EFFECTIVENESS OF CURRICULUM DEVELOPMENT IN ADVANCED PLANT SCIENCE IN INVASIVE SPECIES AND AGRICULTURE BIOSECURITY

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by

Jacob Dylan Brandon

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Jacob Dylan Brandon

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Mark J. Anderson, PhD
Committee Director

Doug R. Ullrich, EdD
Committee Member

Richard K. Ford, EdD
Committee Member

John B. Pascarella, PhD
Dean, College of Science & Engineering Technology

DEDICATION

This thesis is dedicated to all of those that have made an impact on me in my life, this goes to my family that believed in me and was there for every step of the way. Especially my mom, dad, and my brother for helping me continue my dream of becoming an agricultural educator.

If you are reading this, this means more to me than anything you can imagine. This is dedicated also to those that want to be difference makers and future life changers as agriculture educators.

ABSTRACT

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The volume and diversity of material that agriculture teachers must be semi-efficient in is astronomical in comparison to other disciplines. Texas there are 29 courses that a certified agriculture sciences teacher can teach based upon the local and regional needs. That is why in our study we are looking at developing curriculum Advanced Plant and Soil Science, a course that 144 out of the 1300 high school programs offered to their high school students. Additionally Advanced Plant and Soil science is offered as a science credit in public schools in Texas.

This course also coincides with two topics that are seldom discussed in other curriculum materials available to agriculture teachers in Agricultural Biosecurity and Invasive Species. This study will be creating a unit of instruction and curriculum on Agricultural Biosecurity and Invasive Species that align with the Texas Essential Knowledge and Skills (TEKS) in Advanced Plant and Soil Science. We will first develop the material for the instructors and students with assistance from the Texas Invasives Species Institute. Secondly, we will distribute this material to 10 schools across the state of Texas *(n* = 10) and gather a pre/post-survey that inquires their knowledge and confidence in teaching agriculture biosecurity and invasive species. We will also receive all the students pre/post-test scores, and all quizzes that are encompassed in the curriculum of 11 lessons.

Data will be analyzed using descriptive statistics and a paired t-test in comparing students test and quiz scores to evaluate if the material was absorbed. Then using the

same analysis to evaluate the pre/post-survey from the instructors on confidence in teaching and if they absorbed any of the material that they are not used to. This in return will help evaluate material effectiveness for both the student and the instructor in a course and topic that does not have substantial research or guides for teachers.

KEY WORDS: Advanced plant and soil science; Curriculum development; Paired t-test; Teacher confidence and effectiveness; Student retention

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To the faculty and staff at Sam Houston State University School of Agricultural Sciences, all of you made the difference for me in my five and a half years in the program. Thank you for believing in me in this place that I have called home for my whole collegiate career and preparing me to be an amazing educator.

To my fellow graduate Teaching Assistants, Graduate Students, Agriculture Ambassadors, Undergraduate Students and Friends. All of you have helped me be a better leader, teacher, and friend. I hope that this thesis and my time in the school of agricultural sciences can serve as an inspiration to all of you that you are all destined to do amazing things and achieve your dreams just as this is one is to me.

Overall, I hope that all of you that have helped me along the way are proud of me for all that I have done towards my research and my service in the 23 years that I have been on this old rock.

PREFACE

(JB) “You are a teacher of life first, and a teacher of agriculture second.”

- Dr. Herb Schumann

(MA) “The simplest answer is probably the correct one.”

- Occam’s Razor

(RF) “Yes you are green, but they are green too, we are all green together.”

- Abraham Lincoln

(DU) "Excitement is found along the road, not at the end, and likewise, peace is not a fixed point-except perhaps in the unwanted "rest in peace" sense. PEACE is the breathing space between destinations, between excitements, an occasional part of the journey, if you're lucky. PEACE is a space you move through very rarely, and very briefly-but you are not allowed to stay there. You have to keep moving and go do what you do. Because you can...”

- Neil Peart

(DP) “The ultimate measure of a man is not where he stands in moments of comfort and convenience, but where he stands at times of challenge and controversy.”

- Martin Luther King Jr.

(MH) ““God does not call those who are equipped, He equips those whom He has called.”

- Smith Wigglesworth

(MV) “The Lord is my shepherd, I’ll not want; He makes me lie in pastures green. He leads me by the still, still waters, His goodness restores my soul.

- Psalms 23

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CHAPTER I

Introduction

Agricultural Education in the United States and Texas has varied in the last few years in the types of courses offered and what needs are to be met for the state of Texas. Advanced Plant and Soil Science is a newer course that shows a small number of instructors teach the course. Overall, this study aims to bridge the gap from Agricultural Education needs to Texas Education Agency standards.

Background

Overall, agricultural education nationwide has changed drastically since the first societies in North America began to promote agriculture and develop articles with the Philadelphia Society for Promoting Agriculture (True, 1929). The Morrill Act in 1862, The Hatch Act of 1887 and the Smith Lever Act all have established the "tripartite mission of teaching, research, and service, and represent what is widely believed to be the most successful educational innovation in the world" (Phipps et. al., 2008). This mission is mirrored by our agriculture teachers following the same basic model, but even with this innovation we continue to have a decrease in the number of teacher retention, both in in the United States and the state of Texas. Agriculture teachers become certified in the state of Texas through one of two options. In the first option, candidates must first obtain a bachelor's degree with a teaching certification from an accredited college or university and in the second, candidates must become alternatively certified through the Texas Education Agency (TEA). Both options require content exams and documented hours in the classroom to be completed prior to certification. Once in the classroom, teachers will use design models ranging from performance improvement to pedagogy assessment,

performance based, and thematic curriculum framework models, to help achieve student success and instructor growth. The model that is most well suited for agriculture and advanced plant science courses is the Pedagogy Assessment model. This model further states that all instructions and information from the curriculum developed are communicated to the instructor prior to being taught (Finch & Crunkilton, 1999). This allows the opportunity for curriculum development that can evolve with instructor input and continue to provide student success even as the material is updated to meet the changes in society and the environment. This flexibility is something that is vital to the fields of agriculture, specifically in advanced plant science, invasive species, and agricultural biosecurity.

Problem Statement

There has been a decrease in agriculture teacher retention in the United States and the state of Texas. On a national scale in 2018, 868 out of 900 leaving agriculture educators surveyed about leaving the agriculture education industry were reported to not to have plans to return to the any educational profession (AAAE, 1). According to Sorensen, McKim, and Velez (JAE, 2016) their findings in a study on why agriculture teachers leave due to the work interfering with family. This illustrates how the increase in workload, unfamiliar lesson topics, or changes in the family life all require additional time commitment that many agriculture teachers face and cannot cope with which results in teachers leaving the industry. (Sorensen et. al., 2016). An example of unfamiliar topic for many agriculture teachers would be Advanced Plant and Soil Science. This is only offered by 144 programs in the state of Texas out of a total of over 1500 high school AFNR programs (TEA AFNR, 2021). Additionally, the two of the major programs

teachers use for supplemental instruction materials, iCEV and Curriculum for Agricultural Science Education (CASE), lack information on advanced plant science, including invasive species and agriculture biosecurity, in their lessons (iCEV 2022; CASE, 2022). Therefore, by understanding that a part of teacher retention rate is tied to workload in the industry, this study aims to reduce the amount of time the instructor needs to be an efficient teacher and as a result allow more time for the other duties of a teacher in secondary agriculture education.

Purpose of Study

The purpose of the study is to examine the effectiveness of a new curriculum in Advanced Plant and Soil Science focusing on invasive species and agricultural biosecurity through teacher evaluation of curriculum, teacher measures of confidence in teaching the new curriculum, and student retention of the new material while following all of the Texas Essential Knowledge and Skills (TEKS) guidelines.

Research Questions

The study will address these questions when it comes to instructors' input, and students output on the material presented:

1. How effective is the new curriculum in Invasive Species and Agriculture Biosecurity on student retention and test scores?

2. How confident does the instructor become after using our new curriculum compared to before using the new curriculum?

3. Does the new curriculum adequately utilize the Texas Essential Knowledge and Skills (TEKS) that is addressed?

4. Does the instructor become more knowledgeable in the areas of Invasive Species and Agricultural Biosecurity after using the new curriculum?

Research Objectives

The objective of this research is:

1. To evaluate the effectiveness of a new online curriculum in invasive species and agricultural biosecurity.

2. To determine the effectiveness and confidence of the instructor, as well as student retention of the material in the new curriculum compared to what instructors have used in the past.

CHAPTER II

Literature Review

This review of literature encompasses many facets that connect to overall education development including theories of education and their impacts in the classroom. Agricultural Education certification for secondary education instructors is another important aspect in the current study, along with the need for curriculum in advanced plant science, agriculture biosecurity, and invasive species. Additionally, evaluation of proper teaching techniques is needed when developing a curriculum for high school students.

Theoretical Framework

Thematic Curriculum Framework

Thematic curriculum framework is based on broad and "all aspects" approach on career and technical education. This framework and model included more effective ways in having active and engaging student learning and experiences (Finch & Crunkilton, 1999). This model is completed through nine different sections that were utilized in the new curriculum developed. Section one is "Understanding the Thematic Curriculum" and section two "Exploring Curriculum Options". Sections three through five work together as "Considering Contextual Options", "Considering Organizational Options", and "Considering Delivery Options" on some of the applied usage of the material and curriculum created. Sections six and seven "Considering Content Options" and "Linking Curriculum with Instruction" is hammering down on the material being used and making it accurate to educational standards that needs to be fit, which in our case is following TEA guidelines. Finally, section nine is "Assessing and Refining the Curriculum" which

is the main focus in our study. Overall, the usage of this method is to help produce accurate, easy to follow, and informational curriculum that can be applied to both in the classroom and can be used outside the classroom.

Education Theory

Bandura's Social Learning Theory

Bandura's Social Learning Theory describes the role that society and social aspects have on ones learning ability. This can be seen as emulating an appropriate role model by mimicking or copying what they do (Bandura, 1976). This involves that the behavior that is learned from this role model is reinforced or strengthened. Reinforcement can be external, internal, positive, or negative, and such behavior no matter what the outcome will directly change a person's behavior, the magnitude of how much it impacts depends on the need of the person. Others take notice because one will consider what actions happen to others before imitating those same actions (McLeod, 2016). This is further explained by the three principles in Banduras Social Learning Theory: Observation, Imitation, and Modeling. These three parts of Social Learning Theory illustrate that while learning can occur without a change in behavior, learning can also occur by observation alone without a reassurance in actions or verbal interactions. (Nabavi, 2012).

Self-Efficacy Theory

The Self-Efficacy Theory is the belief that determines how well one can handle a certain plan in a situation (Boone, 1977). This is interpreted from four main sources of influence: performance outcomes, social role models, social persuasion, and emotional and physiological. Performance outcomes, which is one's interpretation of previous

experiences or how knowledgeable they are to a certain situation. It should be noted that this is considered as the more prominent main source compared to the other three. Social role models, the certain model that a person follows in wanting to successfully complete a task. This can range in education to counselors, coaches, and teachers. Social persuasion, receiving positive or negative feedback, can dictate one's drive and belief that they can succeed, and can be more effective if done earlier in education. Emotional and physiological states are the mental and physical state of the person overall. If one is feeling depressed or anxious then that condition will show in that person's performance (Lopez-Garrido, 2020). Self-efficacy learning examples can be utilized by emphasizing peer modeling that is most effective from those direct peers who can be applied to teachers (Bandura, 1988).

Three Component Model

The Three-Component Model is a model adopted by the National FFA that encompasses modern agriculture education into three separate components. The three circles in the model for agriculture education include Supervised Agricultural Experience (SAE), FFA Leadership, and Classroom Instruction. Each with their importance in the field of agriculture education. Classroom learning incorporates the conceptual learning that encompasses agriculture education within the 8-hour school day. FFA leadership and SAEs are the extracurricular portion of the agriculture education that is designed to enrich beyond the classroom experiences for that career success in many different agricultural fields (FFA., n.d., A 1).

Experimental Learning

Experimental learning is based on the foundation of six propositions of learning: learning being a process, all learning being re-learning, learning requiring the resolution of conflicts, learning being a holistic process of adaptation, learning being a result of synergetic transactions between the person and the environment, and learning being the process of creating knowledge (Kolb, 2009). However experimental learning is better explained as how the planning of "active experimenting" that gives the individual, in this case students, the chance to master a new understanding and retaining that knowledge further down the road. Overall becoming a tool for further development in retaining information that can be used outside of the classroom (Sharlanova, 2004). Many aspects that come from agriculture education such as FFA activities and SAEs also benefit more from the experimental theory and provides a solid framework to complement each other (Baker et. al., 2012). This allows for the opportunity to make learning in the classroom relate more relevantly in the agricultural sector and help guide students to career success and job placement after secondary education. In order to, properly understand how to make the activities more relevant and prominent in the agriculture classroom today, we must first understand how we have the setting of the agriculture classroom we have today.

Agricultural Education

History

Agricultural education nationwide has changed drastically since the first societies in North America began to promote agriculture and develop articles with the Philadelphia Society for Promoting Agriculture (True, 1929). The Morrill Act later in 1862 established

land grant colleges in each state in the United States illustrating the importance of practical arts of education. The Hatch Act of 1887 later established experiment stations through Cooperative Extension Systems in each state to coincide with the land grant institutions in order to further agricultural education. In 1914, the Smith Lever Act further established the relationship between the cooperative extension systems and the land grant universities to provide education to youth and adults not enrolled in college. Together these acts have established the "tripartite mission of teaching, research, and service, and represent what is widely believed to be the most successful educational innovation in the world". The Smith Hughes Act of 1917, also known as the National Vocational Education Act, was "designed to promote and further develop vocational education programs which otherwise might not have been provided in state educational systems" by providing financial assistance for agricultural educators with travel, supervising projects, and supervisors. The Vocational Act of 1963 then improved on what the Smith Hughes act established with more enhancements on maintaining and building existing and newly established programs and provide part time employment to students in need to continue their education (Phipps et. al., 2008). These have all been steppingstones to help further develop agricultural education in the high school class as we see it today. Additionally, they have further promoted the overall importance that agricultural education has in the secondary educational setting. As a result of this, student led organizations like the National FFA Organization "provide leadership, personal growth, and career success training through agriculture education" for over 735,000 FFA members across the United States, Puerto Rico, and the U.S Virgin Islands that has reinforced student learning since 1928 (FFA, n.d.A).

Texas Agricultural Education

Texas follows the guidelines of the Texas Education Agency (TEA). The overall goal of the TEA is to establish improvements to student instruction and produce graduates that can attribute to society and display strong leadership skills (TEA 2022). Agriculture education falls under the Career and Technical Education (CTE) career cluster in the TEA. In this cluster, instructors must abide by the Texas Essential Knowledge and Skills (TEKS) requirements of that course when presenting the material TEKS are the essential guidelines that ensure instructors teach the proper materials and learning objectives in the classroom for student engagement and content comprehension. Currently, there are a total of 29 courses that a certified AFNR teacher can teach in the state of Texas that has a set of TEKS to teach under, this includes over 1200 TEKS that a certified high school agriculture sciences teacher can teach if asked to do so (TEA, 2022 n.d.A).

Certification Process

Agriculture teachers become certified in the state of Texas through one of two options. In the first option, you must first obtain a bachelor's degree from an accredited college or university with teacher certification. In the state of Texas, there are currently 11 universities (Angelo State University, Sul Ross University, Texas A&M Kingsville, Sam Houston State University, Tarleton State University, Texas State University, Texas A&M University, Texas Tech University, Stephen F. Austin State University, Texas A&M Commerce, and West Texas A&M University) that offer an "Agricultural Education" degree and can offer agriculture teacher certification (Teach Ag, 2022). This certification then includes passing two certification examinations, the TExES Pedegogy

and Professional Responsibilities (PPR) exam, and the TExES Agriculture, Food and Natural Resources 6-12 content exam. The applicant also must gather 150 hours in the classroom during their student teaching semester before graduation in order to apply for their certification (TEA, 2022 at al). The applicant would then apply through a state application then complete fingerprinting to complete the first option to become certified in the state of Texas to teach agricultural sciences in secondary education. The second option is to become alternatively certified through the Texas Education Agency (TEA). There are eight other Educator Preparation Programs (EPPs) in the state of Texas that are certified from the TEA to become certified to teach Agriculture, Food and Natural Resource (AFNR) courses. This method requires a screening, developing a plan with one of the previously listed EPPs, obtaining a teaching position, applying for a probationary certificate, and finally completing trainings necessary for applying for the standard certificate to become certified through the TEA (TEA EPP, 2022).

Teacher Retention in Agricultural Education

The number of agricultural science teachers staying in the profession is decreasing more and more each year. In a 2017 study conducted by the National Association for Agricultural Educators (Smith et.al., 2017), found that nationwide that 11,992 teachers taught agriculture sciences with 812 positions needing to be filled. This can also be attributed to the number of new programs that open throughout the year, retirements, and others that leave teaching all together. This leads to 7% of the teaching positions being available with that number likely to increase in the case of a newer study (Smith et.al, 2018). In the state of Texas, it mirrors the difficulties seen in the entire teaching profession regarding the struggles of balancing their career and family life. In

2015, Hainline et. al. examined the influence of Texas agricultural science teacher priorities at work and at home, with an average of 58.65 hours a week going towards their education program they teach in (Hainline et al., 2015). It is also noted that most of the time that the teacher spends within the domains of the Three Component model (FFA n.d. A 1). Within the Three Component Model it is noted that most of the time spent is in the classroom above the other two components in a normal school year. (Croom, 2008). If just teaching some of the more common agriculture classes doesn't help the retention rate, then it is even more difficult to maintain teachers in some classes that show a need but cannot be met with any assistance to the instructors.

The large number of TEKS per course, as several courses have over 80 TEKS, also play a role in teacher retention due to the increased pressure of making sure that students are meeting all of the requirements set forth by the TEA. Overall, the 29 courses taught in agriculture and 1,200 TEKS for those courses absolutely play a role in teachers feeling overwhelmed and uncertain on whether they to go on teaching so many areas they are not proficient in. As previously mentioned, advanced plant science has only 144 programs offer the course and has 82 TEKS in this single course. That much information to go through in a class less than 12% of the programs in Texas even offer is a hard hurdle to jump over. (TEA, 2022 n.d.A).

Invasive Species and Agriculture Biosecurity

Invasive Species and Agricultural Biosecurity Need

Invasive species have a major negative influence in native ecosystems and landscapes that can be costly both environmentally and financially. In fact, it is estimated that invasive species cost billions of dollars annually in damages and can cost even more

to attempting to manage the invasive species (Aukema JE, 2011). The importance for education can be linked to the human expectations of what "pests" are and their impacts on our ecosystem. This goes as far back as 1927, when the U.S House of Representatives passed $4,250,000 dollars to exterminate the Mediterranean fruit fly in Florida as one of the earliest signs of government direction towards acting towards invasive species (Howard, 1929) This led to the introduction for the need for education in this area to inform the public on both invasive species and agriculture biosecurity on a grander scale. A study in 2016 conducted by Huang showed that over 66% of the subjects in the study reported either slightly being knowledgeable or not being knowledgeable at all in invasive species in the state of Florida. These respondents were also asked about their perceptions of invasive species management with the top three concerns being harm to native species, harm to humans, and harm to agriculture (Huang & Lamm 2016). This lack of knowledge goes along with these knowledge gap in the subject and the difficulties in helping the public to understand the impact of invasive species. This is particularly interesting considering that humans are the most prominent transporters of invasive species around the world. This suggests that outside educational programs can have a large role to helping people become educated in their role in invasive species and invasive species transportation (Crall et. al., 2011). With this considered, the most appropriate place to educate the public would be in the place of high school classrooms.

Curriculum Development

Invasive Species and Agricultural Biosecurity Education in Advanced Plant and Soil Science

The importance of invasive species and agriculture biosecurity in a community and how they can be applied to the Advanced Plant and Soil Science course in Texas high schools to improve the environment cannot be understated. This can be seen when evaluating the TEKS in the advanced plant science class, where multiple TEKS are used when implementing invasive species and agriculture biosecurity. The TEKS that can be implemented in an Advanced Plant and Soil Science course focusing on invasive species and agriculture biosecurity include all of the following:

- TEKS 130.25 (1) A-E, (A) identify career development and entrepreneurship opportunities in the field of plant systems; (B) apply competencies related to resources, information, interpersonal skills, and systems of operation in plant systems; (C) demonstrate knowledge of personal and occupational safety practices in the workplace; (D) identify employer expectations and appropriate work habits; and (E) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership.
- (3) G-H, (G) analyze, evaluate, make inferences, and predict trends from data; and (H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

- (4) A-E, (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student; (B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials; (C) draw inferences based on data related to promotional materials for products and services; (D) evaluate the impact of scientific research on society and the environment; (E) evaluate models according to their limitations in representing biological objects or events.
- (8) A-D, (A) identify native and introduced plants, assess their role in an ecosystem, and compare them to plants in other ecosystems; (B) make observations and compile data about fluctuations in abiotic cycles and evaluate their effects on local ecosystems; (C) evaluate the impact of human activity such as pest control, hydroponics, and sustainable agriculture on ecosystems; and (D) predict how the introduction, removal, or re-introduction of an organism may affect the food chain and existing populations.
- (9) A-D, (A) explain soil formation; (B) evaluate the properties and nature of soils; (C) recognize the importance of conservation of soil and agencies involved in conservation; (D) recognize the application of soil mechanics to engineering and excavation operations.

- (10) A-G, (A) summarize methods of land use and management; (B) identify sources, use, quality, and conservation of water; (C) explore the use and conservation of renewable and non-renewable resources; (D) analyze and evaluate the economic significance and interdependence of components of the environment; (E) evaluate the impact of human activity and technology on soil fertility and productivity; (F) analyze and describe the effects on environments of events such as fire, hurricanes, deforestation, mining, population growth, and urban development; and (G) explain how regional changes in the environment may have a global effect.
- (15) A-E, (A) analyze plant physiology, genetics, and reproduction of various crops; (B) recognize characteristics related to seed quality such as mechanical damage, viability, and grade; (C) identify plant pests and diseases and their causes, prevention, and treatment; (D) perform plant management practices such as germination tests, plant spacing trials, and fertilizer tests; and (E) measure trends in crop species and varieties grown locally in Texas and the United States and how they affect agriculture and consumers.
- (16) A-B, (A) analyze plant physiology, genetics, and reproduction of various crops; (B) recognize characteristics related to seed quality such as mechanical damage, viability, and grade; (C) identify plant pests and diseases and their causes, prevention, and treatment; (D) perform plant management practices such as germination tests, plant spacing trials, and

fertilizer tests; and (E) measure trends in crop species and varieties grown locally in Texas and the United States and how they affect agriculture and consumers.

- (17) A-D, (A) describe components of deoxyribonucleic acid (DNA) and illustrate how information for specifying the traits of an organism is carried in DNA; (B) identify and illustrate how changes in DNA cause phenotypic or genotypic changes; (C) compare and contrast genetic variations observed in plants and animals; and (D) compare the processes of mitosis and meiosis and their significance.
- (18) A-D, (A) describe the growth and development of major crops; (B) apply principles of genetics and plant breeding; (C) examine the development of crop varieties through the origin of agriculture; and (D) design and conduct investigations to support known principles of genetics. (TEA 130, 2015).

These TEKS are imperative to help these topics be covered in the Advanced Plant and Soil Science course and be introduced to students that can become knowledgeable of their role on invasive species and agriculture biosecurity.

Important Factors of Development

Curriculum development is a necessity for any successful education program. There is a curriculum gap in invasive species and agriculture biosecurity educational materials. There are multiple designs that can be adopted when developing a curriculum for vocational education or career and technical education. The design models range from performance improvement to pedagogy assessment, performance based, and thematic

curriculum framework models, each with their own objectives that mark student success and instructor growth. The model chosen for our study is the Pedagogy Assessment model. This model further states that all instructions and information from the curriculum developed are communicated to the instructor prior to being taught. The student is the target for planning, and evaluation of instruction and content goals continue to be evaluated by the instructor for their sequence, difficulty, and domain levels to determine what works best for them. This maximizes output from the instructor therefore increasing the retention in the students (Finch & Crunkilton, 1999). Using this model to plan curriculum in an agriculture setting will help ensure quality material is being developed and other available resources validate the need for the curriculum to both students, teachers, and the community are identified. This curriculum development technique can also pull many of the community to help develop the need for that area, particularly when using experts in those fields for information and support. (Newcomb et. al., 2004).

Instructional Strategies in Development

Newcomb et. al. (2004) stated that following 16 principles when teaching agricultural related topics in a secondary educational background are important for effective teaching to the instructors on how they can effectively teach. This ranges from making the structure clear to the students so that active learning opportunities can arise, keeping students involved in the planning and goal setting in lessons, reinforcing the learning to help retention of the material presented, having the students inquire about the topics rather than only instructed about a topic, and most importantly, helping students understand how their learning can transfer to real-life situations rather than just fit a

school based needs (Newcomb et. al., 2004). Learning from the education theories and history of education helps in providing these instructional strategies and content that is needed to satisfy the TEKS. This material is going to fill the need for invasive species and agriculture biosecurity curriculum to be used in secondary education classrooms.

CHAPTER III

Materials and Methods

Research Design

This study utilized a descriptive research design method to accurately gather the data. To do this, a survey was constructed and distributed through the Agriculture Teachers Association of Texas (ATAT) and emailed out to all agriculture teachers in the state of Texas that are a part of the ATAT organization. This allowed the survey to reach as many agriculture teachers that teach advanced plant science as possible and determine if they are willing to implement the developed curriculum.

Population of Study

The target population of this study will be at least ten agricultural education programs in the state of Texas that teach Advanced Plant and Soil Science 130.25 in the 2021-2022 academic school year. The population was sought out through an indirect mass email (Appendix B) that was sent through the Agriculture Teachers Association of Texas (ATAT) to openly recruit agriculture science teachers that teach advanced plant science to be a part of this study ($n = 9$).

Instrumentation

Development on the curriculum was achieved by using the proposal from the USDA APHIS as well as the assistance of the Texas Invasives Species Institute (TISI) which helped create an integrated curricula that connects learners and educators to a similar model of facilitation of learning that produces successful lifelong learners. PowerPoints were created for each lesson included in the curriculum to fulfill the requirements listed in the TEKS guidelines for Advanced Plant and Soil Science. They

include (1) Overview / Introduction to Invasive Species, (2&3) Priority Crop Pests by Commodity, (4) Priority Soil and Cysts Nematodes and Agricultural Impact, (5) Forest Health Pests and Disease and Biosecurity, (6) Invasive Mollusks and Crustaceans. Recreational and Human Health Impact, (7) Priority Pest ID and Transmission Pathways, (8) Invasive Plants, (9) Invasive Plant ID and Transmission Pathways, (10) Take Action, and (11) Evaluation of Lesson Unit. These lessons were accompanied by worksheets and activities that are conducted through a newly created student workbook designed to follow the material created in the PowerPoints for each lesson. Materials included an instructor curriculum guide alongside the PowerPoints to serve as an instruction manual for proper teaching of the material following the TEKS guidelines and Bloom's taxonomy on objectives and student's educational rigor. Prior to releasing the curriculum to instructors there was an editing process through TISI and other professional instructors to finalize the material for the pilot study. The instructors then completed the consent form that comes alongside the pre-survey (Appendix A). The pre-survey was had nine baseline questions that are directed to current student retention from, the instructor's perspective, teacher knowledge of material and ease of teaching the material, and classroom setting on the number of students taking the course. The pre-survey consists of 6 Likert-type questions that included: (1) Extremely Poor, (2) Bad, (3) Average, (4) Good, (5) Excellent. The instructors were then asked about the number of years they taught agriculture science courses in general, and the number of years they taught advanced plant science in a multiple-choice style format to conform groups of years of experience from: 0-5 years, 6-10 years, 11-20 years, 21+ years. This will then help us divide into experienced and inexperienced teachers for the study. Additionally, student

scores on assignments were recorded by the instructors and anonymously submitted to determine student retention. After this process of collecting all of the programs that are volunteering to be a part of the study, each school was randomly identified by a letter and every student was identified by a number to allow anonymous transfer of information. Once the curriculum is fully developed it was released via the Texas Invasive Species Institute website for access to all the participants. After a 3-week process of allowing the instructors use the developed curriculum, post-surveys (Appendix A) were conducted for each of the instructors and student's assignments (pre-and post-test scores and quizzes) were submitted and analyzed.

Statistical Analysis

The variables were analyzed by conducting a paired-T-Tess evaluation to the pre/post-test to the students test scores to determine the LS Mean and the standard deviation which helped us determine the difference score between a related sample (Gravetter & Wallnau, 2011). This method was also used towards the pre/post-survey for the instructors to determine the averages for the Likert scale used for the surveys for questions 1-6 for both pre- and post-surveys. The students quiz scores were analyzed by ANOVA GLM and Least Square Means to determine the LS Means and P-Values.

Institution Approval

Prior to releasing the survey, the researcher submitted an IRB for collection data and the plan of the project to the Sam Houston State University Institutional Review Board (IRB). Approval was received, data collection from Qualtrics will begin for both pre/post-surveys and consent forms, along with a project number to identify the study (IRB-2021-391)

CHAPTER IV

Results

Student Data

In comparing the pre- and post-test scores for the students (n=59) before and after the curriculum material was distributed, there was a difference between the pre/posttest- and post-test scores ($P < 0.01$). This was with an average pre-test score of 31.61 before any material was discussed from the curriculum, and an average of the post-test score of 90.98 (Table 1).

Table 1

Student Pre/Post Test Score Results

	Pre-Test	Post-Test	SE[c]	P Value
Average Score	31.61[a]	90.98[b]	1.916	0.01

Note. Student scores (n=59) from a pre- and post-test before and after the developed curriculum was distributed. Evaluation of student test scores before and after use of curriculum in invasive species and agricultural biosecurity.

[ab]Means with different superscripts within row differ at P< 0.05

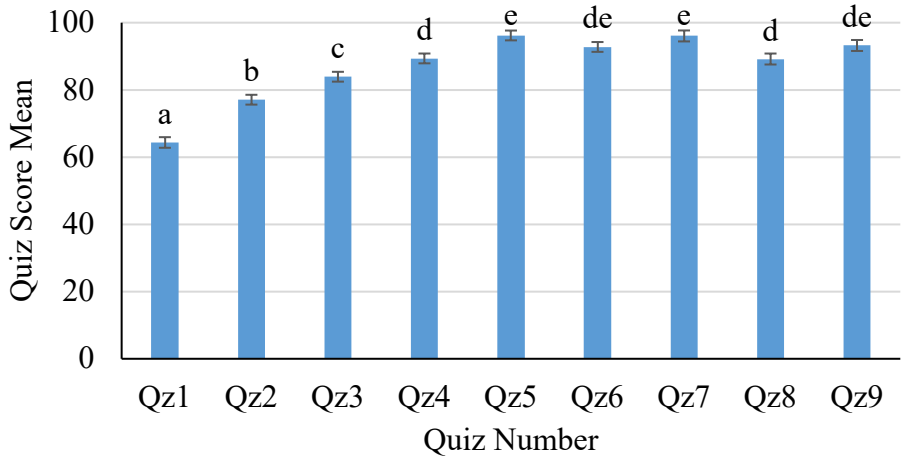
[c]SE – Standard Error

Additionally, the nine lesson-oriented quizzes that accompanied the curriculum pre/post-tests. The lessons that accompanied these quizzes were administered to students in the following order; Quiz 1:Priority Crop Pests by Commodity & Ag Biosecurity, Quiz 2:Priority Crop Pests by Commodity & Ag Biosecurity Continued, Quiz 3:Priority Soil and Cysts Nematodes & Agricultural Impact, Quiz 4:Forest Health Pests and Disease & Biosecurity, Quiz 5:Invasive Mollusks & Crustaceans, Quiz 6:Recreational and Human Health Impact, Quiz 7:Priority Pest ID & Transmission Pathways, Quiz 8:Invasive Plants,

Invasive Plant ID & Transmission Pathways, and Quiz 9:Take Action. Each of these lessons had a 10-question multiple choice quiz that accompanied them.

Figure 1

Mean Score of all Quizzes from Students



[abcde]Means with different superscripts within row differ at P< 0.05

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Note. Results from student quizzes in invasive species and agricultural biosecurity

When comparing the nine total quizzes to one another, Quiz 1 had the lowest score (64.35) when compared to all other quizzes (Figure 1). Quiz 2 had a lower score (77.08) than all other quizzes except Quiz 1. Quiz 3 had a lower score (83.92) than all other quizzes except Quiz 1 and Quiz 2. While differences were detected between the remaining quizzes (Quiz 4-Quiz 9; Figure 1) all average scores ranged from a high "B" range (89.19) to a high "A" range (96.05). This plateauing of scores shows consistency across the performance of students on Quizzes 4 to 9.

Instructor Data

The instructors had six questions that linked between the pre/post quizzes they completed before and after use of our curriculum. The Likert scale used was based on the 1-5 margin that showed 1: Extremely Poor, 2: Bad, 3: Average, 4: Good, 5: Excellent for

their answer choices for all Likert Scale questions listed. The questions asked pertained to the following points.

1. How do you perceive your (previous curriculum guide / lessons) (our curriculum) in agriculture biosecurity and invasive species followed the TEKS guidelines.

2. How would you rate the difficulty of your (previous curriculum guide / lessons) (our curriculum) in agriculture biosecurity and invasive species for your students to learn?

3. How well do you feel your students have learned the areas of the TEKS mentioned in the agriculture biosecurity and invasive species (from our curriculum) (lessons in the past)?

4. How knowledgeable are you in the use of the TEKS for teaching Invasive Species and Agriculture Biosecurity in Advanced Plant Science 130.25 (before) (after) using the Curriculum Guide?

5. How would you rate your overall teaching effectiveness of the TEKS mentioned normally in teaching Invasive Species and Ag Biosecurity before/after using the curriculum guide?

6. How would you rate the effectiveness of the TEKS overall for Advanced Plant Science 130.25 (before using our curriculum) (after using our curriculum)?

These six questions were based on a 1-5 Likert scale that distinguished how the participants felt before and after the usage of our curriculum. The pre/post-survey results for these questions shown a mean difference for each corresponding question from pre to post. The results of question one being a 2 difference, question two and three being a 1.6

difference, question four being a 1 difference, question five being a .04 difference, and question six being a 1.2 difference. These all being still scaled on the 1-5 scale.

Table 2

Pre/Post Survey Instructor Results

Question	Pre-Test	Post-Test	SE[c]	P Value
1	2.8[a]	4.8[b]	0.63	0.034
2	3.8	4.4	0.60	0.056
3	2[a]	3.6[b]	0.51	0.035
4	3.0	4.0	0.45	0.089
5	2.8	3.2	0.81	0.648
6	3.2	4.4	0.49	0.071

Note. Instructor evaluations before and after use of curriculum in invasive species and agricultural biosecurity.

[ab]Means with different superscripts within row differ at $P < 0.05$

[c]SE – Standard Error

Questions seven through nine on the rest of the pre-survey was background information gathered to use for data collection grouping. Question seven asked how many years of service the instructor had in teaching secondary agriculture education entirely. Two stated 0-5 years' experience, one stated 6-10 years, and two stating 11-20 years. Question eight asked how many years of teaching advanced plant science the instructors had with four of the five stating 0-5 years of experience, and one saying 6-10 years' experience. Question nine asked how many students they had expected to be in their classroom during the time of our study with the numbers we received being eight, sixty-seven, fifteen, six, and eight respectively.

Question seven through twelve on the post survey were assessments of the overall curriculum we displayed through this study, question seven through nine using the 1-5 Likert scale as previous. Question seven through nine are as follows.

7. Do you feel that the new curriculum helped the student in learning and retaining the information delivered in the unit?

8. Do you believe the students' scores are an accurate representation of them understanding the material?

9. How many class periods did it take for you to finish this curriculum guide?

Question seven of the five instructors that completed the post-survey had an average of a 3.6/5 overall. Question eight had an average of a 3.4/5 overall. Then question nine had an average of 21.6 class periods of time needed to complete the curriculum. Questions 10 were comments on the curriculum itself that encompassed most of the things that the instructors liked which overall were about how much information that the curriculum had and the structure of the curriculum with quizzes and tests. Question 11 were comments on the curriculum itself that encompassed most of the things that the instructors wished to have seen differently from the curriculum that was developed. The instructors overwhelmingly had wished that they had more time to get the material done, especially when on a block schedule. The other criticisms were some technical issues and navigation and instruction clarity in some areas of the curriculum. Then question twelve asked overall how the instructor felt about the curriculum and its use to the students and instructor, "How would you grade the overall curriculum as a whole?". The results shown that the overall curriculum score was set to be 4.6/5 from the instructors after using our curriculum for the 30-day period.

CHAPTER V

Discussion

Discussion Student Results

The quiz scores showed progressive learning overtime in the quizzes with quizzes one being our lowest scoring average, quizzes two being lower than all other average quizzes besides quiz one. Quiz three showing tendencies higher than quizzes one and two and not the other quizzes. Quizzes four through nine shown a plateau of scoring with no significant differences between these quiz scores besides quizzes one through three. The results displayed the idea that the students overall displayed a growth of knowledge in the topics of the TEKS that were reflected in the curriculum developed. The overall pre to post test scores saw a significant increase in overall student knowledge in the area of invasive species and agricultural biosecurity. These students using the pre/post-test model (USDE 2000) displayed content validity in the topics discussed.

Discussion Instructor Results

The instructor shown overall improvements from their teaching by using our curriculum compared to their previous learning units in the same area. The instructors did show that they felt the curriculum we developed hit on the TEKS of Advanced Plant Science 130.25 shown a difference in higher efficiently and effectively than their previous material used in their classrooms.

The instructors saw a tendency in the difficulty that this curriculum gave the students had a higher rigor than the previous material that the instructors had used before. The instructors saw a significant difference in the students learning the areas of the TEKS that we mentioned would be discussed in relation to our curriculum. The TEKS we

discussed for this objective are mentioned below. The instructors felt that these areas that are encompassed in many different areas were more impactful from our lessons and how we implemented those areas.

Instructors also saw a trend in becoming more knowledgeable in those areas of the TEKS after using our curriculum. This is built on the notion of more experience and more time taken in areas that they were not as knowledgeable in before using our material can be the reason why the instructors felt more comfortable and confident in their knowledge of this material.

The instructors however felt that the teaching effectiveness of this material was only slightly more advanced than previously using our curriculum. This can be related that instructors' use the same kind of developed curriculum areas that can remain effective before using our material, however due to the amount of material that was present in our material and the structure of our curriculum can result in the slight increase in effectiveness of teaching, but not set as a trend or a significant change.

Overall effectiveness of the TEKS for Advanced Plant Science 130.25 we saw had a trend in increasing for instructors with the idea that some instructors may have never seen some areas of the TEKS and can now potentially see a difference while using our curriculum. The instructors can see more use of these TEKS after using our curriculum as well while implementing new ideas during the instructional time in the classroom.

The progressive information that was gathered beyond the paired T-Test on the post survey is information that can be effective in determining the areas that this curriculum did impact students and instructors alike. Overall, the instructors did feel a

partial impact did happen for the students on retaining and gaining the knowledge in this material was above the average on what the post surveys displayed. Instructors did also believe that the scores did semi accurately display that the students' scores demonstrated that the students did indeed develop an understanding of the material that was presented in the curriculum distributed. One matter that was taken in our end survey was gathering an amount of class periods that it took to go over the material for each of our participating schools. The original time that was anticipated was at least 10 class periods and expected that it can potentially go up to 15 periods. All our participants were over our original estimate which was further discussed in the aspects that the instructors appreciated and wished they saw different.

The instructors saw that the major benefit of the material is that the information was very informative and factual. Multiple discussed that the material was easy to follow and was thorough in its material and presentation that made it easy, along with the quizzes to evaluate student learning more effectively was a major high point from instructors' perspectives in our free response portion of the post survey.

The instructors' saw some improvements that can be made were some technical advancements to make it easier for the instructors to follow along with the students. This was also followed up with a bit more instructional guidelines to help the instructor get more out of our material to make it easier for them and the students. One wanted examples of all worksheets that were encompassed in the curriculum as well as more hands-on activities that was in the material distributed. The last point was asking for more time to use the material as one instructor used all 30 days that were given to teach the material to the students.

The last point is taking the instructors overall evaluation of the curriculum that was developed. The instructors overall felt the material was almost excellent on the scale of the instrument that we used which indeed supports that the material did assist with the need for the material and that the instructor did believe that the curriculum made a difference for students and instructors alike.

Limitations

One of the limitations that were gathered from this data set can be on the number of student and instructor participants that were gathered for this study or known as non-response bias which describes that the non-responders can demonstrate different from those that did respond to the survey and students that could have participated in using the material (Catalog of Bias, 2019). It is also noted from Dooley and Linder (2003) that at least 50% response rate is required to generalize from sample to population which displays the non-response error has taken place in our study. Our methods to keep this anonymous while also gathering a large sample size through the VATAT organization was semi-efficient as 9 schools did sign up for the study, however only 2 schools finished all materials needed for accurate data collection for all areas of the study. This also included multiple emails that were sent to all instructors and committee members involved in this study. For 114 schools that offered this course the year prior, only having that many apply for this study was not ideal. Frame error however can be identified from where a wrong subpopulation is used to select the sample to represent the entire population (Qualtrics, 2022). From our study identifying the schools in Texas that offer advanced plant science was limited to only the knowledge of the districts that offered the course in the 2020-2021 school year from TEA (TEA AFNR, 2021) making it difficult to

identify the entire sample size that is desired for this project which can show in our results and our response rate to our survey that was distributed. Using the list from the ATAT association also shows that no list is completely adequate for one's purpose when it comes to the frame of a study, and the surveyor either abandons the survey or whether a certain amount of frame error is acceptable, or if any alternatives exist to go around frame error (Dillman et. al., 2009). This study has a limited frame that can be accomplished by reaching out to the full agriculture sciences teacher association to reach to all the teachers that teach advanced plant science. Though this might lead to some error, there is no alternative list to reach to all advanced plant science instructors only in Texas.

Another aspect is the pre/post-test surveys that were administered for the test scores. Some of the areas in the raw data were blank in multiple areas for multiple students which made the data become null void on collection. It is quite difficult to manage on when a student can be present throughout the curriculum to ensure that the quizzes and pre/post-test are all taken, and that the student was fully attentive during the lessons.

The lessons themselves and their duration can also be a limitation that was discovered after collecting the data. The overall class time was expected to be a total of 11 class periods before the curriculum was released to the test subjects. The post-test from the instructors shown that the average number of class periods that the schools used to cover all the material was 21.6 or in this case 22 class periods to finish, double of what our overall goal for the curriculum was geared to be. The instructors left comments on this that state that the curriculum was very informational, to the fact that it had so much to encompass that some lessons took longer than others, along with minor instructional

directions, and some technical difficulties while using the curriculum can also lead to more prolonged time of use. The lessons themselves were developed to follow one the main principal parts of focusing instruction, finding misalignments, planning for subsequent years simplified, staff development mentoring, assisting in the curriculum validation process, and evidence of accountability (Craft & Bland, 2004). This can explain why the instructors in the study explain the need of the information that must be specific to these certain areas of agricultural biosecurity and invasive species but can sense that while it follows all of the areas needed for the TEKS and lesson planning, it can be overwhelming dependent on the amount of prior knowledge in the areas if not adequate in those areas discussed.

Recommendations

If another study such as this was to be conducted again, the way subjects (schools and students) can be selected should be done in multiple ways. The email list to the entire ATAT association was beneficial to reach out to the teachers that can use this material, however another avenue can be to recruit anonymously through social media in a agricultural teacher based group to where all of the subjects there meet the requirements of our study. Or contacting the school districts themselves to emphasize the schools use the curriculum could potentially lead to more test subjects. Although these two are acceptable substitutes, advertising the material during the ATAT Conference and having instructors sign their schools up to participate in the study from there could lead to the most subjects of any of the avenues presented in this study. Responding to the non-response error that is present is also a crucial manner. Tuckman (1999) suggests if fewer than 80% of the total sample size did not respond and complete a survey or questionnaire

that reaching back out to a portion of the nonrespondents and retrieve data from them. This is to distinguish that the sample size before and after retrieving data isn't too different from one another. In the manner that was used for this study, it is suggested to continue with a certain sample and being able to reconnect with that sample size to reach back out to non-respondents in a more accurate manner.

Another way to further answer the objective that would describe the need of this material is to examine a pre/post-survey question that gathered more into the instructor's preference on if the material in invasive species and agricultural biosecurity a need in their area is indeed. From our study the lack of materials at all presented to see this as a need but having one from the instructors can display more to the TEA to implement more areas such as what this study was directed towards that can be used for other areas in agricultural education.

CHAPTER VI

Conclusion

When evaluating the effectiveness of the new curriculum in Invasive Species and Agriculture Biosecurity on student retention and test scores, the student post-test scores were almost three times as high compared to their pre-test scores. Other researchers (O'Leary & Isreal) discussed how there are ways that the pre/post-test model are accurate ways to collect data especially for our case in the manner of observing information / a skill change is a positive aspect of the pre/post-test model. Piaget's theory shows that the students build their conceptual understanding based on relating the prior experiences and knowledge to new concepts, (Piaget, 1970) the material presented in the curriculum in their order of being presented can be seen in this way with partial of the information in the beginning potentially being new material dependent on the factors of what the instructor has taught before using the curriculum that is built on during the later lessons which explains the plateau of scores on the quizzes and the higher scores from pre-posttest. Following the Blooms taxonomy method of development for the cognitive domain presented the idea for critical thinking during the lessons developed in this curriculum, (Bloom, 1956). The opportunity that the students had throughout this curriculum to also gather this knowledge through the methods the students learned the material in more critical thinking opportunities can also be discussed in how the students' scores were representative of the curriculum developed (Duke TOP 2012).

Essential to curriculum development is also stated by, (Allen Talbert et. al., 2022) to display that those involved in the curriculum development process involves the school and the community in which the curriculum is utilized alongside using the agricultural

advisory committee which does encompass the agricultural sciences teachers. The areas of having the input from these teachers in the areas that our questions were asked were present to guide the valuable input from the instructors, students, agricultural education professionals, and industry professionals to help make the curriculum development process be as efficient as possible.

With the results produced from this study, improvement in student learning from curriculum in invasive species and agricultural biosecurity with the progressive and improving scores that the students scored from the pre to posttest with the subsequent quizzes in between the tests. The constant assessments are directed to student learning along with more confident students in the areas projected in the curriculum that also projects better performance (Phipps et. al., 2008). Student retention of this learning can also be gauged from some suggested methods from Lancelot. This list requiring repetition of this material during and after learning, have the material to be taught well organized, give the students the clearest possible understanding of the material that is learned (Lancelot, 1929).

The notion during this study was to not only develop curriculum that can be implemented into secondary agricultural food and natural resource courses in Texas, but to where this curriculum had plenty of structure and information to where this can be used as a complete set like this pilot study was aimed at, or á la carte to where teachers can also pick and choose the lesson materials that they feel would fit the most in the course they are teaching. (Allen Talbert et. al., 2022) This curriculum potentially can fill the need in a hole in advanced plant science courses in Texas and can be designed to be even more accurate than what it was in this study for the students and instructors.

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APPENDIX A

CURRICULUM GUIDE

Agriculture Biosecurity and Invasive Species
Advanced Plant and Soil Science 130.25
Intro Survey (Instructor Pre)

Questions (1-6) will be based on a 5-point Likert scale. 1: Extremely Poor, 2: Bad, 3: Average, 4: Good, 5. Excellent. Questions 8-10 will be the number that properly represents the answer to that question for you. Please give your honest opinion and answer ALL questions.

1. How do you perceive your previous curriculum guide / lessons in agricultural biosecurity and invasive species followed the TEKS guidelines?

2. How would you rate the difficulty of your previous curriculum guide / lessons in agricultural biosecurity and invasive species for your students to learn?

3. How well do you feel your students have learned the areas of the TEKS mentioned in the agricultural biosecurity and invasive species curriculum / lessons in the past?

4. How knowledgeable are you in the use of the TEKS in Advanced Plant and Soil Science 130.25 before using the Curriculum Guide?

5. How would you rate your overall teaching effectiveness of the TEKS mentioned normally in teaching Invasive Species and Ag Biosecurity before using the curriculum guide?

6. How would you rate the effectiveness of the TEKS overall for Advanced Plant and Soil Science 130.25?

7. How many years of teaching experience do you have?

8. How many years of teaching Advanced Plant and Soil Science 130.25?

9. How many students do you have in your class this semester on Advanced Plant and Soil Science 130.25?

CURRICULUM GUIDE

Agriculture Biosecurity and Invasive Species

Advanced Plant and Soil Science 130.25

Intro Survey (Instructor Post)

The following questions will be based on a 5-point Likert scale. 1: Extremely Poor, 2: Bad, 3: Average, 4: Good, 5. Excellent. Please give your honest opinion and answer ALL questions.

1. How well would you say that the new curriculum guide / lessons in agricultural biosecurity and invasive species followed the TEKS guidelines?

2. How would you rate the difficulty of the new curriculum guide / lessons in agricultural biosecurity and invasive species for your students to learn?

3. How well do you feel your students have learned the areas of the TEKS mentioned in the agricultural biosecurity and invasive species curriculum / lessons through the new curriculum?

4. How knowledgeable would you say you are about using the TEKS in Advanced Plant and Soil Science 130.25 after using the new Curriculum Guide?

5. How would you rate your overall teaching effectiveness of the TEKS mentioned normally in teaching Invasive Species and Agricultural Biosecurity after using the new curriculum guide?

6. How would you rate the effectiveness of the TEKS overall for Advanced Plant and Soil Science 130.25 after using the new curriculum?

7. Do you feel that the new curriculum helped the student in learning and retaining the information delivered in the unit?

8. Do you believe the students' scores are an accurate representation of them understanding the material?

9. How many years of teaching experience do you have?

10. How many years of teaching Advanced Plant and Soil Science 130.25?

11. How many students do you have in your class this semester on Advanced Plant and Soil Science 130.25?

APPENDIX B

Recruitment Letter:

My name is Jacob Brandon, and I am a master's student in the School of Agricultural Science at Sam Houston State University. I am working with the Texas Invasive Species Institute and USDA to develop an online based curriculum over Agricultural Biosecurity and Invasive Species in Texas, aligned with the TEKS for Advanced Plant Science 130.25. This is a roughly 2-week curriculum with all the lesson plans and material being included in this test run of the curriculum (Tests, PowerPoints, etc.)

This will include lessons such as

- Introduction Agricultural Biosecurity
- Major Crop Pests in Texas
- Soil Cyst Nematodes
- Forest Health Pests
- Invasive Mollusks
- Pest Identification
- Invasive Plants and Transmission Pathways
- Pest Management
- and more....

As a participant in this study, you will receive the curriculum material that you can use for future lessons, and we will also use your feedback for making improvements to the curriculum. You will receive the final product free of charge. As an additional incentive, all programs in the study that complete both surveys (pre- and post-test) and submitted student test scores will receive a Microscope Smartphone Camera Adaptor (or something similar).

This study is a part of my master's thesis that analyzes the implementation of the curriculum, effectiveness of the TEKS, and the impact of the course structure on teaching and students learning in Advanced Plant Science classes. So, your participation will be as helpful to you as it is to me in learning how to properly implement TEKS and improve quality of lessons implemented in this format.

We are looking to begin field testing the materials this coming spring semester (Spring 2022). I will send that information after we get all the interested programs identified.

Please let me know by February 28th, 2022, through the Qualtrics survey on accepting to become a part of this survey that is attached at the bottom of this paragraph. To qualify for this study, you must be 18 years of age or older and teach Advanced Plant and Soil Science in the High School Setting. This study is voluntary, and your participation will be anonymous - I won't even know who has taken the survey. If you would like to be part of my study, please click on the following link.

https://shsu.co1.qualtrics.com/jfe/form/SV_0PSFuqYDHfVm82W

Sincerely,

Jacob Brandon
Sam Houston State University
Agriculture Sciences M.S.
Graduate / Research Assistant

APPENDIX C

Sam Houston STATE UNIVERSITY
A Member of The Texas State University System

Date: Jan 28, 2022 12:48:18 PM CST

TO: Jacob Brandon Doug Ullrich

FROM: SHSU IRB

PROJECT TITLE: Advanced Plant Science Curriculum Study

PROTOCOL #: IRB-2021-391

SUBMISSION TYPE: Initial

ACTION: Exempt

DECISION DATE: January 28, 2022

EXEMPT REVIEW CATEGORY: Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).

The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

OPPORTUNITY TO PROVIDE FEEDBACK: To access the survey, click **here**. It only takes 10 minutes of your time and is voluntary. The results will be used internally to make improvements to the IRB application and/or process. Thank you for your time.

Greetings,

Thank you for your submission of Initial Review materials for this project. The Sam Houston State University (SHSU) IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

Since Cayuse IRB does not possess the ability to provide a "stamp of approval" on any recruitment or consent documentation, it is the strong recommendation of this office to please include the following approval language in the footer of those recruitment and consent documents: IRB-2021-391/January 28, 2022.

We will retain a copy of this correspondence within our records.

*** What should investigators do when considering changes to an exempt study that could make it nonexempt?**

It is the PI's responsibility to consult with the IRB whenever questions arise about whether planned changes to an exempt study might make that study nonexempt human subjects research.

In this case, please make available sufficient information to the IRB so it can make a correct determination.

If you have any questions, please contact the IRB Office at _____ or _____

Please include your project title and protocol number in all correspondence with this committee.

Sincerely,

SHSU Institutional Review Board

VITA

JACOB D. BRANDON

EDUCATION

MS Sam Houston State University, Master of Science in Agriculture Dec 2022
Thesis: "Curriculum Development in Invasive Species and Agriculture Biosecurity"
Committee: Mark Anderson, Doug Ullrich, Richard Ford
GPA: 3.55

BS Sam Houston State University, Interdisciplinary Agriculture Dec 2020
Graduated Cum Laude
Minored in Secondary Education
GPA: 3.65

HONORS AND AWARDS

SHSU Agricultural Sciences Graduate Leadership and Service Award	2022
3 Minute Thesis People's Choice Winner	2022
SHSU Agricultural Sciences Alton Burgess Leadership Award	2020
SHSU Agricultural Sciences Ann Christian Service Award	2019
American FFA Degree	2019

RESEARCH EXPERIENCE.

Thesis, Sam Houston State University, Huntsville, TX 2022
Advisor: Mark Anderson, Doug Ullrich, Richard Ford

- Curriculum development in agriculture biosecurity and invasive species
- Statistical analysis on surveys in educational settings

Poster, American Association Agriculture Educators Western Region 2022
Advisor: Doug Ullrich, Maureen Victoria, Dwayne Pavelock

- Student teacher evaluations post student teaching experience
- Statistical analysis on student teaching center perceptions

TEACHING EXPERIENCE

Porter High School, Porter, TX Aug 2020 to Dec 2020
Student Teaching, Agriculture

- Taught Principles of Agriculture, Floral Design, Veterinary Medical Applications, and assisted with Agriculture Mechanics and Technologies
- Coached LDE teams including Creed Speaking, Public Relations, and Skills
- Assisted with SAE projects including livestock and non-livestock

Sam Houston State University, Huntsville, TX Jan 2021 to Dec 2022
Teaching and Research Assistant, School of Agricultural Sciences

- Jan 2021 – July 2021: Plant Science Teaching Assistant, including developing lessons and laboratories with main instructor for PLSC 1307 & 1107
- Aug 2021 – Dec 2022: USDA Invasive Species Research Assistant, developed curriculum for invasive species and agriculture biosecurity. Conducted a pilot study for curriculum with Texas Invasives Species Institute

PRESENTATIONS AND INVITED LECTURES

Agricultural Communications ACOM 3360 Lecture, "Evidence and Claims in Agricultural Communications"
Sam Houston State University, September 2022

Agricultural Communications ACOM 3360 Lecture, "Branding and Marketing in Agricultural Communications"
Sam Houston State University, November 2022

Agricultural Communications ACOM 3360 Teaching Assistant
Sam Houston State University, August - December 2022

The Secondary Ag Ed Program AGED 3320 Lecture, "Texas AFNR Curriculum"
Sam Houston State University, September 2022

The Secondary Ag Ed Program AGED 3320 Teaching Assistant
Sam Houston State University, August - December 2022

Curriculum Development in Invasive Species and Agriculture Biosecurity
Agriculture Teachers Association of Texas, July 2022

Statewide Agricultural Biosecurity Curriculum for High School Students
American Society for Engineering Education, June 2022

3 Minute Thesis, "Invasive Species Curriculum Development in Secondary Agriculture Education"
Sam Houston State University, April 2022

PROFESSIONAL TRAINING

Agriculture Teachers Association of Texas Conference
ATAT, Varies, 2019-2022
Workshops and professional development for agriculture educators in the state of Texas that occurs yearly.

PROFESSIONAL ACTIVITIES

SHSU Agricultural Ambassadors Advisor, 2021-Present
American Society for Engineering Education, 2022-Present
Agriculture Teachers Association of Texas, 2020-Present
American Association of Agriculture Educators, 2020-Present
SHSU Agricultural Ambassadors, 2018-2020
Delta Tau Alpha (Agriculture Honor Society), 2019-2020
Texas FFA Collegiate Alumni President, 2018-2019
SHSU Collegiate FFA, 2017-2021
SHSU Agriculture Engineering Technology Club, 2018,2022