



Northern New York Agricultural Development Program 2019 Project Report

Assessing the Effect of E-learning Training Systems on Milk Quality and Dairy Parlor Performance

Project Leaders:

- Paula Ospina DVM, MPH, PhD, Extension Associate, QMPS Ithaca Laboratory, Animal Health Diagnostic Center, 240 Farrier Rd, Cornell University, Ithaca, NY 14853-8002; pav5@cornell.edu, 607-253-3933
- Paul D. Virkler, DVM, Senior Extension Associate, QMPS Canton Laboratory, Animal Health Diagnostic Center, 34 Cornell Drive, Newell Veterinary Technology Building, SUNY Canton, Canton, NY 13617; pdv3@cornell.edu, 315-379-3930

Collaborators:

- Wolfgang Heuwieser, DVM; Adjunct Professor; Cornell University
- Valeria Alanis Gallardo, DVM; Cornell University

Cooperating Producers:

St. Lawrence County	Jefferson County	Franklin County	Clinton County	Lewis County
Chambers Farm	Doubledale Farm	Carsada Farm	Carter Farm	Marks Farm
Greenwood Dairy	Morning Star Farm	Metcalf Farm	Rusty Creek Farm	
Kelly Farm				

Background:

Mastitis research has focused on developing strategies to improve udder health, milk quality, and other considerations recently to promote judicious antibiotic use. Nevertheless, achieving or maintaining high standards for best practices depends on dairy employees and remains a constant challenge for many dairy farms, mainly due to a lack of consistency of work performance and insufficiently skilled work teams. There is no doubt that strategic management of human capital is a necessity for a productive team.

By definition, a Standard Operating Procedure (SOP) is a set of written instructions that document a routine or repetitive activity. The term SOP may also be used interchangeably with protocol. The development and consistent implementation of SOPs are integral parts of a successful work system, as they provide individuals with the information required to properly perform their jobs. Also, if clearly

written, SOPs can minimize miscommunication and variation between individuals. A good example where a SOP is helpful for a dairy farm business is the milking routine.

Although most dairy producers and industry professionals would agree that both initial-hire and ongoing employee training is essential to assuring proper adherence to SOPs, the practical logistics of on-farm training are a limiting factor. Based on a recent USDA–APHIS report, less than 60% of the employees among all the dairies in the U.S. received any kind of training (USDA National Agricultural Statistics Service Census of Agriculture, 2014).

Insufficient training of farm employees has been argued by some to be the cause of lower detection of health problems and poor milking technique (Gutierrez-Solano et al, 2011). In many cases, dairy farms in the U.S. depend on Spanish-speaking labor and many on-farm managers are limited in their Spanish-speaking abilities. Recent growth in the number of Latino employees on dairy farms complicates management-to-employee and employee-to-employee relationships. It is often the case that a co-worker, who may have limitations in communication skills, trains most employees on the job. Without ongoing evaluation and training, assuring adherence to protocols is impossible. In addition to the benefits of training, it is important to note that there is a desire for more information by employees. A recently published study showed that employers oftentimes underestimate the employees' interest in learning and commitment to the success of the farm (Durst et al., 2018).

Since 1946, Quality Milk Production Services (QMPS) has worked directly with farms on improving milk quality and udder health, and promoting judicious use of antibiotics particularly through mastitis pathogen identification and comprehensive training and education. Although there are four QMPS laboratories across New York State, developing a face-to-face connection with all farms is impossible. Identification of training methods that would allow broader and more efficient access to more farms would benefit both farms and the dairy industry in Northern New York (NNY). Additionally, improving employee knowledge and providing user-friendly training may increase employee satisfaction.

An alternative approach to face-to-face training is to provide the SOPs to the people that need them in a manner that is easy-to-understand and follow, and allows evaluation and feedback. Research from Germany shows that e-learning modules may be able to fill that gap. Employee engagement during e-learning was high and the modules were effective at creating a feeling of confidence and accuracy in work performance (Hesse et al., 2018). A cloud-based learning management system (LMS) provides the platform to distribute these learning modules in an efficient manner to areas where in-person training can be difficult to schedule. This is especially true for new employees as they begin employment. The main goal is that farms that have access to this training will have better adherence to milking SOPs, and improved parlor performance, including reduced risk of mastitis and improved udder health.

This Northern New York Agricultural Development Program-funded e-learning study was conducted on 10 commercial dairy farms across five counties in NNY between July 2019 and January 2020.

Methods:

Phase 1. Baseline Survey

For each of the 10 participating farms, we first performed an extension survey, which consisted of assessment in the following areas:

- 1) Equipment analysis involving average claw vacuum, milk line vacuum during milking, and graphing all pulsators
- 2) Milker assessment re: milking routine timing, milk flow rate analysis, unit alignment scoring, teat end cleanliness scoring, and dip coverage
- 3) Cow assessment involving teat scoring, strip yields, and udder hygiene scoring.

This baseline survey assessed the opportunity areas for the farms to reduce the risk of mastitis and identify bottlenecks that might impede employee performance. For each farm we prioritized our recommendations and then only looked at the top three priorities.

Phase 2. Development of e-learning Modules on the LMS System

Over a five-month period, we worked on designing an interactive online training system using Gomo Learning suite[®] as an authoring tool. The main idea was to use a story about a milker who needed help so that the user could relate to the experience. The module which was developed is about how to perform a proper milking routine and has seven sections corresponding to the seven steps in a milking routine. We estimated that each section would take the user only two to three minutes to complete with the entire training lasting approximately 15-20 minutes.

Each section includes embedded videos, pictures, and text to add to the information on how and why every step is necessary in a proper milking routine. These elements are simple and straightforward in order to keep the learning process less stressful and engaging. Questions related to the milking process and management on each farm are available. See the Appendix for two screen shots of pages from the module.

Phase 3. Introduction to the e-learning Tool

An initial training visit was made to each of the 10 farms to provide access to the training software during an employee meeting. During the first few visits, we delivered a card with the webpage, username, and password to allow access to the training site for each individual milker. We then discovered that this was too difficult for some, so a QR code was created. Using the QR code, employees just had to scan the code to get to the website (www.lecheat.gomocentral.com/login).

During this training meeting, we asked 3 questions from a list of 24 questions to each individual milker. These questions all related to milking procedures, and were selected using a random number generator. An example question is: “Why is post-dip needed?” Their answers were recorded using voice memos on a cellphone and then saved into an electronic folder. There were two goals for this activity:

- 1) assess the baseline knowledge level of these milkers, and
- 2) evaluate the effectiveness of the learning module in transmitting information.

We divided the results of their answers into 4 categories: correct, partially correct, incorrect, did not answer according to the level of accuracy.

In the start of the training module for each milker, each milker answered seven questions to open the module. These questions were inserted to better understand the type of training that each milker had already been exposed to and to gauge the level of experience of each milker. An example question is: “Did you receive training when you started?”

Phase 4. Re-assess Milking Data Post-Training

A second follow-up visit was performed on each farm to evaluate the effect of the e-learning tool on parlor performance outcomes. We specifically targeted teat end cleanliness care during this visit but also collected data on routine timing as well as dip coverage. We also interviewed some individual milkers about their experience with the module. Unfortunately due to timing and schedules, we were not able to follow up with repeating the individual milker questions that they had been asked prior to completing the training.

Results/Data Analysis: Baseline Survey Findings

From the baseline survey, 100% of the 10 farms had one or more of the top three priorities that involved milker performance, reinforcing the need for additional milker training on these farms.

On the other hand, Forty percent (4 farms) of the participating farms had a major equipment issue that needed to be corrected prior to evaluating milkers in one or more of the categories. For example, one farm did not have a functional unit alignment device that milkers could use to properly align units. This meant that farm owners on these four farms needed to make equipment changes in order to give their milkers the ability to do their job well.

We assessed teat end cleanliness after prep on each individual farm prior to milkers completing the training module. We calculated a composite score for each farm of what percentage of teat ends were clean after prep. The average score across all farms was 41% of the teat ends scored as clean and no farm scored higher than 66% clean. The QMPS goal for this would be that at least 80% of the teat ends would be clean after prep. This meant that none of the farms reached the QMPS goal, demonstrating a need for training on these 10 farms in this critical area for mastitis control.

The results for the three randomized pre-training questions asked to each milker in order to assess their level of knowledge prior to completing the training follow.

Table 1: Results for randomized pre-training questioning of workers on 10 NNY farms; E-learning systems project, NNYADP, 2019.

Correct	Partially correct	Incorrect	Did not answer
33%	39%	17%	10%

These results supported one of the main assumptions of this project which is that milkers need additional training on why each step in the milking routine is important since 76% of the questions were not answered fully correct. Many milkers were performing each step of the milking routine but did not know why.

Table 2 shows the responses for the seven questions asked of workers at the start of the modules.

Overall the results of the seven questions support our initial assumptions that many milkers (especially Spanish-speaking employees) on farms are being trained by co-workers and that re-training is not occurring for many milkers. It is interesting to note that among the Spanish-speaking employees almost half had not milked cows before this farm (46%) and had worked less than six months (48%) on this farm. This also reinforces a need for a good on-boarding tool that employers could use for new employees to explain the whys of a milking routine since many of their applicants are lacking the basic knowledge gained from growing up on a farm or previously working on a farm.

Completion of e-learning Modules by Milkers

We worked with 89 employees (16 English-speaking (ES) and 73 Spanish-speaking (SS)). Most of the training was completed using a smartphone (72% ES, 93% SS). A total of 67 employees completed up to 50% of the modules, nine up to 75%, and thirteen up to 100%. Five employees completed the entire training (three ES and two SS).

Table 2: Results for seven questions at the start of the module, E-learning systems project, NNYADP, 2019.

Question	Spanish (n=57) Percent	English (n=10) Percent
Have you milked cows before you worked on this farm?		
Yes	54	70
No	46	30
Did you receive training when you started?		
Yes	84	78
No	16	20
Who trained you on this farm? Check all that applies.		
Coworker	50	38
Manager	22	38
External professional	2	0
Nobody	4	0
Other: IDENTIFY ?	4	0
Coworker and Manager	19	25
How is training done on the farm?		
Only when you arrive	42	44
Routinely, example every few months	36	44
Only when something bad happens	7	0
Never	3	0
I don't know	12	11
Are you satisfied with that training?		
Yes	87	78
Not sure	12	0
No	2	22
Which shift do you work?		
Day	47	89
Night	40	0
Other	13	11
How long have you milked dairy cows on this farm?		
Less than a month	13	0
1-6 months	35	11
More than 6 months	52	89

We were disappointed that not all employees completed the entire module but in our analysis of this data we came up with some interesting divisions that may help explain:

The odds of completing more than 50% of the training module was 2.9 higher based on farms that have Wi-Fi access compared to no Wi-Fi access ($p=0.02$).

The odds of completing more than 75% of the training module is 3.9 higher based on farms that have Wi-Fi access compared to those with no Wi-Fi access ($p=0.02$).

This has two main components:

- 1) Access to internet in rural communities: Wi-Fi has become a more relevant tool for everyday working practices. Internet is vital for any industry, including a dairy business. Applications requiring high transmission speeds have become an integral part where the productivity and

competitiveness depends mainly on a business's capacity to generate, process, and apply efficiently knowledge-based information.

- 2) Owner culture/farm culture: Some owners avoid installing and providing Wi-Fi to their employees because they think it will decrease productivity. We think it may be possible for employers to have some sort of temporary passwords that would allow access for a limited period of time. This would allow employees to complete a training module such as we have developed and may also help to provide data about worker productivity during this period. This data could then be used to make a more permanent decision on providing wireless access to employees.

The odds of completing the training on a smartphone was 5.5 higher compared to using a desktop computer ($p < 0.001$). Even if employees used a desktop computer, some completed the module. This proves that both means of access are equally suitable for a successful training but e-learning tools must be formatted for smartphones.

Overall, the lack of module completion may be subjectively explained by the following factors:

- 1) Employees are not comfortable using the internet as an education tool
 - For example: We discussed using "YouTube" for continued training and most Spanish-speaking workers were not familiar with "YouTube."
- 2) Different levels of literacy
 - For example: When we asked workers to write out the URL (first farm, first training), it was obvious that some were nervous and unable to follow the directions. The module contained a fair amount of text which may also have been a deterrent for some.
- 3) Internet/wireless access:
 - On some farms there was good internet access in the buildings, but on others it was only available outside. Some farms provided wireless access to their employees while others did not.
- 4) Unclear expectations from farm management about completing the module
 - On some farms, employees were given work time to complete the module but on others they were expected to do it on their own time.
- 5) Our module was not engaging enough to keep their interest.

Post-training Assessments

We re-assessed teat end cleanliness after prep approximately two weeks after milkers were introduced to the training module. Each milker was individually assessed. We discarded the results from any milker that had not resumed the training in the online module. We then compared the results for each farm before and after the training.

The average teat end cleanliness score went from 41% to 61% of teats clean. **In 100% of farms we saw an improvement in the percentage of teats that were clean for those milkers that had resumed the training but only one farm reached the QMPS goal.** Although we saw improvement when milkers understood more about why they needed to wipe the teat ends, our subjective interpretation as we watched them do this step was that the online format did not do a good job at teaching the specific technique needed. An in-person meeting would most likely be superior to demonstrate the specific hand technique needed to correctly clean the teat ends or the use of better videos or graphics in an online module.

We evaluated the milking routine timing and attempted to evaluate the flow rate data for those herds that had automated milking equipment. The challenge that we quickly realized was that since only a

percentage of the milkers completed the module we could not use the overall timing or flow rate data because it did not reflect an individual milker's ability.

Individual Farm Management and Milker Feedback

Overall, managers on the 10 farms were eager for training tools to better educate their employees based on their response to being included in the grant project. It was more difficult than we anticipated, however, for farmers to persuade their employees to complete the training. Many farm owners assumed that we would walk them through the entire training on the day that we introduced the module but we wanted each employee to complete it on their own. For the next phase of the grant, we plan to have the employees individually complete the module while sitting in the meeting so that it can be completed on work time.

One farm owner stated he would welcome this e-learning tool as a critical piece of his on-boarding process and important that all new employees understand the material in the module. If we could provide a document that showed the employee had completed the training that would further help the farm satisfy the necessary training documentation needed for other programs such as the FARM program.

One point of feedback from an individual milker was that it took him much longer than 15-20 minutes to complete the module. He said that he wanted to fully learn the material and that it took him close to one hour to complete the module. This will need to be considered in future module development.

Conclusions/Outcomes/Impacts:

This project indicates that farms in NNY could benefit from additional employee training in the milking center. We learned that employers are very interested in additional tools to help train their employees but with some restrictions. We built an e-learning module that provided a way to reach employees with training on the how and whys of a successful milking routine. In the process of testing this e-learning module with farm employees and attempting to assess its impact we encountered unexpected challenges for attention in the next phase of this project. Overcoming these challenges in phase two should lead to an excellent tool that employers can use with new employees and as a refresher course with any employee.

One of the challenges encountered is literacy. A lack of basic reading and writing skills by employees was a constant over the 10 farms. Future module development will account for this by using a different approach such as the use of voice and recordings throughout the modules. This point was mentioned in feedback after training in the short interviews.

An additional consideration is that the QR codes have to be used to facilitate using the module on smartphones. We also need to provide an easier log-in method for milkers as it was a deterrent to some to type a long email as the user name.

For the next phase of the project, we will have employees complete the entire module individually while sitting in a training room on work time. This will ensure a much higher rate of completion and will allow us to more successfully assess the impact of this type of e-learning tool. We also will attempt to build into the next phase of the project some sort of completion standard and certificate that can be used by employers to document that training has occurred.

Outreach:

The results of this project to-date were presented at the following meetings:

1. Cornell Cooperative Extension. January 3, 2020; Brushton-Moira Legion, Moira, NY
2. Cornell Cooperative Extension. January 22, 2020; Lowville Elks-Moira, Lowville, NY

3. Cornell Cooperative Extension. January 24, 2020; Watertown Elks Lodge, Watertown, NY
4. National Mastitis Council Meeting Short Course. January 28, 2020; Orlando, FLA
5. Clinton County dairy producers meeting. TBD in 2020

Next Steps:

1. Create a second training module that describes the basic functions of milking equipment. This will include a quick guide to pulsators, claws, and vacuum. Milkers will use the module to increase their skills and be able to detect problems with the milking equipment earlier, leading to less risk of teat damage and a more efficient milking center. We will incorporate the knowledge gained from this project's phase one on how to make the module more likely to be successful in transferring information to milkers.
2. The detailed goal for the second training is to develop a focused tool that will include information about when a liner is not properly placed in the shell, when a vent hole is plugged and how to open it, how to evaluate the vacuum gauge to check vacuum at each milking, how to feel if pulsation is working in a liner, and what to do if milk or water is in the pulsation line. For advanced milkers, we will focus more in depth on equipment function and start to relate this to teat end health, flow rates, and mastitis.

As we develop the second module, we will alter the first module with the improvements so that both modules can be used as a package to help NNY farms better train their employees.

References:

- USDA National Agricultural Statistics Service Census of Agriculture. 2014. Accessed 24th Oct 2018. https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/monitoring-and-surveillance/nahms/nahms_dairy_studies
- Durst, P. T., S. J. Moore, C. Ritter, and H. W. Barkema. 2018. Evaluation by employees of employee management on large US dairy farms. *Journal of Dairy Science* 101:7450-7462.
- Gutierrez-Solano, C., A. Ceballos-Marquez, and Y. H. Schukken. 2011. Bilingual trainings for milkers in New York State: A success for quality milk. Pages 191–196 in *Udder Health and Communication*. H. Hogeveen and T. J. G. M. Lam, ed. Wageningen Acad. Publ., Wageningen, the Netherlands.
- Hesse, A., Ospina, P., Wieland, M., Leal Yepes, F.A., Nguyen, B., and Heuwieser, W. 2019. Short communication: Microlearning courses are effective at increasing the feeling of confidence and accuracy in the work of dairy personnel. *Journal of Dairy Science* 102: 9505-9511.

For More Information:

- Paula Ospina DVM, MPH, PhD, QMPS Ithaca, NY; pav5@cornell.edu, 607-253-3933
- Paul D. Virkler, DVM, QMPS Canton; pdv3@cornell.edu, 315-379-3930

Northern New York Agricultural Development Program 2019 Project Report APPENDIX

Assessing the Effect of E-learning Training Systems on Milk Quality and Dairy Parlor Performance

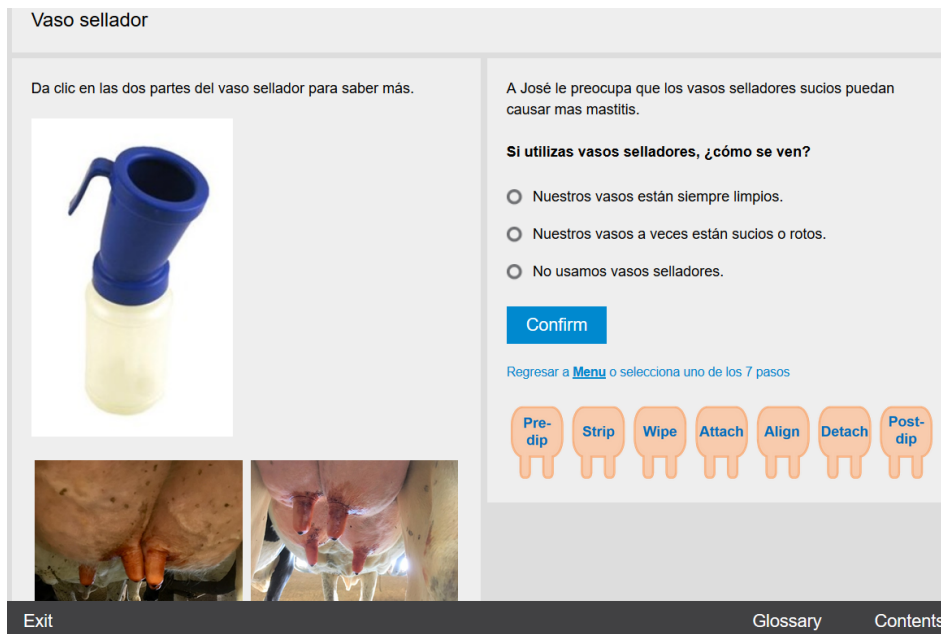


Figure 1. Screen shot from the Spanish version of the milker-training e-learning module tested on 10 NNY farms, 2019, NNYADP.

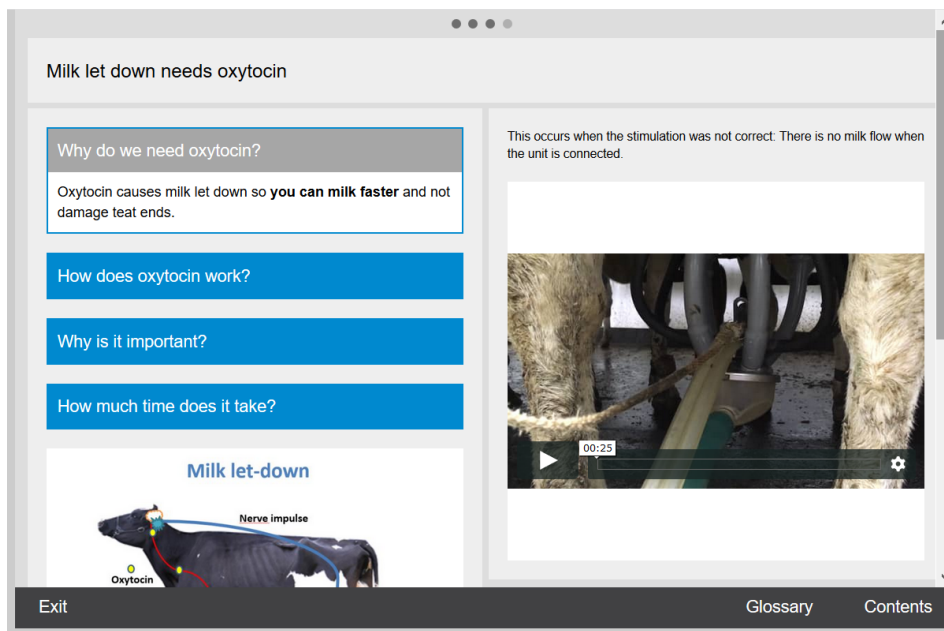


Figure 2. Screen shot from the English version of the milker-training e-learning module tested on 10 NNY farms, 2019, NNYADP.