IMPACT OF AN EQUINE REPRODUCTIVE SHORT COURSE ON PARTICIPANTS' KNOWLEDGE AND SELF-EFFICACY

A Thesis

by

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ABSTRACT

Continuing education opportunities available to the public are becoming increasingly popular. Land grant universities with agricultural extension departments play an important role in providing continuing education programs to the public. These courses are important to the equine industry in providing opportunities for the public to learn various concepts and grow their businesses. The Equine Reproductive Short Course hosted by Texas A&M University Extension provides the general public with knowledge and skills in equine reproduction. These opportunities are important for horse owners to learn current practices and how to safely and correctly perform reproduction procedures to improve the equine industry as a whole. Using a qualitative approach, this study evaluated the impact of the short course on conceptual knowledge and self-efficacy of the participants after completion of the short course. This study is focused on the following research questions: 1) What content knowledge, if any, is gained by participants after the completion of the course? 2) What is the impact of the course on participants' confidence in performing the skills they learned? 3) What skills do past participants use in their own operations? 4) What factors influence the past participants' use or non-use of skills learned in the course?

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Survey Data from 2019 and 2020 was provided by Dr. Huseman.

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CHAPTER I

INTRODUCTON

Agriculture extension has been an important part of land grant universities since the Smith Lever Act passed in 1941 (USDA). Agriculture extension in Texas offers a wide range of public programs to create high-quality, relevant continuing education that encourages lasting and effective change. Extension education opportunities provide programs, tools, and resources — local and statewide — that teach people how to improve agriculture and food production, advance health practices, protect the environment, strengthen our communities, and enrich youth (Texas A&M Extension).

In effort to support Texans and agriculture, agriculture extension delivers annual short courses to the public for continuing education opportunities. These courses are designed to teach participants vital information and allow them the opportunity to get hands on experience to perform a wide range of skills. Extension short courses share valuable information with the public and give participants the opportunity to engage with industry experts.

AgriLife extension courses give the public access to platforms to gain skills and learn concepts to increase their involvement in their operations. Extension resources have the opportunity to impact the participants economically by providing them with valuable knowledge and skills to enhance their operations. Programs focused on agricultural production and management practices, evaluation of technologies, and improved decision-making led to

economic gains of more than $486 million for agricultural producers in 2019 (Texas A&M Extension).

Acquiring the skills and knowledge to address issues that arise in owning a horse can benefit the owner greatly (Lawrence, 1995). Horse ownership is expensive, and horse owners are seeking ways to improve the economic efficiency of their operations. As costs increase, not surprisingly, interest in learning skills and knowledge to help cut costs has also increased. The extent to which the owner assumes responsibilities for specific tasks in horse operations varies widely, and may be impacted by the owners' skill level, knowledge level, and confidence.

To meet the growing need for continuing education opportunities in equine reproduction, Equine Extension Specialists have developed a range of courses. This is particularly important as equine breeding technologies have become more advanced. The use of these technologies requires a great deal of knowledge and skill. Texas A&M University launched a short course in the 1970s to give the public an opportunity to engage with these technologies and learn from world renowned specialists. This course was designed to teach participants skills and content that they would need to take over some of the breeding related activities in their own operations.

The Texas A&M University is Equine Reproductive Management Short Course is designed for owners and breeding managers who want to learn the most efficient methods for ensuring the success of their breeding programs. The short course aims to engage participants on anatomy and physiology of the mare and stallion, gestation and foaling, feeding the broodmare and young horse, and estrous cycle manipulation of mares. Hands-on laboratory activities are scheduled each day and include semen collection and evaluation, estrous detection, artificial insemination, body condition scoring, perineal conformation evaluation of the mare and foaling management.

The Equine Reproductive Management short course attracts participants from all over the world. The annual short course at Texas A&M fills up quickly and always has a waiting list. Horse owners across the world are eager to learn these skills and increase their knowledge in equine reproduction. The short course is traditionally held in person at the Texas A&M College Station campus. The course was forced to move to an online format for 2021 because of the COVID pandemic. The change in format allowed for more participants to have the opportunity to sign up. The equine specialist at Texas A&M Equine Reproductive Management short course that will be offered to the public for purchase year-round on AgriLife Learn.

With increasing popularity of short courses in equine science, the need for evaluation has increased to determine the effectiveness of these efforts. Courses such as the Equine Reproductive Management short course have only been around for a few years and very little academic evaluation has been done on them. This research is designed to fill this need.

Horse ownership in the United States has a long history and is very popular as a hobby and for those have agricultural operations or engage in equine competitions. No matter what the purpose, horse ownership is expensive, with the average cost of owning a horse estimated to be at $3,086.54 per year per horse (Texas Equine Industry Study, 2015). Finding ways to reduce these costs is a high priority for most horse owners.

Breeding horses is a high-risk activity that requires specialized expertise, and as a result, most horse owners hire veterinarians or breeding professionals to perform the tasks like stallion collection, artificial insemination, and embryo transfers. Additional costs are incurred to transport and board horses for these services. The skills needed for equine reproduction can be learned and performed by horse owners for their own operation, thus saving them substantial money. What is needed is fairly complex: a knowledge of equine anatomy and physiology, a

knowledge of equine reproduction, a knowledge and ability to perform specific skills safely and effectively, and the confidence to perform those skills.

To meet these needs, AgriLife at Texas A&M University created a short course to teach horse owners the knowledge and skills that they need, and to increase their confidence in taking over these tasks. The course has been offered since the 1970s and to date, little is known about the impact of this course on participants' knowledge, skills, and confidence in performing these tasks. This study seeks to better understand the impact of the short course on participants.

CHAPTER II

LITERATURE REVIEW

Equine Industry Economics

The equine industry includes various different disciplines and uses of horses. There are various costs that go into raising, owning, and exhibiting horses for work and for hobby. According to the American Horse Council Foundation, "The horse industry contributes approximately $50 billion in direct economic impact to the U.S. economy, and has a direct employment impact of 988,394 jobs. Additionally, the industry itself contributes $38 billion in direct wages, salaries, and benefits. From those direct effects, the horse industry's contribution ripples out into other sectors of the economy. Adding these ripple effects results in an estimate of the total contribution of the horse industry to the U.S. economy of $122 billion, and a total employment impact of 1.7 million jobs" (2017).

The Equine Reproductive Management Short Course is held in College Station, Texas. Texas houses largest equine population in the United States. According to the Texas Equine Industry Study conducted by Texas A&M, Texas alone is estimated to be home to 882,900 horses (2015). Texans use their horses for a variety of different uses. According to the Texas Equine Industry Study, 35% of participants used their horses for recreation, 19% used them for breeding, 7% for ranching, 11% for racing, ~4% for rodeo, 9% for showing and 15% for other

uses. Horses are often bred to perform a certain skill. Because of this, selective breeding is used to achieve a desired athletic cross.

Equine Reproduction Management

Equine reproduction practices are commonly performed in a veterinary or breeding farm setting. Typically, a veterinarian will examine the horse and create a plan for treatment. Treatment for the mare usually consists of a breeding soundness exam where a holistic physical examination of the mare is performed. Once the mare is determined sound to breed, the veterinarian will start to monitor the mare's cycle. This may include ultrasounds, palpation and hormone therapy. Veterinarians also manage stallions. They will manage the semen collection and preparation procedures along with lab diagnostics of semen (Samper, 2009). Depending on the situation, the veterinarian may need to perform these procedures multiple times. If the mare is to be artificially inseminated, the owner will typically purchase semen. The cost of semen ranges greatly, depending on the stallion. The cost of these procedures varies and may require multiple cycles for a successful breeding to occur. These costs add up quickly and are the owner's responsibility. These costs are on top of the costs associated with daily care of the horse. It is estimated that the average cost of horse ownership is $3,086.54 per year per horse (Texas Equine Industry Study, 2015).

Many horse reproduction procedures can be done safely and effectively from home if the owner has accurate conceptual knowledge and refined skills. One advantage of doing equine reproduction practices at home is cost savings. In addition to daily costs associated with equine care, owners interested in breeding their horses incur additional costs that come with reproduction management for both stallions and mares. These extra reproduction costs include

veterinarian fees, artificial insemination costs, ultrasounds, medication, and boarding fees. These costs vary depending on the care needed. Due to the high cost of relying upon veterinarians or breeding farms for these procedures, many horse owners are seeking ways to take over some or all of these tasks. Short courses and continuing education opportunities have been created to educate the public on how to perform these procedures safely and correctly.

Equine reproduction education consists of skills and concepts that are difficult to learn. Equine reproduction includes several topics in both mare and stallion management. According to the Manual of Equine Reproduction, crucial issues in mare reproduction include reproductive anatomy, reproductive physiology, manipulation of estrous cycles, breeding soundness, ultrasonography, artificial insemination techniques, and nutrition and care of the mare. Stallion reproductive concepts include semen collection, stallion handling, semen freezing and semen cooling, breeding soundness, and stallion nutrition (Brinsko, 2011). The art and science of equine reproduction has become increasingly popular to learners and farm owners. With the increase in domestication of horses used for competition, the desire and use of selective breeding has increased.

Equine obstetrics presents a complex and challenging knowledge domain to both students and teaching staff. It requires the mastery of a specific set of integrated knowledge and the mastery of complex skills. Clinical skills are best mastered by performing them on a regular basis, but a challenge in doing so without substantial support is that trial and error is not easy to justify when dealing with horses, where estrus cycles are infrequent and errors are costly. Because of the difficult nature of these procedures and the need to practice these skills routinely, high level continuing education opportunities are crucial for horse owners to be able to learn and

master these skill sets and concepts and continue to practice them routinely. Minimizing the involvement from a veterinarian or breeding technician can have a positive financial benefit for the owner. Breeding horses has the potential to cost thousands of dollars. Because of this, various programs have created public courses that teach participants how to lower costs by performing some of these procedures themselves. An ideal site for such courses is the U.S. land grant university.

Land Grant Universities and Extension Programming

Land grant institutions were established to create higher learning focused on agricultural and mechanical arts. Land grant institutions strive to provide information to the public. Land grand universities focus on three main pillars. These pillars are: Teaching, Research, and Extension.

Agricultural extension provides research findings and continuing education opportunities to the public. "Agricultural extension brings agricultural research findings to the people who can put them into practice. Since passage of the Smith-Lever Act in 1914, the United States has developed an expansive Cooperative Extension System operated through the land-grant university system in partnership with Federal, state and local government" (Congressional Research Service, 2019).

Texas A&M University is a publicly-supported land grant institution, founded with a commitment to sharing research and research-based practice with the state's citizens. One component of the university that fulfills this responsibility is AgriLife, located in the College of Agriculture. Texas A&M AgriLife's mission is to "help Texans better their lives. Through the application of science-based knowledge, we create high-quality, relevant continuing education that encourages lasting and effective change. AgriLife provides programs, tools, and

resources —local and statewide — that teach people how to improve agriculture and food production, advance health practices, protect the environment, strengthen our communities, and enrich youth" (Texas A&M AgriLife).

The Equine Reproductive Short Course at Texas A&M AgriLife

AgriLife strives to help Texans improve practices so they can have the highest efficiency output of their goods and services. The Equine Reproductive Short Course at Texas A&M AgriLife aims to help the equine community learn the most efficient and effective methods of equine reproduction, with an ultimate goal of enabling horse owners to save money by performing these tasks safely and skillfully for their operation. The short course includes three days of classroom-based instruction and hands-on activities that address several mare and stallion reproductive concepts and techniques. Participants learn how to perform these procedures on their own. This course is important to the equine community by teaching safe practices to the participants so they can utilize these skills in the future to enhance their equine programs and operate with greater economic efficiency.

The Equine Reproductive Management short course was created to provide a continuing education opportunity for the equine community. The equine reproductive community ranges from large scale operations to individual hobby farms. These operations are run by a large variety of people. Breeding operations could be run by veterinarians, breeding managers, or the horse owner. With the correct equipment and education, reproductive practices can be performed by a wide variety of individuals involved in the equine community. This short course provides an educational opportunity for equine enthusiasts to learn about the best breeding practices. Horse owners have a wide range of backgrounds. Individuals with interest in equine reproduction do

not always have formal education in equine science. The Equine Reproductive Management short course gives these individuals the opportunity to gain skills and knowledge about equine reproduction content. The lessons taught in the short course are tailored to teach them how to perform common reproductive techniques on their own herd. Performing these techniques on one's own can have a large positive economic impact on the participants' operation.

The Equine Reproductive Management Short Course strives to increase participant knowledge and skills to achieve the following outcomes: perform semen evaluation, describe and perform stallion handling, handling the AV, artificial insemination, and perform more of their operations' reproductive procedures. The program objectives also aim to increase participants' knowledge in understanding mare and stallion anatomy and physiology by: employing reproductive practices that increase breeding efficiency in their operation, and articulate with professionals who are managing reproductive practice for them to increase involvement on decision making to make the most economical choices for their operation.

Texas A&M has been offering the Equine Reproductive Management Short course since the 1970s. Traditionally the short course consisted of hands-on and lecture activities that lasted three days at the Texas A&M College Station Equine Campus. Participants participate in a series of lectures from equine professionals, and then get the opportunity to try some of the techniques under the professionals' supervision. The hands-on course is limited to around 12 participants each year. The short course is highly desired and always has participants on the waiting list. Because of the COVID pandemic, the 2021 short course was offered digitally. Participants were provided with interactive kits to allow participants to practice various hands-on techniques at home to supplement the lecture. The virtual course allowed for a greater number of open spots for enrollment. The virtual short course did not include the hands-on skill practice on

horses that the in person short course offers. The recordings from the 2021 short course will be available for future customers to purchase. This will allow participants who missed registration or are not able to travel to College Station to participant in the short course at any time.

Evaluation has become a more significant component of planning and delivering extension programs (Krishna et al., 2012). In a study conducted on an AgrilLife course for new landowners, the course was found to have a positive economic impact on the participants (Shackleford, 2014). Particularly in times of economic uncertainty, knowing the specific impacts of AgriLife and other extension programs can better enable them to optimize their mission as part of the land grant university.

CHAPTER III

METHODS

The study reported here is an analysis of the Texas A&M AgriLife Equine Reproductive Management Short Course. The course is designed for horse owners to learn the knowledge and skills they need, and increase their confidence to take over all or portions of these tasks in their operations. Determining the impact of the course on participants' knowledge, skills, and confidence is important to inform changes in the program and help us better understand how this complex knowledge and skills are developed by participants.

Research Questions

This study is guided by the following research questions: 1) What content knowledge, if any, is gained by participants after the completion of the course? 2) What is the impact of the course on participants' confidence in performing the skills they learned? 3) What skills do past participants use in their own operations? 4) What factors influence the past participants' use or non-use of skills learned in the course?

Participants and Study Context

The short course was available to anyone interested who signed up and paid a registration fee. Participant knowledge and years of experience with horses varied. Some participants have engaged in multiple continuing education opportunities within equine reproduction and some

participants were participating in their first. The majority of participants in 2019 and 2020 were Texans; the course for these years was held at Texas A&M University in College Station, Texas. A few participants that were a U.S. state other than Texas, and one participant lived outside of the U.S.. Participants from the 2021 course included individuals from multiple states in United States and Canada. The virtual option gave the opportunity for more participants to enroll and was available to people who couldn't participate during previous years because of travel challenges.

Table 1. Participation and Format of the Course

Year	Number of Participants	Course Format
2019	**15**	**Face to Face**
2020	**11**	**Face to Face**
2021	**23**	**Virtual**

The short course is offered each year from Wednesday-Friday in early-mid January. In 2019-2020, the course was offered in-person at the Texas A&M Hildebrand Equestrian Center and Dick Freeman Arena. The course was taught in the complex conference room in an intimate setting. The participants were gathered around the conference table while the instructor lead the lesson from the head of the table. The hands-on portion of the course was taught in a classroom used to teach equine reproduction and housed all the equipment needed to perform the tasks involved. The hands-on portion was taught one-on-one with the instructor and the participants.

The course was taught by a group of equine experts. These individuals included Dr. Chelsie Huseman, an Assistant Professor and Extension Horse Specialist in the Department of Animal

Science. Dr. Huseman serves the state of Texas by disseminating equine education across the state for both adults and youth. A second instructor was Jennifer Zoller, an Assistant Professor and Extension Horse Specialist for Texas A&M AgriLife Extension stationed in College Station. She provides statewide leadership for planning, implementing, conducting and evaluating Extension education programs in equine sciences for both adult and youth audiences. Mrs. Krissy Schroeder also taught the course, and she manages the equine herd and facilities for the Texas A&M Department of Animal Science. Mr. Stephen Vogelsang is a graduate of Texas A&M. His masters research led to the first non-surgical equine embryo transfer in North America in 1977. He has been working in equine breeding industry since 1975. Dr. Martha Vogelsang, DVM, has conducted research focused on mare reproduction. Ms. Jessica Hertel currently handles the semen freezing responsibilities and manages the recipient herd for Birdsong Farms in Hearne, TX. Jessica earned her undergraduate degree from West Texas A&M University and completed a Master of Agriculture degree at Texas A&M University focusing on equine reproduction. Mr. Rafael Martinez, a graduate student in the animal science department with expertise in equine behavior, equine reproduction, and equine management.

The major course topics include: equine anatomy and physiology, equine nutrition, equine safety and handling, and equine reproductive techniques. The daily agenda for the short course can be found in Appendix A. The daily agenda for 2020 can be found in Appendix B.

In 2021, the course was offered virtually due to the COVID-19 pandemic. Participants were given the option of doing the entire three-day course, or take a single day that focused on mares, or stallions. The course was taught live via Zoom. Every participant received and interactive hands-on kit to go along with the live stream. The kit included a semen collection kit, an AI

pipette and syringe, palpation sleeve and "Techniques in equine reproduction" by Patrick McCue. The daily agenda for the 2021 short course can be found in Appendix C.

Data Sources, Instrumentation, and Analysis

Research Question One: What content knowledge, if any, is gained by participants after the completion of the course?

To address this question, a survey was developed and given to all participants in the 2019, 2020, and 2021 versions of the course. The 2019-2020 survey (see Appendix D) was developed by Dr. Chelsie Huseman and Dr. Jennifer Zoller, and they were the instructors of the course. This version of the survey was given at the end of the course in person to complete with pen and paper. The completion rate was 100%.

A second version of the survey was developed by the researcher and the course instructor and given to all participants in a pre/post design in 2021. The 2021 pre-survey completion rate was 78% and the post-survey completion rate was 56%. The survey was revised to include more questions about content knowledge related to equine reproduction (see Appendix E). Participants were asked to complete the pre and post survey by Qualtrics link pre and post course. Course completion certificates were held from participants until they completed the post survey. However, some participants still chose not to complete the post-survey. Because of the virtual nature of the 2021 survey, participant response rates were lower than the face-to-face version, likely because the survey was not distributed in a paper/pencil format during the course.

The content questions from the survey were analyzed using open and axial coding techniques to determine categories of responses. Response categories were then scored according to accuracy: Accurate, Accurate/Vague, Partially Inaccurate, Inaccurate. For the 2021 data,

individuals were compared from pretest to post-test to examine changes, if any, in their understanding of concepts. Frequencies are reported for the data set as a whole on the post-test, and for the 2021 data, changes are also reported from pre-survey to post-survey.

Research Question Two: What is the impact of the course on participants' confidence in performing the skills they learned?

To address this question, questions from the surveys that related to confidence were analyzed. Means and standard deviations were calculated for questions that asked participants to quantify their level of confidence. For the 2021 survey data, pre-survey scores and post-survey scores were compared to examine changes, if any, in participants' confidence. Due to the small sample sizes involved in this study, descriptive statistics are reported, and inferential statistical tests were not conducted.

Research Question Three: What skills do past participants use in their own operations?
Research Question Four: What factors influence the past participants' use or non-use of skills learned in the course?

To address research questions 3 and 4, the researcher contacted all participants from the 2019, 2020, and 2021 courses via email and asked them to participate in a recorded Zoom interview. The interview followed a semi-structured interview format, enabling the researcher to have common questions and also follow interesting responses to gain additional insight. The research questions are provided in (Appendix E). The researcher took field notes, and went back to the recordings during analysis if additional detail was needed.

Due to the small number of past participants and an even smaller response rate (N=4), each interview participant was considered as a case, and case study methods were employed. All skills that the participants mentioned that they use in their own operations were recorded. Additional information related to these skills was noted, such as difficulties they may have had or continue to have, financial constraints, etc. This information was considered in the context of the individual's context, reason for enrolling in the course, expressed satisfaction with the course, etc. While the initial intent of this research question was to develop a list of skills that are most likely to transfer to individuals' operations, the researcher found a great deal of variance in expectations for the course and personal needs, which may impact what skills are learned and eventually used. Thus, the shift toward a case study approach was deemed appropriate for the available data.

Cases were developed for each interview participant, organized around the following themes that were developed from the data: 1) participant/operation background and context; 2) reason for enrolling in the short course/expectations; 3) skills being used; and 4) factors the participants feel impact their operation related to equine reproductive management.

Limitations

Due to the hands-on nature of this course, the number of participants per year is limited to a small number. This limits the data available from previous versions of the course. In addition, the pandemic resulted in changes to the format of the 2021 course, which may impact participants' learning and experience in ways that could not be controlled.

The 2021 short course, because of the remote format, offered an option to sign up for sections that just covered mares, just covered stallions, and an option that covered both mare and

stallions. The previous courses did not have this option, and participants completed both sections. The 2019 and 2020 course only had an option that covered mares and stallions. Assessing participants' self-efficacy and experiences may be difficult when comparing experiences with single section days versus participants who took the complete course.

Finally, instrumentation is always a challenge. Participants may not have told the researcher everything they know, which means that their responses must be interpreted as best as possible, but may not reflect their full understanding.

CHAPTER IV

RESULTS

Section 1: Quantitative Results

Participant Confidence

Surveys from 2019, 2020, and 2021 were analyzed to assess the confidence level participants had to implement skills and concepts that were covered in the short course in their own operation. Table 2 provides the mean, standard deviation, and range from data collected in the 2019, 2020, and 2021 post surveys.

Table 2: Participant Confidence in Performing Skills Taught

Year	Mean	Standard Deviation	Range (0-100)	N
2019	69.2%	25.9	90 Low:10 High:100	15
2020	60.5%	26.3	70 Low:20 High:90	11
2021	80%	19.9	90 Low: 20 High:90	13

Overall, participant confidence after the short course ranges from 60-80%. Notably, the standard deviations are high, which is reflected by the very large range of responses, including a participant with a 10% confidence level, and another with a 100% confidence level.

Participant Understanding of Equine Reproduction Concepts

Open-ended questions that addressed participants' conceptual understanding were provided on the 2021 pre and post survey. These responses were scored using the guide in Table 3. Each question was analyzed and scored from one to five. Exemplar statements from participants are provided for each score.

Table 3: 2021 Open Ended Survey Question Scoring Guide

Score	Description	Exemplar
5:Sophisticated Understanding.	Represents a high level of understanding consistent with the goals of the short course. Shows connections between the course concepts and demonstrating skills in equine reproduction.	"There are many ways to achieve efficiency, but first and foremost would be taking copious notes on each mare/stallion and setting good routines. I would check for proper BCS for both the stallion and the mares going into the breeding season and keep the nutrition program on track and re-assess often." (Participant #6)
4: Good Understanding.	Response is accurate but lacks important details.	"In a firm and safe manner, without being allowed to be overpowering or over reactive. Handlers should keep their eye on the stallion and be facing him at all times. Following a routine is crucial for a successful collection." (Participant #15)
3: Vague Response	Response is accurate, but is quite vague, so the understanding of the participants is unclear.	"Nutrition, Body Condition Scoring, Artificial Lights" (Participant #2)

2: Mixed Response	Response contains some accurate elements and some inaccuracies.	"with a dummy mare and collection equipment" (Participant #11)
1: Inaccurate Response/ No Response	Response is inaccurate.	"Not too sure." (Participant #7)

To determine the 2021 group's growth in understanding, overall means were calculated from the open-ended survey questions response scores, and compared from the pre and post survey (see Table 4). Because overall means can mask potentially important differences between items, pre and post survey means were also calculated for each question (see Table 5).

Table 4: 2021 Overall Mean Understanding from Open-Ended Survey Responses

Year	Overall Mean Pre-Survey	Standard Deviation Pre-survey	Overall Mean Post-Survey	Standard Deviation	N
2021	2.75	0.95	3.37	0.96	13

Table 5: 2021 Mean Scores for Each Content Knowledge Item

Question #	Pre-Survey Mean	Standard Deviation Pre-Survey	Post-Survey Mean	Average improvement from pre to post	Post-Survey Standard Deviation	N
1- Equipment needed to analyze semen	2.77	0.93	2.77	0	1.07	13
2- Stallion handling	2.69	0.75	3.00	0.31	0.58	13
3- How to increase reproductive	2.77	1.01	3.46	0.69	0.95	13

efficiency						
4- Mare's reproductive tract	2.77	1.17	3.92	1.15	0.64	13
5- Veterinarian terminology	2.77	1.01	3.08	0.31	1.19	13

Tests of statistical significance were not conducted to determine if differences in the means are likely due to chance. This is due to the small sample size that is below the threshold required for paired-samples t-tests. While this data must be interpreted with caution due to this limitation, it is encouraging to note improvements for all items but one, where the means were the same. The largest improvement was seen participants' understanding of the parts of the mare's reproductive tract (question 4), where participants showed an average improvement of 1.15, which represents a full category of improvement with a post survey mean of 3.92 out of 5.

Another way to interpret the data is to examine individuals' scores. Because the standard deviations were rather high, certain individuals may be outliers that can create challenges when interpreting mean scores. To address this, individual gain scores were calculated from the 2021 data. Pre and post survey scores were calculated by adding each individual's scores of the six conceptual items on the survey, and subtracting the summed pre survey score from the summed post survey score. The highest total possible gain score was 25, which would exist for an individual who scored 0 on the pre survey and 25 on the post survey. A score of -25 was possible if a participant scored 25 on the pre survey and 0 on the post survey.

Table 6: 2021 Participant Overall Gain Score

Participant #	Overall Gain Score
1	3
2	1
3	2
4	5

5	2
6	7
9	8
11	7
13	0
15	1
17	3
18	1
16	0
Mean Gain Score	3.08

No participants performed worse on the post survey than they did on the pre survey. Only two participants showed no gains in their conceptual understanding as measured on the five survey questions analyzed. Four participants (27% of the participants) showed gain scores of 5 or higher, illustrating that their understanding improved by an average of a full category across the conceptual questions. In contrast, forty percent of the participants in 2021 (N = 6) showed gain scores of zero or one. This is likely not due to a ceiling effect, given that no individual had a total score above 8.

Section 2: Qualitative Results

Quantitative results from interview participants who completed the 2019- 2020 Equine Reproductive Management Short Course provides interesting insight into overall performance, confidence and levels of understanding attained by participants at the end of the course. A major limitation of this study, however, is the small sample size due to the enrollment limitations of this intensive course. Qualitative analysis is ideally suited for gaining deeper insight into specific misconceptions, conceptual challenges and successes, impacts of the short course on participants' actual practices, the reasons for participants' reported confidence, and the characteristics of the participants who enroll in this course. To gain a deeper understanding of

these issues, the open-ended responses were analyzed for patterns within their responses using grounded theory (Strauss & Corbin, 1991). Interviews were also conducted with past participants to provide additional insight into their knowledge, perceptions, confidence, and practices. The interview data was analyzed using a case study approach and is reported in the final section of this chapter.

Meaningfulness

Asking participants what they found meaningful in the course provides important insight into their perceived needs, which may be very useful for the program instructors in the course design. Participants were asked to list what they felt was the most meaningful part of the course. Analysis of the responses from 13 participants indicates no discernable pattern, which indicates that participants had a wide range of interests or needs. These responses are summarized in Table 7. Please note that several participants listed more than one topic, so the total number of responses listed is greater than 13.

Table 7. Most Meaningful Part of Course for 2019-2021 Course Participants

Self-Reported Most Meaningful Part of Course	Frequency of Response
Live Demonstrations	3
Mare management	2
Trouble-shooting problem mare and/or stud	2
Stallion collecting, shipping, freezing	2
Dissection	2
Nutrition	2
Light management	2

Reproductive physiology	2
Liked everything/vague positive response	2
Mare heat cycle/when to breed	1
Newer technologies/practical applications	1
Difficult breeder strategies	1
AI	1
Tour	2

Participants were the most specific in their comments about mares. For example, Participant 5 stated, "To me the most meaningful was learning about how to put mares under lights. Also, when I got to learn more about the mare's heat cycle and when to breed was very helpful." Comments about stallions were limited to "I found the section and tour involving freezing semen the most interesting" (Participant 4) and "…gained a lot of knowledge…collecting, shipping and freezing stallions" (Participant 2). No participant mentioned focusing specifically on stallions in their operation, but four participants discussed only mares in their responses. Participant 5's response above illustrates an exclusive focus on mare issues, and the following responses indicate that at least three participants plan to focus on the mare side of reproduction:

> The most meaningful aspect for me was all that we learned on the mare side as that is the side we are focusing on…. (Participant 6)
>
> Because I do not stand a stallion I found the information pertaining to management of the mare very helpful…. (Participant 11)
>
> Wanting to start breeding our own mares, so this was PERFECT! (Participant 17)

The value placed upon mare-related issues is consistent with the highest level of knowledge and highest gains and occurring on Question 4, which assessed participants' understanding of the mare's reproductive tract.

Understanding of Mare Reproductive Tract

Participants' responses to Question 4 ("Describe the mare's reproductive tract.") overwhelmingly listed specific structures. All but one participant accurately named six or more structures that included: vulva, vulvar lips, vagina, cervix, uterus, uterine horn, oviduct, and ovaries. Two participants included broader descriptions of the locations and orientation of these structures relative to the pelvis or hips. For example, Participant 15 noted, "From outside to inside: vulva, vagina, cervix, uterus, oviducts, and ovaries. The vagina and cervix sit over the pelvic floor while the ovaries and uterus are sort of "hung" between the hips by the broad ligaments." Participant 9 was the only person to describe both structure and, to some extent, function: "Made up of multiple parts that function together for the health of the mare and the foal. Includes ovaries, oviduct, uterus, cervix, horns, vulva, vagina."

Improving Efficiency

Survey question number three asked participants to describe ways they can increase efficiency in their operations. The most common response was nutrition, mentioned by six participants.

> Also keeping mares at a body score of at least 5 to 6 will increase efficiency (*Participant 1)*
>
> Nutrition, Body Condition Scoring (*Participant 2)*
>
> You can start with nutrition (*Participant 5)*
>
> I would check for proper BCS for both the stallion and the mares going into the breeding season and keep the nutrition program on track and re-assess often. (*Participant 6)*

> Good nutrition is a must. Healthy horses are easier to follow a proper estrus and breeding cycle. (*Participant 11)*
>
> Managing the mares and stallion nutrition optimally. (*Participant 13)*

Equipment Needed for Semen Analysis

Question One asked participants what equipment was needed to analyze semen. This question contained the most incorrect answers and potential misconceptions. Participants commonly missed the items needed for gross examination. The most common answer on the post survey was, "Microscope and densimeter." This is partially correct. Gross examination needs to be performed. Participant #15 was the only participant to list materials needed to house and transfer the semen to the machine before using the equipment: "Microscope, slides, densimeter, stain, a transfer pipette or syringe." These tools are very important in aiding in the proper transfer of sperm. The most common mistake participants made was omission of tools. All participants had partially complete answers but commonly forgot all the tools needed to analyze sperm.

Section 3: Case Studies

Four interviews were conducted with participants who participated in the short course in 2019 or 2020. The interviews were coded and the codes were used to create a case study for each participant.

Participant #1- Paul

Participant operation and background

Paul became involved in horses because of his family equine breeding program. When he first started working with his family, he had no knowledge of equine reproduction. Paul wanted to gain more knowledge about horses so he could participate in the family operation and be a part of their growth and success. His family owns about 15 broodmares. Some of these broodmares are carriers and some of them are receipts. Currently, his family uses outside stallions to breed their mares. Paul traveled internationally from Europe to attend this course. He noted that resources in his country can be limited when it comes to equine reproduction and he wanted to attend other continuing education opportunities to help him understand equine reproduction better.

Reason for enrolling in the course

Paul enrolled in the short course to gain hands on experience in equine reproduction. His family owns a small breeding operation overseas, and he wanted to be able to participate in assisting with breeding. He wanted to attend the course to learn common practices in equine reproduction. He wanted to learn breeding terms used to better communicate with equine professionals. His operation uses mostly artificial insemination with frozen and cooled semen. Paul wanted to leave the course knowing how mares are artificially inseminated with cooled and frozen semen. He wanted to learn the best techniques to optimize his operation.

Skills being used, and factors the participants feel impact their operation related to equine reproductive management

Paul's operation was positively impacted by the hands-on experiences he had in the short course. The hands-on experiences improved his understanding of modern breeding practices. He

was specifically impacted by concepts that involved the mare. Learning how to predict foaling and manage mares for optimal output are concepts that have helped improve his broodmare herd. Paul purchased the foal alert system and the refractometer that was suggested in the short course. He bought these to use to improve the operation's accuracy in predicting foaling. Paul also noted he learned a lot of information about mare nutrition. The information from the short course helped Paul change his feeding regimen to increase efficiency. After the course he noticed he significantly understand the concept better and is more comfortable performing the skills taught.

Participant #2 - Linda

Participant operation and background

Linda works with her grandfather on his horse farm where he houses 30 horses. Their operation has three stud prospects coming up this year that they want to stand to the public. Linda is actively involved in the breeding operation and has interest in growing the operation. She is passionate about equine reproduction and has a special interest in foals and foaling management. Linda is a pre-veterinary student who plans to persue a Doctor of Veterinary Medicine degree to work specifically within equine reproduction.

Reason for enrolling in the course

Linda wanted to enroll in the course to gain a better understanding of modern equine reproduction techniques. She is applying to veterinary school and she wanted to have the certificate to add to her application. Currently, her operation is only live cover, and they are looking to expand their operation to include collection and shipment of semen and artificial insemination. She wanted to take this course to learn the processes involved with collecting a

stallion and shipping their semen and the process of that semen being artificially inseminated into the mare.

Skills being used, and factors the participants feel impact their operation related to equine reproductive management

Linda's most valuable information she gained from this course was the costs involved in collection and artificial insemination. She was not aware of the steps and costs associated with freezing semen and found this portion of the short course very valuable. The information she learned about collection, cooling and freezing, will aid her in moving forward with stallion collection in her operation. The information she learned from the short course also gave her the skills to track her mare's estrus cycles and how to implement light therapy for estrous manipulation. Implementing light therapy has enable her mares to cycle on the schedule she wants. The mares are now all cycling on the same schedule and breeding them will be more efficient because she can breed them at the same time.

Participant #3- Misty

Participant operation and background

Misty has her own small breeding operation and breeds American Quarter Horses for racing. Currently she owns a couple broodmares and foals. She breeds her mares on a schedule of every other year. Misty has a veterinary technician degree and is familiar with equine anatomy and physiology. She takes her mares to a clinic for artificial insemination when she breeds them. She

works closely with others in the equine industry to breed the best crosses she can. Misty breeds with the goal to sell the foals as racing prospects.

Reason for enrolling in the course

Misty enrolled in the course because she wanted to learn more about stallion reproduction. She interacts with stallion owners on a regular basis and she wanted to be educated on the processes involved in stallion reproduction. She also wanted to learn more about how to best prepare her mares for the breeding season. Misty wants her mares to foal out early in the season and wanted to understand how to optimize her resources to help breed early in the season.

Skills being used, and factors the participants feel impact their operation related to equine reproductive management.

Misty was familiar with mare reproduction before the course but not very familiar with stallion reproduction. After the course she felt she can effectively communicate with stallion owners and understand what they are communicating. The course made it easier for her to communicate with other equine professionals and know what she is talking about when communicating with them. The course taught her the technical jargon that equine professionals use and has helped her communicate with them on the same level. Misty also learned a lot about using lights on mares. Before the course she was using lights, but she was not using them in the most optimal way. Learning how to use lights properly for mare estrous manipulation, helped her get her mares cycling on the optimal days. Knowing how to optimize natural and artificial lighting, has helped her save on her electric bill since attending the course. Misty also learned how to troubleshoot when mares are not taking. She is now aware of what factors are potentially

preventing her mares from conceiving. Misty now feels that she will be able to determine these factors if a problem arises in her operation.

Participant #4- Patty

Participant operation and background

Patty is currently a Ph.D. student and high school chemistry teacher. She has her undergraduate degree in animal science with a focus in equine production with minors in chemistry and biology. She then went on to get her masters degree in general agriculture with an emphasis in equine reproduction. She is currently completing her coursework for her Ph.D. in Agriculture Education and Leadership with a focus in Extension. Patty previously worked at Stephen F. Austin State University as the equine center supervisor. She managed the university's herd of about sixty-five horses. Within the herd, there are nine broodmares that are used strictly for breeding and teaching. She managed the day-to-day breeding operations of the school's herd of broodmares. She also has her own small breeding operation that consists of three broodmares and one stallion. She breeds her own horses as working cowhorse prospects.

Reason for enrolling in the course

Patty enrolled in the short course as a refresher course to sharpen her equine reproduction skills. While attending Texas A&M University for her undergraduate degree, she took courses in equine reproduction. When she got offered the job at Stephen F. Austin University, she wanted to update her skills to make sure she had accurate knowledge of current concepts. She was going

to be managing their herd of broodmares, so she wanted to make sure she knew what she was talking about when working on other people's horses.

Skills being used, and factors the participants feel impact their operation related to equine reproductive management.

Patty saw many positive impacts on her operation after the Equine Reproductive Management Short Course. Before the short course, she felt that she knew the day-to-day operations of breeding management from her previous coursework. She felt she had a good understanding of equine breeding from a bird's eye view. The short course gave her a more detailed level of information about breeding. She learned about breeding contracts and the business aspects of equine reproduction from the course. These skills have helped her communicate with stallion and mare owners on the business aspects of breeding. After attending the short course, she reported that she knew much more about equine reproduction and was able to use her skills to improve her operations. Patty also taught college level courses and utilized the information from the short course to provide quality teaching to her students. Before attending the short course, the broodmare operation she was managing had roughly a 10% pregnancy success rate each year. After the short course and her involvement in the operation, the pregnancy success rate rose to 78%. She was able to successfully manipulate the cycles of her mares with artificial lighting techniques that were taught in the course. The increase in successful breedings has positively affected the economic status of her operation. The knowledge Patty gained in the course increased breeding success and saved them money on semen. Because she had the knowledge to make sure her mares were prepared for breeding, they were able to get them to catch on fewer breedings, thus reducing the number of doses of semen they had to buy.

The foals that result from these breedings are sold as babies. Patty sold the foals and put the money back into improving the program.

Self Assessment of Knowledge Growth

When asking interview participants how they felt their knowledge on equine reproduction concepts changed, they all described how the short course has helped their understanding of equine reproduction concepts. The following quotations exemplify their perception of knowledge growth:

> *Paul:* I significantly understand the concept better and am more comfortable interacting with the material and equine professionals.
>
> *Misty:* I can talk to stud and mare owners and understand concepts on both sides.
>
> *Linda:* I see improvement in my understanding because I now understand practical practices for problem mares.
>
> *Patty:* Before the course I felt I knew the content from an outsider looking in perspective. The short course taught the ins and outs of breeding barns from a behind the scenes perspective.

Section 4: Summary of Findings

Finding #1: Course participants are involved with very different operations, if any.

The case study data illustrate that each participant had different current contexts. Interview participant Paul is involved in a family operation. Linda was involved in her grandfather's 30 horse operation that deals with both stallion and mare management, and plans to apply to vet school. Misty was running her own small hobby breeding operation when she took the course. Patty is intending to become a professor of equine science.

Finding #2: Participants have a highly diverse range of expectations for the course.

Not surprisingly, interview participants enter the course with differing expectations that reflect their diverse backgrounds.

Paul took the course to understand equine reproduction topics to better assist his family in their operation. He wanted to learn more about equine reproduction to aid in foaling and mare management and gain hands-on experience in equine reproduction.

Linda wanted to enroll in the course to learn equine reproduction techniques and earn a certificate to add to her vet school application to get a head start on the content before she enrolls in reproduction courses. She also wanted to help her grandfather with improving his pasture breeding operation. Linda's involvement in her grandfather's operation, including experiences with stallions and mares, grew her passion for equine reproduction and led her to enroll in the short course and pursue a career in equine reproduction.

Misty's small operation included breeding two of her own mares each year with the goal of selling the babies before they are a year old. She enrolled in the course because she wanted to learn more about stallion reproduction. She interacts with stallion owners on a regular basis and wanted to be educated on the processes involved in stallion reproduction. She also wanted to learn more about how to best prepare her mares for the breeding season.

Patty took the short course to brush up on her skills before she became a professor of equine science at the college level. She has experience with these topics, but she wanted to make sure she was up to date on modern practices.

Each interview participant had different involvement levels in the industry and had their own goals for how the short course would impact their operation. The type of operation they were involved in was associated with their expectations from the course. The diverse

expectations of the interview participants were consistent with the survey results of the 2021 participants. The survey respondents noted very different aspects of the course to be most meaningful, which indicates that they likely had diverse expectations for the course. No single aspect of the course stood out as most meaningful for participants, yet all found something in the course to be of great value.

Finding #3: Participants had highly diverse confidence levels about their ability to implement skills from the short course in their own operations.

Responses from the interviews were analyzed to assess participants' confidence in using concepts and skills from the short course. All participants rated themselves on how confident they were performing skills in equine production before and after the short course Table 8 shows the ratings interview participants gave themselves pre and post short course.

Table 8: Interview Participants' Self-Reported Confidence in Skills (Scale: 1-10)

Participant	Pre Course Score	Post Course Score
Paul	0	6
Misty	3	6
Linda	7	8
Patty	6	9

The interview participants have had time to implement the skills taught in the course, and we might expect that their confidence would be more accurate and thus different than the responses on the post survey by participants who have not yet implemented any new skills they learned in

the course. This conclusion is not necessarily supported by these data (although the sample size of past participants who were interviewed is low). A similar range of confidence exists for the course participants immediately after participation (scaled means between 6-7) and those who took the course 1-2 years ago. Patty, with a confidence of "9" after the short course, is likely an outlier. As a prospective faculty member who will be expected to teach this content, her confidence level should be relatively higher than others.

No positive relationship appears to exist between participants' self-reported confidence and their knowledge of reproduction concepts. For example, Participants 4 and 18 both scored 17 on their knowledge of equine reproduction concepts, but Participant 4 reported a confidence level of 20% and Participant 18 reported 90%. Both participants scored the same on concepts but had very different confidence levels implementing what they learned.

Finding #4: A diverse range of factors influenced how past participants utilize skills in their operations.

The results showed that participants demonstrate a diverse range in the skills they utilized in their operations. Each participant faced individual challenges that impacted their operations, which impacted the skills they could employ.

Paul, an international participant, has run into issues with the availability of resources in his country and the lack of internationally shipped semen. Linda struggles with financial constraints in her operation. Modern equipment is expensive and not a possibility for many smaller operations. Participants mentioned that some skills they learned in the short course cannot be performed due to a lack of access to the proper equipment. Similarly, Patty faces a wide range of challenges in her operation that affected her use of skills she learned in the short course. Factors

that are out of her control, like delayed shipping, has prevented Patty from implementing some of the skills that were taught in the course. Another factor that influenced the implementation of skills in her operation is the constraints within her herd. Having aging mares or stallions in the operation limits some of the techniques they can use in their operations. Patty also mentioned financial constraints from the expenses involved in breeding.

Each participant had different goals and different set ups within their operations. The operation size, personal involvement, and the procedures they perform on-site were very different from one another. Misty owns her own broodmares, but she uses outside professionals to perform a majority of breeding. She emphasized that the short course has helped her communicate with breeding professionals. She uses the terms and vocabulary she used in the course often to communicate with equine professionals.

Paul's main goal was to better predict foaling and being able to manage their foaling mares. Paul only deals with the mare side of breeding and does not directly use skills from stallion side of the course. However, knowing the concepts from stallion breeding helps him understand how to communicate with stallion owners to increase the efficiency of his operation. Misty is also only involved in the mare side and uses outside services to breed her mares and buy semen from other stallion owners.

Linda deals with stallions and mares, but her operation only does pasture breeding. She uses the information she learned about breeding and estrous cycle manipulation to increase her herd's chance of successful pregnancies. Patty continues to use a variety of skills taught in the course. She manages a breeding herd and is in charge of teaching students the basics of equine reproduction. Her job managing the breeding herd requires her to use skills on mare and stallion management. Patty uses the skills to get the broodmare herd in foal every year. She is in charge

of selecting the stallions to breed the broodmares to. She is also in charge of foaling out the mares every year.

The examples provided above illustrate how each participant uses skills from the short course in their operations. Consistent with previous findings, the diverse operations and needs of the participants is also reflected in a highly diverse range of skills that are employed by them.

Finding #5: Participants' content knowledge increased.

Scores from the open ended questions show that all but one participant in 2021 increased their understanding from pre to post survey. The average score increased by 12%, with a mean score of 67% at the end of the course.

Interview participants were asked if they understood equine reproduction concepts better after the short course. Each participant felt their concept knowledge on equine reproduction concepts increased. Each participant utilizes different concepts from the short course, but reported a noticeable difference in how the concepts they learned affected their operations.

> *Paul:* I learned a lot on nutrition and the body weight of the mare and relation to fetal sex and majorly improved my understanding of nutrition and BCS.
>
> *Linda*: The course helped me learn about counting days in a cycle and knowing the correct days to breed on.
>
> *Misty:* I'm now educated on stallions and how and why they ship the way they do and the schedules.
>
> *Patty:* The course taught me how to get mares under lights properly to get team cycling early.

Despite the 1-2 year time span since they completed the course, the interview participants all shared specific concepts taught in the course that have positively impacted their work.

CHAPTER V

DISCUSSION

The short course reaches a large, diverse community. The data showed that participants worked in diverse equine contexts, which accounts for the very different expectations that they have for the short course when they enroll. Not surprisingly, different aspects were perceived as valuable by the participants, based on their context and needs. Overall, however, participants showed improvements in their conceptual understanding, found value in the course, and implemented, to varying degrees, skills that they learned in the course. A number of constraints exist that impact skill implementation, most notably their access to specialized equipment that is required for some skills. Participant confidence varies widely at the end of the course, which raises many questions that warrant further investigation.

This chapter proposes explanations for the findings, and makes recommendations for further research and future iterations of the course. All explanations and recommendations must be interpreted with caution due to the small sample size of this study. Further, the unique nature of this course limits the generalizability of the findings to other educational contexts.

Participant Diversity and Course Breadth

The diverse nature of the participants who enroll in the course can be interpreted as both a strong indicator of success and a challenge. The advertisement of the course is clearly reaching a wide audience, including Paul, who traveled to the U.S. to take the course so he could apply

this information to improve his operation overseas. In addition to a large geographic diversity, participants had a range of involvement in equine operations, years of experience, needs, and expectations. Thus, the course is reaching a broad audience in both recruitment and enrollment.

With such a high level of participant diversity, challenges are inevitable. Because participants' needs and expectations varied so widely, meeting those needs can be difficult. The course designers created a virtual "mare day" and "stallion day" and provided participants with the option of attending one or both days, this option was available for the 2021 online course. This indicates that they are aware of differing needs that participants may have, and are trying to reduce participant time receiving instruction that is not well aligned with the needs they have.

Participants' expectations and needs were broader than mares vs. stallions, however. Differences were also noted in terms of participants' desires to learn skills vs. concepts, and whether they wanted to have more knowledge to better communicate with outside breeders vs. take over the operation themselves. These differing desires may impact engagement in various aspects of the course, as well as perceptions of confidence. Those who have no plans to take over reproductive aspects of an operation may have low confidence in doing such tasks and have no intention of improving their confidence, thus impacting their effort in those aspects of the course that focus on specific skill development (Eccles & Wigfield, 2002). Research on motivation has indicated that individuals exert more effort to learn when task have high utility value, that is, the tasks are perceived as directly useful in some way (Clark, 1998; Olson, 1999). It can be assumed that the participants will have relatively high levels of general motivation, given that they opted to take the course and pay money for it. That said, participants tend to have a very specific goal in mind for what they want to gain from the course, and the sheer diversity of those goals

inherently makes any given topic in the course of interest to some and perceived as irrelevant or unimportant to others.

The current course design is taking a "breadth" approach by providing a wide array of concepts, skills, demonstrations, dissections, hands-on experiences, a tour, and more. The advantage to this is that all participants reported finding something to be of great value in the course. If participants find a particular topic to be of less interest or relevance to them, they do not have to wait long before the topic will shift toward something that is likely to be of higher relevance/interest. On the other hand, topics of great interest or relevance may not receive sufficient time and attention to develop a high level of understanding or competence. This issue is apparent to participants; the most frequent suggestion for improvement to the course is to add more time. A tension always exists between breadth and depth. Whenever breadth is a priority, depth is sacrificed to some degree.

Participant Learning and Implementation

An encouraging finding of this study is that participants expressed a greater level of understanding at the end of the short course, and 1-2 years later. The areas of greatest learning are associated with the areas that individuals found to be most valuable, a finding consistent with studies on motivation (Clark, 1998). Given the context of the course as an Extension opportunity that is intended to improve the practical knowledge and skills of those involved with equine operations, this finding is reasonable and appropriate. Expecting individuals to improve their knowledge across all topics equally in a non-compulsory, practical course is likely unrealistic. Participants expressed a high level of satisfaction with the course and what they learned, and they were using skills they learned 1-2 years later.

Of particular interest are the constraints that participants faced in using the skills that they learned. Participants performed most poorly on a survey question related to equipment, and they regularly under-reported the specific equipment needed to perform skills. Those interviewed 1-2 years after completing the course expressed concerns about the availability of equipment in their operations. One participant faced particular challenges due to issues importing equipment into the country, and others faced the challenge of equipment costs. While these issues may seem to be outside the control of the course designers, it is an issue that is impacting the implementation of skills that are being taught, which then impacts the economic impact of the course on equine operations.

The course designers may wish to investigate issues related to equipment that are likely to be faced by course participants. For example, are equipment borrowing programs available or possible? To what extent do participants know what equipment they will need to perform the skills taught in the course prior to their enrollment? Are less expensive alternatives available and addressed in the course?

Participant Confidence

Participants' reported confidence is a fascinating issue. Self-efficacy is positively associated with a number of outcomes in diverse fields such as teaching and business (e.g., Enochs & Riggs, 1990). That said, the well-known Dunning-Kruger effect illustrates that those who perform the most poorly on assessments are most likely to over-assess their performance. Novices often do not know what they don't know, so they can report high levels of confidence that can decrease over time as they learn more and realize how complex or difficult a task really is. Thus, the challenge when interpreting any data that reports confidence or self-efficacy is that

we may have Dunning-Kruger effects occurring for an unknown number of the participants due to their novice status.

The perennial question related to confidence is whether participants' self-reported confidence level is associated with their quality of implementation and their level of knowledge. In this study, instances occurred where two individuals scored equally in their knowledge, but reported vastly different levels of confidence in their abilities to perform skills. What accounts for this difference could be any number of factors: past negative or positive experiences, physical limitations that make skills difficult to perform, availability of knowledgeable and skilled others to assist, fears of making mistakes, etc. A longitudinal examination of participants would be illustrative to determine their reported self-confidence, the reasons they provide for their confidence level, and what they eventually do in their operations in instances when resources are available to do those skills.

In this study, recruiting individuals to participate in the interviews was particularly challenging. This is somewhat expected, given the voluntary nature of the request and lack of compensation, as well as the population that this course serves and the daily constraints on their time and their high level of focus on utility. A wide variety of times were offered for participants to sign up for interviews, however, with participants from across the globe, time zones could have played a role in time conflicts. The interviews were conducted in February and March. For most operations, this is the beginning of breeding season. Preparing for breeding season takes time and effort and could also have limited the participants' availability to participate in the interview.

However, another reason past participants may have avoided participation in the interview is that they were uncomfortable sharing their experiences after the course. For instance, if

participants had not tried any of the skills or made mistakes, they may be reluctant to share this information, possibly perceiving this as a reflection of their capabilities. Because most participants had such positive responses in the post survey about the course, they likely have positive views of the course instructors, which may further exacerbate their unwillingness to share personal mistakes or failure, for fear of disappointing them. This possibility further supports the need for follow-up studies on a more representative sample of the course participants to determine the extent to which the knowledge and skills being taught in the course are being transferred to the participants' operations.

Conclusions and Recommendations

Overall, the course is perceived by participants as valuable, despite the participants' widely varying backgrounds and expectations for the course. The existing emphasis on breadth is addressing topics of interest across this diverse participant group and is increasing their knowledge in these areas. The greatest challenge appears to be providing sufficient time for participants *in their topics of interest* for them to experience more depth, ask questions related to their specific operations, and practice new skills. Due to their widely differing interests, specialization of the course would likely need to occur in some way to meet these diverse needs.

A possibility exists that the course could be split in different ways to provide more depth in areas of need. Of course, any such changes might impact enrollment, and will require time and resources to offer and advertise. The course designers would need to look at current demand for the course to determine if enrollment can still be met through a more specialized version of the course.

Specialization could be achieved by adjusting the schedule of the course. Adding additional days could allow the participants more time with the experts and time to practice the skills.

Topic-specific “electives” could be offered within such an arrangement so that participants could choose how they spend a particular time period to gain more depth in a selected area. Allowing participants an option to select where they want to spend the extra time would allow them to learn more in-depth topics that are most useful to their operations. This type of specialization would still allow the participants to learn a holistic approach to equine reproduction with the opportunity to learn specific topics of their choice more in depth. I believe it is important that participants who may only deal with mares or stallions in their operations still learn about both sexes. There are a lot of concepts about stallions and mares that go hand-in-hand in equine reproduction. If participants don't gain understanding about mares *and* stallions, they may develop misconceptions that could hinder their operations’ efficiency.

Another option is splitting the course into multiple, specialized workshops that are organized by participants’ level of understanding before the course. Creating an advanced and beginner version of the course may address participants’ needs more directly. For more advanced participants, this approach would eliminate some of the basic concepts about equine reproduction and allow more time for depth with difficult concepts and skills. This approach could also encourage beginners who may be reluctant to sign up for the course. The beginner options may reduce some of the low confidence and apprehension that beginners may have.

The final option I recommend would be having a mare-only day and a stallion-only day, with the option for participants to choose if they would like to do just one or both days. This would give participants the opportunity to only learn the content within the side of the operations they are most interested in. The downside to this approach is that they will miss beneficial concepts if they only attend one day.

Despite the audience's diversity, the short course was able to increase content knowledge and teach participants skills they will perform in their own operations. Data showed that participants used skills they learned in the short course to increase the efficiency of their operations. Even though the participants are involved in very different operations, they found the short course positively impacted the efficiency of their operations, although more data is needed to ensure this claim is representative of the group as a whole given the self-selected nature of the interview participants.

As with all research in the social sciences, limitations exist in the study design and thus caution should be exercised when interpreting results. The small sample size and self-reported nature of the data limited the strength of the claims. The virtual nature of the 2021 short course made it difficult to obtain data from the participants. Not all participants answered the questions on the post survey, and this this reduced the sample size. Further, we do not know the extent to which the virtual 2021 course can be compared to the previous years' data. Teaching online is not the same as teaching face-to-face, and this may impact how well the 2021 participants can implement skills in their operations.

A final issue is that the interview participants reported what they are doing in their operations, but we do not know the extent to which they are performing these skills with accuracy and competence. Ultimately, this is the desired outcome for those who enter the course with the expectation that they will take over some or all reproductive aspects of their operation. This study provides important initial information that indicates that participants are finding the topics to be important, the methods used to be very useful to them, and that skills are being used by past participants. The next step is to determine the extent to which the knowledge and skills are being used for a representative sample of past participants, and the competency they have in

those skills. This will be important to determine in order to assess the economic impact of the course on equine operations.

REFERENCES

American Horse Council Foundation (2017). Economic Impact Study of the U.S Horse Industry. https://www.horsecouncil.org/economic-impact-study/

Brinsko, S. (2011). Manual of Equine Reproduction. 3rd Ed. Mosby.

Clark, R. E. (1998). The CANE model of motivation to learn and work: A two-stage process of goal commitment and effort. *Trends in Corporate Training*, 1-25.

Congressional Research Service. (2019). The U.S. Land-Grant University System: An Overview. https://crsreports.congress.gov/product/pdf/R/R45897

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*(1), 109-132.

Enochs, L. G., & Riggs, I. M. (1990). Further development of an elementary science teaching efficacy belief instrument: A preservice elementary scale. *School Science and Mathematics, 90*(8), 694-706.

Hughes, M., Bertram, S. M., & Young, A. M. (2020). Teaching animal behavior online: A primer for the pandemic and beyond. *Ethology*, 127, 14–31.

Lawrence, G. (1995). Some things to consider before getting your first horse. *Countryside & Small Stock Journal, 79(6), 35.*

Martinson, K. L., Bartholomay, T., Anderson, K. P., Skelly, C., Greene, E. (2012). Effective Evaluation of Equine Extension Programs. Journal of Equine Veterinary Science, 32(10), 616-619.

National Institute of Food and Agriculture(USDA). Smith Lever-Act of 1914 https://nifa.usda.gov/history

Olson, J. K. (1999). Learner factors associated with radical conceptual change among undergraduates. Unpublished doctoral dissertation. Los Angeles: University of Southern California.

Samper, J. (2009). Equine Breeding Management and Artificial Insemination. Second Edition. Saunders Publication.

Sayles, R. C. (1993). Economic analysis of Quarter Horse and Thoroughbred yearling production in Texas. Master's thesis, Texas A&M University.

Shackelford, P. W. (2014). Assessing perceptions, knowledge gain, behavioral change, and economic impact related to the adoption of best management practices by past participants

of the Texas A&M AgriLife Extension Service Multi County New Landowners Educational Series. Doctoral dissertation, Texas A & M University.

Strauss, A., & Corbin, J. M. (1990). Basics of qualitative research: Grounded theory procedures and techniques. Sage Publications, Inc.

Texas A&M AgriLife Extension (2020). Economic Impact Briefs. https://agrilifeextension.tamu.edu/

Texas A&M Equine Science. Texas Equine Industry Study (2015). https://equine.tamu.edu/boarding-a-horse/texas-equine-industry-study/

APPENDIX A

2019 SCHEDULE

Wednesday, January 9th

8:00am- Welcome & Introductions *Hildebrand Equine Complex*

8:15am- Reproductive Anatomy and Evaluation of the Stallion
Dickie J. Vest, DVM - Diplomate, American College of Theriogenologists
Diplomate, American Board of Veterinary Practitioners, Brazos Valley Equine Hospitals

10:00am- Break

10:15am- Stallion Nutrition
Dale Kelley, DVM, PhD. - Resident in Theriogenology, Texas A&M University Veterinary Medicine and Biomedical Sciences

11:15am- Lunch

12:45pm- Body Condition Scoring & Weight Estimation
Chelsie Huseman, PhD. - Horse Specialist, Texas A&M University

1:30pm- Krissy Schroeder - Breeding Manager, Texas A&M University
Whit Byers - Representative, Breeder's Choice - Demonstration iSperm & Botu Pharma Products

3:30pm- Preparation of Fresh Semen for Breeding and Cooling for Shipping
Krissy Schroeder - Breeding Manager, Texas A&M University

4:30pm- Semen Freezing and Storage
Jessica Hertel M.Ag. - Breeding Assistant, Birdsong Farms
Stephen Vogelsang, M.S. - Owner/Breeding Manager, Birdsong Farms

5:15pm- Adjourn

Thursday, January 10th

8:00am- Reproductive Anatomy and Evaluation of the Mare *Hildebrand Equine Complex*
Martha Vogelsang, PhD. - Retired Faculty Texas A&M University, Owner Birdsong Farms

9:00am-Reproductive Physiology of the Mare – The Estrous Cycle

Gary Williams, PhD. - Regents Fellow, AgriLife Research Faculty Fellow, ASAS Research Fellow,
Professor

10:00am- Break

10:15am- Broodmare and Young Growing Horse Nutrition
Matthew McMillan, PhD. - Nutritionist/Technical Sales, Hi Pro Feeds

11:15am- Lunch

12:45 pm- Reproductive Tract Exams and Evaluation of the Mare
Krissy Schroeder - Breeding Manager, Texas A&M University

1:30pm-Manipulation of the Estrous Cycle and Artificial Insemination of the Mare
Krissy Schroeder - Breeding Manager, Texas A&M University

3:30pm- Semen Collection & Evaluation
Krissy Schroeder - Breeding Manager, Texas A&M University

5:00pm-Adjourn

Friday, January 11th
8:00am-Troubleshooting Breeding Management *Hildebrand Equine Complex*
Stephen Vogelsang, M.S. - Owner/Breeding Manager, Birdsong Farms

9:00amFoaling and Parturition
Jennifer Zoller, PhD. - Horse Specialist, Texas A&M University
Professor

10:00am- Break

10:15am- Assisted Reproductive Technologies
Dickie J. Vest, DVM - Diplomate, American College of Theriogenologists
Diplomate, American Board of Veterinary Practitioners, Brazos Valley Equine Hospitals

11:15am- Lunch

12:45 pm- Artificial Lighting Management
Chelsie Huseman, PhD. - Horse Specialist, Texas A&M University
Krista Hazlett - Territory Manager, Equilume - Demonstration Equilume Light Mask

1:30pm-MPregnancy Examination

Rafael Martinez, M.S. - Graduate Student, Texas A&M University

2:30- On-the-farm Test Kits
Kailyn Capps - Austin County Extension Agent, Graduate Student, Texas A&M University

3:30pm- Open Session Based on Participant Interests in Stallion or Mare

5:00pm-Adjourn

APPENDIX B

2020 SCHEDULE

Wednesday, January 8th

8:00am- Welcome & Introductions **Hildebrand Equine Complex**

8:15am- Reproductive Anatomy and Evaluation of the Stallion
Dale Kelley, DVM, PhD. - Resident in Theriogenology, Texas A&M University Veterinary Medicine and Biomedical Sciences

9:45am- Break

10:00am- Nutrition on the Breeding Facility
Jennifer Zoller, PhD - Assistant Professor and Extension Horse Specialist, Texas A&M University

11:30am- Lunch

12:45pm- Body Condition Scoring & Weight Estimation
Ellen Black - Graduate Student, Texas A&M University

1:30pm- Semen Collection & Evaluation
Krissy Schroeder - Breeding Manager, Texas A&M University

3:30pm- Preparation of Fresh Semen for Breeding and Cooling for Shipping
Krissy Schroeder - Breeding Manager, Texas A&M University

4:30pm- Semen Freezing and Storage
Jessica Hertel M.Ag. - Breeding Assistant, Birdsong Farms

5:15pm-Adjourn

Thursday, January 9th

8:00am- Reproductive Anatomy and Evaluation of the Mare **Hildebrand Equine Complex**
Martha Vogelsang, PhD. - Retired Faculty Texas A&M University, Owner Birdsong Farms

9:00am- Reproductive Physiology of the Mare – The Estrous Cycle
Gary Williams, PhD. - Regents Fellow, AgriLife Research Faculty Fellow, ASAS Research Fellow, Professor

10:00am- Break

10:15am- Facility Management and Layout **New Horse Center**
Steve Cannon, MS- Manager, Livestock Operations Texas A&M University, Department of Animal Science

11:15am- Lunch

12:45pm- Reproductive Tract Exams and Evaluation of the Mare
Krissy Schroeder - Breeding Manager, Texas A&M University

1:30pm- Manipulation of the Estrous Cycle and Artificial Insemination of the Mare
Krissy Schroeder - Breeding Manager, Texas A&M University

3:30pm- Semen Collection & Evaluation
Krissy Schroeder - Breeding Manager, Texas A&M University

5:00pm- Adjourn

Friday, January 10th

8:00am- Troubleshooting Breeding Management **Hildebrand Equine Complex**
Stephen Vogelsang, M.S. - Owner/Breeding Manager, Birdsong Farms

9:00am- Break

9:15am- Foaling and Parturition
Susanne Kahn - Graduate Student, Texas A&M University College of Veterinary Medicine

10:15am- iSperm Demonstration
Chelsie Huseman, PhD - Assistant Professor and Extension Horse Specialist Texas A&M University

11:15am- Lunch

12:45pm- Artificial Lighting Management
Ashton Dunkel - Graduate Student, Texas A&M University, Department of Animal Science

1:45pm-Pregnancy Examination
Rafael Martinez, M.S. - Graduate Student, Texas A&M University, Department of Animal Science

2:30pm- On the Farm Test Kits
Mattea Much, M.S. - Graduate Student, Texas A&M University, Department of Animal Science

3:30pm- Open Session Based on Participant Interests in Stallion or Mare

5:00pm- Adjourn

APPENDIX C

2021 SCHEDULE

Wednesday, January 6th

9:00am- Welcome & Introductions

9:15am- Reproductive Anatomy and Evaluation of the Stallion
Sheila G. Spacek, DVM, MS, Veterinary Resident, First Year - Theriogenology, College of Veterinary Medicine & Biomedical Sciences, Texas A&M University

10:15am-Stallion Nutrition*Jennifer Zoller, PhD. - Horse Specialist, Texas A&M University*

11:15am-Break

12:30pm- Semen Collection & Evaluation
Krissy Schroeder - Breeding Manager, Texas A&M University

1:30pm- Preparation of Fresh Semen for Breeding and Cooling for Shipping
Krissy Schroeder - Breeding Manager, Texas A&M University

3:00pm- Semen Freezing and Storage
Jessica Hertel M.Ag. - Breeding Assistant, Birdsong Farms

4:00pm- Adjourn

Thursday, January 7th

9:00am- Welcome & Introductions

9:15am- Reproductive Anatomy and Evaluation of the Mare
Martha Vogelsang, PhD. - Retired Faculty Texas A&M University, Owner Birdsong Farms

10:15am- Reproductive Physiology of the Mare -Hormonal and Seasonal Control of the Estrous Cycle
Gary Williams, PhD. - Regents Fellow, AgriLife Research Faculty Fellow, ASAS Research Fellow, Texas A&M University

11:15am- Break
12:30pm- Broodmare Horse Nutrition

Jessica Leatherwood, PhD. - Assistant Professor, Department of Animal Science, Texas A&M University

1:30pm- Reproductive Tract Exams and Evaluation of the Mare
Sheila G. Spacek, DVM, MS, Veterinary Resident, First Year - Theriogenology, College of Veterinary Medicine & Biomedical Sciences, Texas A&M University

2:30pm- Manipulation of the Estrous Cycle and Artificial Insemination of the Mare
Krissy Schroeder - Breeding Manager, Texas A&M University

4:00pm- Adjourn

Friday, January 8th

9:00am- Welcome & Introductions

9:15am- Troubleshooting Breeding Management
Stephen Vogelsang, M.S. - Owner/Breeding Manager, Birdsong Farms

10:15am- Tour of Texas' finest reproduction facility, **Cinder Lakes Ranch** in Valley View, TX and Q&A with leading industry professionals, owners Rick and Jade Ford

11:15am- Break

12:30pm- Artificial Lighting Management Systems
Chelsie Huseman, PhD. - Horse Specialist, Texas A&M University

1:30pm- Body Condition Scoring and Weight Management for Breeding Efficiency *Chelsie Huseman, PhD. - Horse Specialist, Texas A&M University Jennifer Zoller, PhD. - Horse Specialist, Texas A&M University*

2:45pm- On-the-farm Test Kits for Foaling
Ellen Black, Graduate Student, Texas A&M University

3:30pm- Final Q&A with Short Course Professionals

4:00Ppm - Adjourn

APPENDIX D

2019-2020 SURVEY

1. Do you have access to an ultrasound, densimeter (blue box or similar) and/or weight scale for use with your horses?

2. After participating in this short course, what percentage of your operation do you now feel you could take over and do?

3. Have you handled and collected a stallion prior to attending the short course?
4. Have you handled and collected a stallion prior to attending the short course?

5. Have you processed and shipped semen prior to attending the short course?
How proficient would you consider yourself?

6. Have you artificially inseminated a mare prior to attending the short course?
How proficient would you consider yourself?
7. What part of the short course did you find the most meaningful?

8. What part of the short course did you find the least meaningful?

9. Did you find the cost of the short course to be a fair price for the education, training, and materials that were received?

10. If an additional one day was to be offered to cover in depth training for freezing semen, would you attend for an additional cost?

11. Please select the following supplemental materials that were helpful to you in your learning at the short course:

APPENDIX E

2021 SURVEY

1. Do you have access to an ultrasound, densimeter (blue box or similar) and/or weight scale for use with your horses?

____ Ultrasound

____ Densimeter

____ Weight Scale

____ None

2. After participating in this short course, what percentage of your operation do you now feel you could take over and do?

____ %

3. Have you handled and collected a stallion prior to attending the short course?

____ Yes

____ No

How proficient would you consider yourself?

___ Fair

___ Good

___ Excellent

4. Have you processed and shipped semen prior to attending the short course?

____ Yes

____ No

How proficient would you consider yourself?

___ Fair

___ Good

___ Excellent

5. Have you artificially inseminated a mare prior to attending the short course?

____ Yes

____ No

How proficient would you consider yourself?

___ Fair

___ Good

___ Excellent

6. What part of the short course did you find the most meaningful?

7. What part of the short course did you find the least meaningful?

8. Did you find the cost of the short course to be a fair price for the education, training, and materials that were received?

____ Yes

____ No

9. If an additional one day was to be offered to cover in depth training for freezing semen, would you attend for an additional cost?

____ Yes

____ No

10. Please select the following supplemental materials that were helpful to you in your learning at the short course:

____ Presentation notebooks

____ Product catalogs

____ Company representatives

____ Reproductive Techniques textbook

Open-Ended Questions

1. What pieces of equipment are needed to analyze semen?

2. Describe the mare's reproductive tract.

3. How is a stallion handled for collection?

4. How can you increase reproductive efficiency in a breeding operation?

5. What terms might a veterinarian or breeding professional use to describe preparation of a mare for breeding?

APPENDIX F

RESEARCH QUESTIONS

1. What content knowledge, if any, is gained by participants after the completion of the course?

2. What is the impact of the course on participants' confidence in performing the skills they learned?

3. What skills do past participants use in their own operations?

4. What factors influence the past participants' use or non-use of skills learned in the course?