferences. We would also like to have more professional development workshops in the future. Future workshops for agriscience educators will demonstrate how to successfully use the STEM curriculum in their specific classroom setting. Agriscience educators will be able to effectively use the course content at the end of the professional development workshop. The program designer is planning to create a survey on teacher and student satisfaction of the curriculum, which will be a key tool in redesigning the course over the next several years. The course designer aims to have this curriculum in other content areas, such as Biology or Environmental Science courses. We are anticipating to have more grant funding to purchase more lab kits and expand the curriculum.

As more information becomes available from future research at the University of Florida, the course designer has plans to add additional modules with learning objectives and essential questions. Researchers from the University of Florida will be conducting additional research in Antarctica from January to March of 2018. NDVI images gathered from Antarctica will be added to this curriculum in the future. Because we have a limited amount of lab kits available for students to use the imaging systems, the course designer plans to make a Flickr account in which agriscience teachers can access. The images collected from NDVI technology will be available online if an agriscience teacher is unable to get the NDVI lab kits in time. We are hoping to make a web-based inquiry website where students can share the images they collect with other agriscience classrooms. As time progresses, supplemental materials will be evaluated for their effectiveness in the classroom. Revisions will be made in accordance to the course mission and learning objectives.

Resources Needed

Course takers will need to have access to the course materials, which is free for the instructor to access once they have contacted the program. Instructors will have access to the NDVI lab aid kits, which will include the NDVI cameras, data collection sheets, and teacher resources if needed once they contact the University of Florida Space Plant Program. NDVI lab aid kits cost an estimated \$25 each, which is covered by grant funding from NASA. A classroom supply will be given for free for agriscience instructors interested in utilizing the lab aid kits. Shipping the lab aid kits to and from classrooms is covered by grant funding, so there is no cost at all for agriscience teachers to use this curriculum.

References

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