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The effectiveness of virtual and on-site dairy farm field trips to increase student knowledge in science, social studies, and health and wellness standards

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GRADUATE SCHOOL
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By Abby Marie Sweet

Entitled

The Effectiveness of Virtual and On-Site Dairy Farm Field Trips To Increase Student Knowledge in Science, Social Studies, and Health and Wellness Standards.

For the degree of Master of Science

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07/28/2014

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THE EFFECTIVENESS OF VIRTUAL AND ON-SITE DAIRY FARM FIELD TRIPS
TO INCREASE STUDENT KNOWLEDGE IN SCIENCE, SOCIAL STUDIES, AND
HEALTH AND WELLNESS STANDARDS

A Thesis

Submitted to the Faculty

of

Purdue University

by

Abby M. Sweet

In Partial Fulfillment of the

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of

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ABSTRACT

Sweet, Abby M. M.S., Purdue University, August 2014. The Effectiveness of Virtual and On-Site Dairy Farm Field Trips to Increase Student Knowledge in Science, Social Studies, and Health and Wellness Standards.

The integration of agriculture into the curriculum can be difficult for educators when materials and resources are not aligned with state learning standards. However, online educational tools, such as virtual field trips that are aligned with state learning standards, can allow for educators to bring the experience of a field trip to the classroom, as well as complement curriculum in the classroom. Virtual field trips also assist with removing many barriers that prevent educators from taking their students on an on-site field trip.

This study sought to describe the effectiveness of a virtual and on-site dairy farm field trip in teaching Science, Social Studies, and Health and Wellness standards to study participants. Additionally, this study sought to describe associations between enjoyment of a virtual and on-site dairy farm field trip and knowledge gained in specific Science, Social Studies, and Health and Wellness standards. A virtual dairy farm field trip was developed by the researcher to teach specific Science, Social Studies, and Health and Wellness standards in the context of a dairy farm. This study took place during the spring and there were seventy-two on-site dairy farm field trip study participants and one

hundred and twenty-five virtual dairy farm field trip study participants. Using a quantitative method approach, study participants' knowledge was assessed using pre-/post-tests. Virtual dairy farm field trip study participants were assessed regarding their knowledge gained and enjoyment of the virtual dairy farm field trip. On-site dairy farm field trip study participants were assessed regarding their knowledge gained and enjoyment of the on-site dairy farm field trip.

Findings revealed that both a virtual and on-site dairy farm field trip were effective methods of teaching study participants specific Science, Social Studies, and Health and Wellness standards. This study also found that enjoyment and knowledge gained in the specific Science, Social Studies, and Health and Wellness standards addressed were not associated.

CHAPTER 1. INTRODUCTION

1.1. Introduction

Enhancing student knowledge related to specific academic standards is very important in current classroom teaching strategies. When connected to classroom curriculum and state standards, an on-site field trip is one example of an informal learning environment that provides youth with an opportunity to attain a greater understanding of the agricultural industry, and relevant academic standards such as science, social studies and health and wellness. . However, barriers such as time limitations, lack of alignments with classroom curriculum, funding and distance to travel may prevent teachers from taking their students on an on-site field trip. Educational technologies such as a virtual field trip help teachers eliminate some of these barriers and still give youth a meaningful learning experience.

The National Research Council (2009) suggested that agriculture that is integrated into the K-12 curriculum be aligned with state learning standards, which assists teachers in determining where material fits into their classroom curriculum. State learning standards serve to increase expectations for student academic performance (Balschweid & Huerta, 2008). However, lack of resources, as well as teachers' past experiences are among the barriers that influence the development of agriculturally-related curriculum materials to be used in the classroom (Trexler & Hikawa, 2001). However, when

combined with informal agricultural experiences, content provided to students in the classroom can help youth gain a greater understanding of the agricultural industry (Hess and Trexler, 2011). Therefore, educators need to provide opportunities for agricultural experiences that give youth the chance to initiate an interest or enjoyment with regards to agriculture. These experiences can assist youth in becoming informed decision makers (Hess and Trexler, 2011) and possibly lead to career decisions (Beale, 2000; Cassady, Kozlowski, & Kommann, 2008).

Well-organized field trips can provide such educational experiences for youth, as well as promote motivation and enhance learning (Morentin & Guisasola, 2014). While field trips provide great learning experiences, they often lack a connection to curriculum does not make for a meaningful learning experience for students (Kisiel, 2006).

Furthermore, there are multiple factors or hurdles, such as distance, time, funding, and curriculum constraints, that prevent teachers from being able to provide their students with an opportunity such as an on-site field trip (Anderson, Kisiel, & Storksdieck, 2006; Elleven, M. Wircenski, J. Wircenski, & Nimon, 2006; Garner & Gallo, 2005; Nespore, 2000).

Educational technologies are a tool that can alleviate some of the barriers that prevent educators from taking their students on field trips. E-learning or online learning can be defined as the use of web-based tools to deliver instruction or training and promote learning (Mayer & Clark, 2011; Sun, Tsai, Finger, Chen, & Yeh, 2008). The use of web-based tools gives students the opportunity to relate concepts learned in different subject areas in the classroom to real-life examples (Roschelle, Pea, Hoadley, Gordin, & Means, 2000). Similarly, field trips allow youth to apply concepts learned in the

classroom to real life contexts (Elleven, M. Wircenski, J. Wircenski, 2006; Tuthill & Klemm, 2002). Therefore, virtual field trips that utilize web-based tools cannot only provide alternatives to barriers of physical field trips but provide youth with meaningful learning experiences (Cassady, Kozlowski, & Kommann, 2008).

When connected to classroom curriculum and not treated as a stand-alone experience, on-site field trips give students an opportunity to connect their in-class learning and develop an overall meaningful learning experience. While there are many barriers that can hinder an educator from taking their students on an on-site field trip, educational technologies help prevent some of these barriers. Educational technologies such as a virtual field trip not only bring the experience of an on-site field trip to the classroom but also can enhance and provide focus for an on-site field trip.

1.2. Significance

On-site field trips are not always practical for a teacher to take advantage of. However, virtual and on-site field trips give youth an opportunity to be exposed to many career options and initiate an interest in many of these options. The effectiveness of the virtual field trip in teaching specific standards can not only assist in future development of virtual field trips. Furthermore, the effectiveness of the virtual field trip in teaching specific standards can assist a teacher in eliminating some of the barriers that can prevent him or her from taking their students on an on-site field trip.

According to the U.S. Environmental Protection Agency (2012), only 2% of Americans live on a farm and less than 1% claim farming as their primary occupation. However, agriculture generally accounts for 22% of employment in the United States,

including those in the production phase to those in retail (Scott, 2004). Agricultural experiences provide an opportunity for youth to be able to communicate about agriculture and this interest could potentially influence their career decisions. Field trips are just one example of an experience that can offer various opportunities to demonstrate to youth the many possibilities of career paths that they can choose (Beale, 2000; Cassady, Kozlowski, & Kommann, 2008).

This study will also assist in the future development of online learning modules as an effective alternative to an on-site agricultural experience. In today's society, the presence and use of digital technologies are more widespread than ever before (Flanagin & Metzger, 2008). The use of online learning venues, can allow students to review background information about a particular topic before coming to class or it can assist teachers in determining areas where students seem to be struggling (Lawrence, 2012).

Furthermore, while teachers stress that a field trip that fits within classroom curriculum is important, time constraints have prevented teachers from being able to plan if their instructional unit of the curriculum coincided with the field trip (Anderson, Kisiel, & Storksdieck, 2006). Therefore, by providing information regarding the outcomes and effectiveness of the virtual field trip as an alternative to the on-farm tour, educators may be able to freely choose when to use this module as a way to provide an agricultural experience that coincides with their curriculum.

Similar to an on-site field trip, a virtual field trip can expose students to many career options and give students a chance to initiate an interest in these career options. A virtual field trip can serve as an effective alternative to an on-site field trip by bringing the experience of the field trip into the classroom through a technology medium. The

effectiveness of a virtual field trip can enhance not only students' in-class learning, but also an on-site field trip.

1.3. Purpose

The purpose of this study was to assess if an online dairy virtual field trip is an effective method of teaching selected Science, Social Studies, and Health and Wellness standards to 2nd grade students. This study assessed if an on-site dairy field trip is an effective method of teaching selected Science, Social Studies, and Health and Wellness standards to 3rd grade students.

1.4. Research Questions

The following questions guided the study:

1. Does participation in a virtual dairy farm field trip increase knowledge gained in specific Science, Social Studies, and Health and Wellness standards?
2. Does participation in an on-site dairy farm field trip increase knowledge gained in specific Science, Social Studies, and Health and Wellness standards?
3. Does the level of enjoyment of participants in the virtual and on-site dairy farm field trips impact knowledge gained in specific Science, Social Studies, and Health and Wellness standards?

1.5. Assumptions Guiding the Study

The following assumptions were made by the researcher.

1. Youth were able to read and understand pre-/post-test questions and statements.
2. Youth were able to read and understand the activities and information in the virtual dairy farm field trip.
3. Youth read and followed the directions for completing the pre-/post-tests and answered all questions honestly.
4. Participating schools had access to the necessary computer equipment and technology needed to complete the virtual dairy farm field trip.
5. Participating schools had adequate time for the on-site and virtual field trip and adequate time for completing the pre-/post-tests.
6. Data were analyzed by the researcher without a bias.
7. The virtual field trip and the on-site field trip were similar in objectives and content.

1.6. Limitations of the Study

The following were limitations of the study.

1. The level of knowledge and previous experience youth have with agriculture could influence how much they learn from this experience.
2. Study participants knowledge and familiarity with online learning could affect knowledge gained.

3. Technology limitations in schools could prevent certain features in the virtual dairy farm field trip from properly working.
4. Time constraints imposed by the school schedule could hinder study participants from completing all activities and reading through all information presented in the virtual dairy farm field trip.
5. Study participants may be less distracted in a computer lab than those study participants on the on-site dairy farm field trip.

1.7. Terms

Active learning - Active learning refers to both the cognitive and behavioral learning that takes place when the learner is physically engaged with an activity or when they are cognitively paying attention to material and structuring it into a mental model (Mayer, 2002).

e-learning - “The use of telecommunication technology to deliver information for education and training” (Sun, Tsai, Finger, Chen, & Yeh, 2008, p. 1183).

Indiana Academic Standard for 2nd grade students: Health and Wellness Standard 2.1.1 (Indiana Department of Education, 2014) - Identify that healthy behaviors affect personal health.

Indiana Academic Standard for 2nd grade students: Health and Wellness Standard 2.7.1 (Indiana Department of Education, 2014) - Demonstrate healthy practices and behaviors to maintain or improve personal health.

Indiana Academic Standard for 3rd grade students: Health and Wellness Standard 3.1.1 (Indiana Department of Education, 2014) - Identify the link between healthy choices and being healthy.

Indiana Academic Standard for 3rd grade students: Health and Wellness Standard 3.7.1 (Indiana Department of Education, 2014) - Name healthy behaviors.

Indiana Academic Standard for 2nd grade students: Science Standard 2.3 (2014) - Observes, ask questions about and describe how organisms change their forms and behaviors during their life cycles.

Indiana Academic Standard for 2nd grade students: Science Standard 2.4.2 (Indiana Department of Education, 2014) - Identify technologies developed by humans to meet human needs. Investigate the limitations of technologies and how they have improved quality of life.

Indiana Academic Standard for 3rd grade students: Science Standard 3.2.5 (Indiana Department of Education, 2014) - Describe natural materials and give examples of how they sustain the lives of plants and animals.

Indiana Academic Standard for 3rd grade students: Science Standard 3.4.2 (Indiana Department of Education, 2014) - Give examples of goods and services provided by local business and industry.

Indiana Academic Standard for 2nd grade students: Social Studies Standard 2.4.4 (Indiana Department of Education, 2014) - Research goods and services produced in the local community and describe how people can be both producers and consumers.

Indiana Academic Standard for 3rd grade students: Social Studies Standard 3.4.2

(Indiana Department of Education, 2014) - Give examples of goods and services provided by local business and industry.

VFT- A virtual field trip “embraces a range of instructional approaches and technologies but generally denotes a multimedia presentation that brings the sights and sounds of a distant place to the learner through a computer” (Klemm & Tuthill, 2003, p. 178).

CHAPTER 2. REVIEW OF LITERATURE

2.1. Purpose of the Study

The purpose of this study was to assess if an online dairy farm tour is an effective method of teaching Science, Social Studies, and Health and Wellness to 2nd grade students. This study will assess if an on-site dairy field trip is an effective method of teaching selected Science, Social Studies, and Health and Wellness standards to 3rd grade students.

2.2. Research Questions

The following questions guided the study:

1. Does participation in a virtual dairy farm field trip increase knowledge gained in specific Science, Social Studies, and Health and Wellness standards?
2. Does participation in an on-site dairy farm field trip increase knowledge gained in specific Science, Social Studies, and Health and Wellness standards?
3. Does the level of enjoyment of participants in virtual and on-site dairy farm field trips impact knowledge gained in specific Science, Social Studies, and Health and Wellness standards?

2.3.Theoretical Frameworks

2.3.1. Cognitive Theory of Multimedia Learning

The instructional design principles of the Cognitive Theory of Multimedia Learning (Mayer, 2001) guided the design of the virtual field trip. These principles include: the multimedia principle, spatial-contiguity principle, temporal contiguity principle, modality principle, specific redundancy principle, coherence principle, and the personalization principle, which are discussed in the following sections.

The design of an online learning module should consider the learner and how he or she processes information (Mayer, 2001). The Cognitive Theory of Multimedia Learning (CTML), outlined in Figure 1, consists of three assumptions that help describe the cognitive processes that occur when using multimedia learning (Mayer, 2001; Chen, She, Wu, & Wang, 2009). The dual-channel assumption states that there are two separate channels that process visual and auditory information independently (Mayer, 2001; Mayer, 2002; Chen, She, Wu, & Wang, 2009). The second assumption made is the limited-capacity assumption, which asserts that people can process only a limited amount of information simultaneously in the auditory and visual channel (Mayer, 2001; Mayer, 2002; Chen, She, Wu, & Wang, 2009). The last assumption made in the Cognitive Theory of Multimedia Learning is the active-processing assumption which states that “people engage in active learning by paying attention to relevant incoming information, organizing selected information into coherent mental representations, and integrating mental representations with other knowledge” (Chen, She, Wu, & Wang, 2009 p. 2).

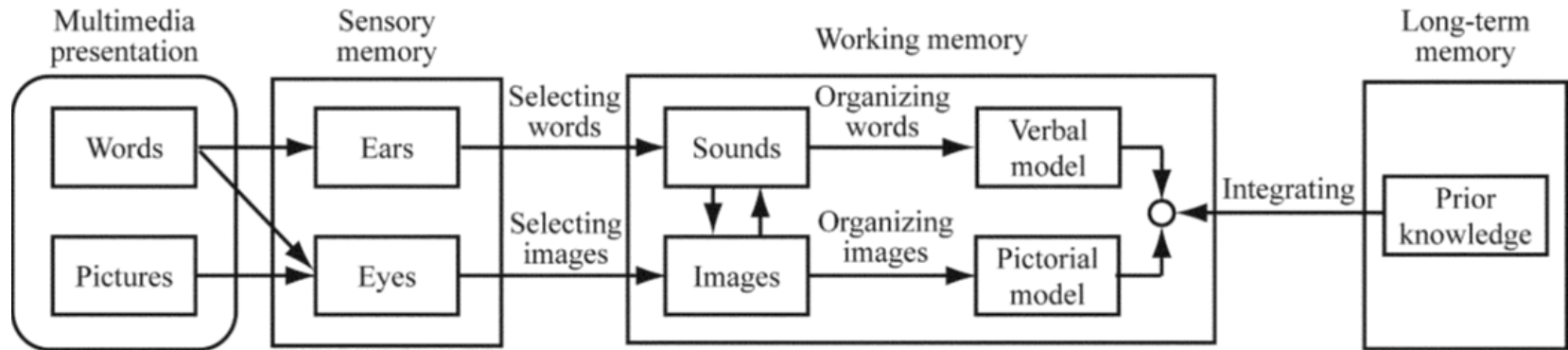


Figure 1 Cognitive Theory of Multimedia Learning (Mayer, 2001, p. 61). The arrows in this figure represent how the user process information and the boxes represent how the user stores the information that is processed (Mayer, 2008).

Within the active processing component framework, five processes must take place cognitively to ensure that effective learning occurs (Mayer, 2005). The first two processes are the selection of relevant words and the selection of relevant images. The selection of relevant words can occur in either the audio or visual channel. The selection of relevant images involves selecting parts of the picture (Mayer & Moreno, 2003) and then putting these parts into a visual image base in the working memory (Mayer, 2005). After the audio and visual bases are represented in the working memory, they need to be organized. The process of organizing selected words and images involves the learner making connections amongst verbal representation and amongst image representations to make sense of the information (Mayer, 2005; Mayer & Moreno, 2003). Since a learner's working memory has cognitive limitations, the connections that are made must be simple and finally, the learner must integrate his or her prior knowledge in their long-term memory and make connections to the verbal and image bases in the working memory (Mayer, 2005).

2.3.1.1. Multimedia principle

The multimedia principle states that people learn better from words and pictures rather than from words exclusively (Mayer, 2005). However, as the age of the reader rises, the inclusion of pictures accompanying words tends to decrease since the reading level increases (Mayer, 2005). Therefore, younger audiences may not have as high of a reading level and the inclusion of pictures with text may help with the sense-making process.

2.3.1.2.Spatial-contiguity principle

The spatial-contiguity principle suggests that when words and pictures are used together, they should be coordinated and located in close proximity to each other, which reduces extraneous processing by the learner (de Jong, 2010; Mayer, 2005). The spatial-contiguity principle states that youth make better use of their memory capacity by grouping pieces of similar information together (Brown, Cocking, & Bransford, 2000).

2.3.1.3.Temporal contiguity principle

The temporal contiguity principle refers to the use of animations in multimedia. When using animations and narration in a multimedia lesson, use them at the same time instead of explaining the animation and then having the animation happen (Mayer & Moreno, 2003).

2.3.1.4.Modality principle

Another design principle regarding the use of animations is the modality principle. If animation is included in the multimedia design, it is better to use a narration such as spoken text instead of written text (Mayer, 2005). The use of both spoken text and visual information is more effective than just showing a picture or just using text (Mayer, 2005). However, animation does not always lead to increased test performance and therefore computer-based animations may need additional help from the teacher to explain to students how to process animations (Mayer, Hegarty, Mayer, Campbell, 2005).

2.3.1.5. Specific redundancy principle

The specific redundancy principle and the coherence principle provide further design guidelines for reducing extraneous cognitive load. Extraneous cognitive load can occur due to the instructional design in which unnecessary information and elements must be processed in the working memory at the same time (Wong et al., 2012). The specific redundancy principle states that the same information should not be presented in multiple formats (animation, text, and pictures) simultaneously (Mayer & Johnson, 2008). When designing a multimedia lesson or presentation, it is best to exclude any extraneous or redundant information that will hinder the sense-making process of the learner (Mayer, 2005).

2.3.1.6. Signaling principle

The signaling principle is another way to reduce extraneous cognitive load by highlighting essential material or organizing information into sections with headings (Yue, Kim, Ogawa, Stark, & Kim, 2013). The signaling principle helps in guiding the user's attention to essential information and therefore assisting him or her to ignore extraneous information (Mayer, 2005).

2.3.1.7. Personalization principle

The personalization principle can also be used as part of instructional design in which words are presented to learners in conversational style rather than formal style,

such as using ‘your’ instead of ‘the’, without creating any extraneous cognitive load (Mayer, Fennel, Farmer, & Campbell, 2004).

2.4. Scaffolding

In addition to the Cognitive Theory of Multimedia Learning, the theory of Scaffolding (Wood, Bruner, and Ross’ theory of Scaffolding, 1976) also guided the study. Scaffolding was originally thought of, and described as, how a parent guides young children to essential information in language development, as well as breaking information down into a more manageable way for learning (Wood, Bruner, & Ross, 1976). Scaffolding has since been described as the guidance that allows a child to learn concepts they would not be able to learn or accomplish on their own (Hammond & Gibbons, 2005; Puntambekar & Hubscher, 2005).

A major feature of scaffolding is that it should enable learning to take place even when the guidance or support is removed (Wood, Bruner, & Ross, 1976). Support building and support fading are two aspects that help describe scaffolding (Chen, Kao, & Sheu, 2003). The temporary guidance or support that the adult or teacher provides to the children or novice plays a crucial role in scaffolding. The support should be temporary to allow for the child to succeed on their own, but be available if needed (Hmelo-Silver, 2006). Fading support should not be completely removed, which would leave the learner with no support (Azevedo, Cromley, Winters, Moos, & Greene, 2005). Therefore, educators should be cognizant of their students’ understanding of concepts and what concepts they still are struggling with to make any adjustments (Hammond & Gibbons, 2005). When learners are given help with a task but lack understanding of the experience,

the guidance is limited to that specific experience and there is no support for learning (Resier, 2002).

Scaffolding can be used to support a variety of instructional objectives, including learning domain knowledge (Azevedo & Hadwin, 2005). There are two types of scaffolds: hard scaffolds and soft scaffolds. “Hard scaffolds are static supports that can be anticipated and planned in advance based on typical student difficulties with a task” (Saye & Brush, 2002, p. 81). Soft scaffolds are situation-specific and require the teacher to be constantly cognizant of the concepts students appear to be struggling with so that they may step in and provide support (Brush & Saye, 2002).

With the increased use of computers in today’s classrooms, the concept of scaffolding has begun to be used to describe the features or tools that can be utilized by computers to support learning (Pea, 2004). Scaffolds used in technological settings should be designed to meet the cognitive needs of the learner for a specific context (Sharma & Hannafin, 2007). Question prompts are just one scaffolding strategy that can be utilized to assist learners in online learning environments and direct them to important information in the lesson (Ge & Land, 2003). While question prompts can be integrated into the online lesson, question prompts can also be provided by the teacher, peers, or other students (Lim, 2004).

Some limitations to scaffolding are also described in the literature. Scaffolding that encourages more reflection and questioning is better for more mature learners, whereas directive scaffolding is better for youth or novices (Beyer, 1997). In order to adjust the amount of support given to meet the learner’s needs, educational technologies need to be able to provide many options to the learner and therefore technology can

sometimes be limited as compared to an actual human tutor or guide (Sharma & Hannafin, 2007). Therefore, scaffolding is a balancing act, in which too much scaffolding can cause students to lose their determination to learn and too little scaffolding can leave students frustrated and losing motivation to learn (Dabbagh, 2003).

2.5. Conceptual Framework

2.5.1. Active Learning

Active learning is just one method that can be utilized by educators to engage youth in the learning process (Prince, 2004). Using the method of active learning, youth have the ability to choose what they learn and how strongly they will challenge themselves mentally when it comes to learning (Stern & Huber 1997). Active learning environments encourage students to construct their own mental models with the information they are learning (Modell & Michael, 1993).

There are two kinds of active learning, behavioral and cognitive. Behavioral active learning describes the physical interactions that occur such as using the mouse to click buttons that are on the computer; cognitive active learning refers to when the learner is paying attention to relevant information and organizing the information into their own mental model (Mayer, 2002). While the physical, hands-on interactivity can provide meaningful learning, behavioral interactivity does not always mean that there is cognitively active learning taking place (Mayer, 2005).

Students in online learning environments have the opportunity to have more flexibility in when they learn and what they learn (Floyd, Koohang, Smith, & Yerby, 2012). Online learning environments can employ a variety of instructional tools to

promote active learning. Tools such as video clips, quizzes, assessment surveys, or presentations can be used to promote active learning in an online learning environment (Phillips, 2005). Furthermore, the role of the teacher in an online environment that incorporates active learning should be that of a facilitator, in which they may guide discussion or summarize the lesson (Phillips, 2005).

Active learning involves independent inquiry and the structuring and restructuring of knowledge (Niemi, 2002). Active, meaningful learning occurs when the learner is “attending to relevant information, mentally organizing it into a coherent structure, and integrating it with what they already know” (Mayer & Clark, 2011, p. 35). These concepts of structuring and restructuring of knowledge are the results of the individual’s schemata prior to the educational experience. A schema describes the already existing information and knowledge that the learner has about a particular topic (Hess and Trexler, 2011). When youth are able to connect old or previous experiences with new experiences, they are actively learning (Noel & Colopy, 2006; Noel, 2007). However, a challenge for a novice is that they do not always have prior knowledge into which they are able to integrate new information (Shapiro, 1999).

Another aspect of active learning is the social element of learning and the social interactions that take place regarding the educational experience. According to the National Research Council (2010), learning is very much a social interaction and designers of informal science experiences can develop activities that encourage interactivity, discussion, and reflection among the learners. Collaboration among peers concerning a learning activity promotes active learning because students must be able to articulate their understanding regarding the topic to another peer, as well as asking and

answering questions (Michael, 2006). Therefore the process of learning this information but also sharing it with others is an important aspect of active learning.

Within active learning, perceptions that youth have regarding the educational activity will play a vital role regarding the success of an educational tool in effectively teaching agricultural concepts (Kane, 2004). By determining what youth liked and did not like about the online learning module and how information was perceived, future development of these digital tools for schools and county extension offices can be improved upon. Kane (2004) further explains that within active learning, activities should be carefully selected to enhance the level of interest that youth have regarding the topic area.

Constant assessment is another important element to an active learning environment. Assessments should provide teachers with information or feedback on how well their students are learning and then adjust classroom activities based on student performance and needs (Modell & Michael, 1993).

2.6. Agriculture as a context for learning

In 2000, the National Council for Agricultural Education placed emphasis on the integration of agricultural concepts across multiple subject areas. However, curriculum constraints, limited resources, and educators' discomfort teaching agriculture in the classroom are just a few factors that can hinder educators from integrating agriculture into their classrooms (Knobloch & Ball, 2003). The integration of agriculture within the K-12 curriculum should be aligned with state standards which assist the teacher in finding a place where the material fits within their curriculum (National Research

Council, 2009). Teachers determine classroom curriculum based on state standards, which they believe will help better prepare students for state standardized tests (Bellah & Dyer, 2009). Educators are more willing to integrate agriculture if they see the educational benefit and if the material is perceived to be a good fit within certain subject areas (Knobloch, 2008).

Previous research on the development of programs to provide agricultural experiences, such as science fairs (Blackburn, 1999; Boleman & Burrell, 2003) and in-class programs, allow youth to be engaged and have a hands-on approach to learning (Baker & Mabie, 1996; Reidel, Wilson, Flowers, & Moore, 2007). While experiential learning (Dewey, 1938) activities, such as supervised agricultural experiences or Agriculture in the Classroom, provide an avenue for students to apply concepts learned in the classroom to real life experiences (Dailey, Conroy, & Shelley-Tolbert, 2001), they are not always practical due to financial limitations of the school (Trexler, Johnson, & Heinze, 2000). In 2012, the National Research Agenda, published by the American Association for Agricultural Education, identified one of the focal points for future research as determining better delivery method preferences and effectiveness of agriculturally related information. Practical examples and resources, such as online modules, should assist the teacher in making abstract concepts fit and apply to the classroom curriculum (National Research Council, 1988).

Similar to the National Council for Agricultural Education's (2000) plea for the integration of agriculture into other school subjects, the American Association for the Advancement of Science (1989) urged educators to connect science with other science-related areas. Science education should provide opportunities for youth to explore career

options and see the real-life application in their everyday life (DeBoer, 2000). In 2011, the 4-H National Headquarters released the 4-H Mission Mandates, encouraging youth and adults to work together to bring about change in the community. Two of the identified areas include Science and Healthy Living. One of the goals of this mandate is the integration of science, in the context area of animal science and agriculture, into learning “through inquiry based opportunities that connect knowledge, skills, and resources to practical application across multiple settings” (4-H Mission Mandate, 2011, p. 2).

Many youth do not understand positive nutritional choices or the origins of their food (Holz-Clause & Jost, 1995). Elementary school educators in Michigan also saw the value of promoting healthy living through agriculture (Trexler, Johnson, & Heinze, 2000). Students were unable to make the connection regarding a good diet and overall health and therefore teachers wanted to be able to educate their students about positive healthy, nutritional choices (Trexler et al., 2000). As identified previously, one of the focal points for the 4-H Mission Mandates (2011) is Healthy Living. One of the objectives of the Healthy Living mandate is to provide youth and their families with opportunities to make decisions regarding healthy choices. Furthermore, another objective is to improve nutrition and well-being of not only the individual but the community as well (4-H Mission Mandate, 2011).

2.7. Field Trips

2.7.1. On-Site Field Trips

An on-site field trip serves as the bridge between formal and informal learning by adding relevancy and realism to content in the classroom (Tuthill & Klemm, 2002). As one of the largest target audiences of educational venues such as museums, zoos, and aquariums, school groups visit these places for a meaningful science learning experience (Rennie & McClafferty, 1995). Furthermore, on-site field trips add variety to teaching (Raskind, Smedley, & Higgins, 2005), as well as transport students out of the classroom and give them the opportunity to learn and interact in an informal environment (Nespor, 2000).

When connected to the curriculum, field trips provide opportunities for students to connect their in-class learning and create an overall meaningful learning experience (Kisiel, 2006; Noel, 2007; Stoddard, 2009). Field trips can serve as an introduction to new topics in the classroom or even be utilized as a way to tie information together from an instructional unit once it is completed (Cox-Petersen & Melber, 2001). Factors such as age can also play an important role in the success of a field trip. Youth who are older tend to benefit more from a longer visit to an educational venue, whereas younger youth benefit more from shorter informal learning experiences (Cassady, Kozlowski, & Kommann, 2008). Additionally, younger youth gain more from field trips when educators spend more time preparing and integrating activities for the trip in class (Davidson, Passmore, & Anderson, 2009).

A field trip can be more effective and successful when educators relate and connect content being learned in class to the future field trip or refer back to the field trip

(Cassady, Kozlowski, & Kommann, 2008). Stoddard (2009) recommended that educators work with field trip site guides and experts to provide a more meaningful learning experience for students. Field trips to the physical site can also encourage youth to begin thinking about potential career options by gaining first-hand experience (Beale, 2000).

However, field trips do not always provide the most conducive environment for learning. Students may miss information that is being presented due to distractions in the environment, or they may have a difficult time trying to hear or listen while taking in their surroundings (Tuthill & Klemm, 2002). On-site field trips may also be less effective when incorporated as a standalone experience with no follow-up with students about the experience (Bellan & Scheurman, 1998). After the field trip, teachers should allow students to reflect on what they learned or experienced on the field trip to reinforce important concepts. On-site field trips, such as visiting a museum, aquarium, or zoo, are not always feasible for schools and educators for a number of reasons. Barriers that can keep classrooms from participating in an on-site field trip include timing of the trip, funding, transportation and curriculum constraints (Cox-Petersen, & Melber, 2001; Elleven, Wircenski, M., Wircenski, J., & Nimon, 2006; Nespor, 2000).

2.7.2. Virtual Field Trips

A virtual field trip brings the experience of an on-site field trip to the classroom through a technology medium and assists an educator in eliminating barriers that may prevent them from taking their students on an on-site field trip (Cassady, Kozlowski, & Kommann, 2008). With the variety of multimedia formats available, information can be

presented in different ways and thereby meet the needs of different learning styles (Raskind, Smedley, & Higgins, 2005). A virtual field trip gives the learner more autonomy by letting them make their own observations without any guidance or without being at the actual location (Stainfield, Fisher, Ford, & Solem, 2000).

Virtual field trips are just one resource that allows educators to assist their students in making connections from in-class learning to out-of-class learning and real-life contexts (Cox & Su, 2004). Virtual field trips can be as complex as video conferencing with subject experts and virtual experiences to something as simple as a PowerPoint presentation (Kirchen, 2011). Even a website that provides educational resources for educators can serve as a virtual experience. Various art museums have begun providing educational resources online for teachers to use in their classroom regarding works of art (Wetterlund, 2008).

Virtual field trips can be either asynchronous or synchronous. Asynchronous virtual field trips are those that are not presented in real-time, whereas synchronous virtual field trips are interactive and give students the opportunity to ask questions to other educators or content area experts (Zanetis, 2010). There can also be pre-developed virtual field trips and teacher-created virtual field trips. One of the disadvantages of a pre-developed virtual field trip, as compared to a teacher-created virtual field trip, is that educators are unable to update, edit, or modify the content for their students to make it personal to them (Kirchen, 2011). Teacher-created virtual field trips can allow educators the ability to create content that can be matched toward curriculum as well as use language that matches the students' reading level (Tuthill & Klemm, 2002).

While a virtual field trip does not replace the interactions and experiences gained from an on-site field trip (Cox & Su, 2004; Garner & Gallo, 2005), it can serve as an effective alternative (Zanetis, 2010). Virtual field trips simply cannot fully replace the physical field trip experience, including location, smells, and sounds which help students interpret information (Placing & Fernandez, 2002).

Wood (as cited in Placing & Fernandez, 2002, p. 42) suggests that virtual field trips should serve to enhance and support rather than replace an on-site field trip as well as enhance in-class activities (Tuthill & Klemm, 2002). While curriculum constraints may prevent educators from spending time on preparing their students for a field trip or doing a follow-up after the visit (Anderson, Kisiel, & Storksdieck, 2006), an in-class virtual field trip can be used to prepare students and/or serve as a follow-up for the physical field trip (Klemm & Tuthill, 2003; Raskind, Smedley, & Higgins, 2005; Kirchen, 2011). In a study of fourth-grade teachers and a local history site, educators wanted material and short activities that they could do with their students to prepare them for the actual field trip (Noel & Colopy, 2006).

There are also other advantages that a virtual field trip has over a physical field trip. One advantage to a virtual field trip is that it is not limited to factors such as “time, weather, distance, and physical strength” (Çalışkan, 2011, p. 3240). Furthermore, virtual field trips remove any accessibility issues or dangers that may hinder students with disabilities or special needs from attending a physical field trip (Elleven, Wircenski, M., Wircenski, J., & Nimon, 2006; Kirchen, 2011).

2.8. Youth and Online Learning

With the vast amounts of technology readily available in today's society, opportunity and potential for learning are also increasing (Flanagin & Metzger, 2008; Raskind, Smedley, & Higgins, 2005). Furthermore, youth are being exposed to technology at a younger age. According to Gutnick, Robb, Takeuchi, and Kotler (2011), 50% of youth between the ages of six and nine use the internet daily, with eight-year olds using the internet the most. Education and the way information is presented and taught to students are transforming through the integration of technologies into the classroom and curriculum (Sun, Lin, & Yu, 2007). Computers provide learning opportunities and experiences for youth that they may not normally be able to have access to (Roschelle, Pea, Hoadley, Gordin, & Means, 2000). The US Department of Education (2010) found that students who participate in online learning score higher on the same educational material than students who participate in traditional face-to-face interactions. Furthermore, Sun, Lin, and Yu (2007) found that the use of web-based tools to teach science to primary school children had a positive influence in accommodating varying learning styles, as well as increasing science learning in youth.

There are many different formats of educational technologies used to promote learning among users. Many educational technologies designed for youth use a game as their delivery method of information (Tüzün, Kızılkaya, Yılmaz-Soylu, İnal, & Karakuş, 2009; Miller & Robertson, 2011; Virvou, Katsionis, & Manos, 2005). The use and design of digital technologies in the classroom, specifically elementary or primary school, should promote playful mastery and competence (Umaschi Bers, 2012). Tüzün et al. (2009) found that the use of a computer game to learn geography increased students'

intrinsic motivation while decreasing their extrinsic motivation and therefore students were not motivated by grades but by independent interaction and exploration of the game. While intrinsic motivation refers to doing a task simply because you enjoy and are interested in it, extrinsic motivation is doing a task in hopes of receiving a reward, such as a good grade in school (Deci & Ryan, 2000). Virvou et al. (2005) found that the use of an educational game to educate students about geography made students more enthusiastic and motivated to learn, as well as allowed them to be more collaborative with others or independent.

While educational games offer positive outcomes, they also have limitations. Computer play does not always act as a supporter for learning due to limitations. These limitations include not explaining why answers are incorrect and youth not being familiar with the technology, and difficulties in youth reading the instructions (Stephen & Plowman, 2005). Younger youth, such as preschoolers, need more educator guidance through the game or learning module in order to achieve more solid and active forms of learning (Stephen & Plowman, 2005).

Non-collaborative online learning can be enhanced through methods such as learner reflection and self-monitoring (U.S. Department of Education, 2010). Assessment is also an important factor in e-learning environments. To be effective, assessments should be included within the online lesson (Nugent, 2003) and therefore reflect curriculum and instruction (Pellegrino, Chudowsky, & Glaser, 2001). Unlike classroom instruction, computers can provide students with immediate feedback (Anderson, Corbett, Koedinger, & Pelletier, 1995).

2.9. Summary

The integration of agriculture into the curriculum can be difficult for educators when content is not aligned with state learning standards. Field trips, both on-site and virtual, can be effective components of the classroom curriculum when aligned with state learning standards. Virtual field trips can remove some barriers that prevent educators from taking their students to an on-site field trip. This study sought to describe the effectiveness of a virtual and on-site dairy farm field trip in teaching specific Science, Social Studies, and Health and Wellness standards. Additionally, this study sought to describe relationships between enjoyment of a dairy virtual and on-site field trip and knowledge gained in Science, Social Studies, and Health and Wellness standards.

CHAPTER 3. DAIRY FARM FIELD TRIP

3.1. Purpose of the Study

The purpose of this study was to assess if participation in an on-site dairy farm field trip is an effective method of teaching Science (Sc), Social Studies (SS), and Health and Wellness (HW) to 3rd grade students. This study assessed the enjoyment and effectiveness of an on-site dairy farm field trip.

3.2. Research Questions for the Study

The following questions guided the study:

1. Does participation in an on-site dairy farm field trip increase knowledge gained in specific Science (Sc), Social Studies (SS), and Health and Wellness (HW) standards?
2. Does the level of enjoyment of participants in an on-site dairy farm field trip impact knowledge gained in specific Science (Sc), Social Studies (SS), and Health and Wellness (HW) standards?

3.3. Materials and Methods

3.3.1. Background of the Dairy Farm

The dairy farm in this study is located in central Indiana and has been giving educational tours for school groups and organizations for seven years. Educational tours provided by the farm address specific Indiana learning standards for the different grade levels that visit the farm (<http://www.kelsayfarms.com/index-8.html>). Tours last for an hour and are offered during four weeks in the fall, two weeks in the spring, and one week in the summer. The dairy tours given in the spring are more educationally focused, whereas tours in the fall include other activities that students can do after the tour. A tour take one hour for visitors to complete and includes three major stops. At the milk house stop, visitors learn about the process of milking cows and the process of getting milk from the farm to the grocery store. The next stop on the tour is the free-stall barn where students learn about the daily care, nutritional needs, and management of dairy cows. The last stop on the tour is the dairy food tent. In the dairy food tent, visitors learn about dairy foods and why they are important for their overall health. They also learn about making healthy nutritional choices and how it affects their overall health.

3.3.2. Participants

The seventy-two study participants for the on-site field trip were a convenience sample from an elementary school that was registered to visit the participating dairy farm described earlier. The researcher anticipated using a 2nd grade group for data collection,

however there were no 2nd grade groups that signed up for a tour and the closest available age group was 3rd grade.

Data were collected from three third grade classrooms in the spring that visited the dairy farm with their school group. The educational tour coordinator communicated with teachers at the school to determine their consent and willingness to participate in the study. Teachers were sent an e-mail (Appendix A) that informed them of the purpose and specific procedure of the study. Pre-tests and post-tests were given at the school in the students' home room classrooms.

3.4. Instrumentation and Data Sources

This descriptive study used a pre-/post-test design. A unique number was assigned to each youth participant which allowed for no personal information to be collected. This unique number allowed for pre-/post-tests to be linked to assess knowledge gained. The unique number was assigned to study participants based on their seating arrangement in the classroom. The format of the unique number started with a number assigned to the school, followed by the classroom number then the student's unique identification number.

Questions on the pre/post-test were derived directly from third grade learning objectives set by the educational tour coordinator at the family dairy farm. The educational tour coordinator developed the farm visit learning objectives to target specific Indiana third grade learning standards for Science, Social Studies, and Health and Wellness (Table 1). The educational tour coordinator's extensive experience in her seven years of providing educational tours to the public, academic background in

Agricultural Economics, serving as a 4-H Youth Extension educator ,and being one of the family members who assists in running the dairy farm, determined the activities and standards that are addressed in every dairy farm tour.

The first column in Table 1 lists the Indiana academic standard and the second column gives a description of the standard. The third column in Table 1 describes where each standard is addressed and the activity that corresponds with that standard.

Table 1

Third Grade Standards Addressed Through Participation in an On-Site Dairy Farm Field Trip

Indiana Standard^a	Description of Standard	Activity Addressing Standard
Sc 3.2.5	Describe natural materials and give examples of how they sustain the lives of plants and animals.	Occurs at the free-stall barn. The tour guide discusses the six breeds of dairy cows and how they milk Holsteins. She explains age and gender and if they have had a calf. Also, a discussion about how much a cow eats and drinks in one day.
Sc 3.4.2	Define the uses and types of simple machines and utilize simple machines in the solution of a “real world” problem.	Occurs in the milking room. Explanation of the process of delivering the milk from the farm to the store and those involved in the process. Also discusses the milking machines.
SS 3.4.2	Give examples of goods and services provided by local business and industry.	Occurs in the milking room and dairy Station. Explanation of how the farm produces certain dairy food products and discussion of what types of dairy foods youth consume.
HW 3.1.1	Identify the link between healthy choices and being healthy.	Occurs at the dairy station. Explanation of how important calcium, minerals, and proteins are to our diet.
HW 3.7.1	Name healthy behaviors.	Occurs at the dairy station. A comparison is done between different dairy products and how much sugar is in different drinks.

^aIndiana Department of Education (2014)

3.4.1. Pre-Test Instrumentation

Student knowledge was measured using a pre-/post-test design. Pre-tests (Appendix B) included the questions in Table 2. Eight variables were measured to assess student knowledge in the Science standard. These variables assessed species knowledge, daily nutritional needs of the dairy cows, and the process of milking cows. To assess these variable, there were two true/false questions, one matching, and three multiple choice questions used. The Social Studies standard was measured using seven variables that assessed processing knowledge. Each variable represented a step in the process of getting milk from the farm to the student. To assess each variable there was one ordering question used. The Health and Wellness standard was measured by fourteen variables. These variables assessed study participants' knowledge regarding healthy choices and knowledge of dairy foods and why they are important for study participants' health. To assess each variable there were five multiple choice questions used.

Pre-tests included a demographics section which included questions regarding the extent of study participants' previous agricultural experience. Because of the younger target audience, pictures were included as answer choices for multiple choice questions and the ordering question to assist study participants with clarity of the answer choices.

Table 2

Pre and Post Test Questions, and the Standard they address, for an On-Site Dairy Farm Field Trip

Standard	Pre-/Post-Test Questions
Science	Please circle how most dairy cows are milked today. ^a
	On average a dairy cow drinks a bathtub full of water a day. ^b
	A cow must have a calf before they can make milk. ^b
	Please match the word to its correct definition-Cow ^d
	Please match the word to its correct definition-Calf ^d
	Please match the word to its correct definition- Bull ^d
	Which dairy cow is the most popular? ^a
Social Studies	Which of the following pictures shows a Holstein cow? ^a
	Please put in order (from first to last) the steps of how milk gets from the cow to you by numbering the blanks next to each picture. ^c
Health and Wellness	Which of the following are dairy foods? Please circle all of the dairy foods in the list. ^a
	How many servings of dairy do you need each day? ^a
	One serving of milk can give you 30% of what mineral needed? ^a
	Why do you need the mineral calcium? ^a
	Please circle the healthy choice in each row. Milk or Coke? ^a
	Please circle the healthy choice in each row. Chocolate or String Cheese? ^a
	Please circle the healthy choice in each row. Yogurt or Jell-O? ^a

^aMultiple Choice Question

^bTrue or False Question

^cOrdering Question

^dMatching Question

3.4.2. Post-Test Instrumentation

In order to determine what knowledge was gained from the dairy farm tour, the post-test (Appendix C) included the same questions listed in Table 2. The post-test also included an enjoyment scale (Table 3). The enjoyment scale included on the post-test was modified from Moore, Yin, Hanes, and Duda's (2009) Physical Activity Enjoyment Scale (PACES). The modified scale included 12 bipolar statements regarding the on-site dairy

field trip. Enjoyment was measured on a 5 point Likert-scale (1- Disagree A Lot, 2- Disagree, 3- Not Decided, 4- Agree, & 5- Agree A Lot).

Table 3

*On-Site Dairy Farm Field Trip Enjoyment Scale Items**

I enjoyed the tour
The tour was boring
I disliked the tour
I found the tour pleasurable
The tour was no fun at all
The tour was very pleasant
The tour frustrated me
I learned several new things from the tour
The tour was very exciting
The tour was not at all interesting
The tour gave me a strong feeling of accomplishment
I felt as though I would rather be doing something else

*Adapted from Moore et al., 2009

The research questions and survey instruments that were used in this study are listed in Table 4 with the corresponding measures, study variables, and data analyses procedures. A quantitative methods approach was used for data collection. All survey instruments were reviewed by 2nd grade teachers to ensure face validity of the questions.

Table 4

Research Questions and Variables Measured

Research Question	Measure(s)/ Evidence(s)	Variables	Data Analyses Procedures
1. Does participation in an on-site dairy farm field trip increase knowledge gained in specific Science, Social Studies, and Health and Wellness standards?		Knowledge	Pre-/Post-Test
2. Does the level of enjoyment of participants in the virtual and on-site dairy farm field trips impact knowledge gained in specific Science, Social Studies, and Health and Wellness standards?	Moore, Yin, Hanes, & Duda (2009)	Enjoyment	Likert-Scale

3.4.3. Field Test

A field test of the methodology and instruments was performed with a group consisting of sixty-one first grade students. Due to the school being located two hours away from the dairy farm, the pre-test had to be given the day before the students left for the field trip. Furthermore, the pre-test was given towards the end of the school day. During this time, in the middle of one of the pre-test sessions, one of the teachers informed the researcher that their students would not be completing the pre-test that day because of a time conflict. These students completed the remaining part of the pre-test the next day before they left on the field trip. Time restrictions caused the post-test to be given the following Monday, not immediately following the field trip that occurred on Friday. Due to the lower targeted age group and the test timing issues, data collected from the field test was not analyzed.

The field test revealed that, adequate time management when coordinating and communicating with teachers and the dairy farm tour coordinator was crucial. Students

needed adequate time to complete the pre-test and not delay teachers from taking their classrooms to the dairy farm. Furthermore, first grade students' reading and comprehension levels were below those of the targeted age group that the instruments were written for. Therefore, it took students longer to complete pre-/post-tests than anticipated.

3.5. IRB Approval

The protocol for this study was reviewed by the Human Research Protection Program Institutional Review Board and approved on January 31, 2014 with protocol number 1312014349 (Appendix D). The Institutional Review Board approved a consent letter from the dairy farm (Appendix E) stating the purpose and objectives of the study.

3.6. Data Collection

Data collection occurred on a central Indiana dairy farm during the month of April. All study participants were administered a pre-test the day of the tour in their homeroom classrooms (Appendix B). Study participants were told that participation in the study was completely voluntary. They were also informed that those who chose not to participate would be provided other worksheets and supplemental educational activities, without penalty, while their fellow classmates completed the surveys. Study participants were also informed that if they chose not to complete the surveys they would still go on the dairy farm tour with their classmates.

All directions and questions were read to study participants to assist with readability of the instrument. Teachers were allowed to assist study participants if any

questions on the pre-test and post-test were too difficult for them to read or answer. Study participants were allowed to work on the pre-test at their own pace. Once study participants completed the pre-tests they were asked to wait until all study participants had completed the pre-tests.

Students were then taken from their school to the family dairy farm, approximately six miles from the school. Upon arriving at the family dairy farm, the students were given a tour of the farm and introduced to the different practices used by the farm. Throughout the tour, displays and posters were provided and explained and explained to the students. The posters contained information regarding the processing of milk and different dairy products, as well as the nutritional value of dairy foods.

After completion of the tour, participants returned to their school and were asked to complete the post-test (Appendix C). As with the pre-test, all directions and questions were read to the study participants. Study participants were allowed to work at their own pace and once completed with the test, asked to remain seated and quiet until all study participants had completed post-tests. Teachers were allowed to assist study participants with any questions or difficulty they may have regarding readability of the testing instruments. Once all study participants had finished, post-tests were collected.

3.7. Data Analysis

All levels of measurement, central tendencies, and variance for the quantitative study variables are presented in Table 5. Column one in Table 5 identifies the study variables and column two shows each variables' level of measurement. Columns three and four

identify what statistics were reported for each study variable. The fifth column in Table 5 identifies the statistical test that was used to analyze and compare knowledge gained amongst other schools in the study.

Table 5

Study Variables for Data Analysis

Variables	Level of Measurement	Central Tendency	Variance	Statistical Test
Knowledge	Item: Ordinal Scale: Interval	Frequency % Mean	Standard Deviation	Paired t-test
Enjoyment	Item: Ordinal Scale: Interval	Frequency Mean	Standard Deviation	
Gender	Nominal	Frequency		
Agricultural Experience	Nominal	Frequency		

Pre-/post-tests were used to assess knowledge gain. After collection of post-tests, the researcher matched pre-tests and post-tests for each participant. The items on the pre-/post-tests were categorized to match the learning objectives set by the educational tour coordinator at the dairy farm and 3rd grade Indiana learning standards for Social Studies, Health and Wellness, and Science. Descriptive statistics were computed and analyzed to determine normality of the data. All data was normally distributed and therefore parametric tests were used for analysis. The values representing each specific standard were calculated by determining a mean score value and then converting that value into the mean percentage. The mean percentage represents the percentage of correct answers for the variables assessed. All negative items on the enjoyment scale were reverse-coded before analyzing. Cronbach's alpha for the twelve enjoyment scale items was .831.

Data collected from the pre-/post-tests were entered into SPSS and analyzed to find and compare mean values. A paired, one-sided t-test was also used to determine differentials for the pre-/post-tests. A correlation coefficient for the interval by nominal variable was calculated with Spearman's rho between participating on-site dairy farm field trip students' previous agricultural experience and their knowledge gained in Science, Social Studies, and Health and Wellness standards: and between participating on-site dairy farm field trip students' enjoyment and their knowledge gained in Science, Social Studies, and Health and Wellness standards. SPSS defines Spearman's rho as a special case of the Pearson Product Moment Correlation and the Pearson R is reported. Cohen's D was calculated to determine effect size between the pre-/post-tests.

3.8. Results

3.8.1. Demographic Information of Participants

The following characteristics, frequencies, and percentages represent the amount of boys and girls that participated in the study, as well as the different ethnicities of the study participants. Study participants were also asked two questions and two statements regarding their agricultural experience. These questions and statements were used to gauge how much previous agricultural experience study participants may have before completing the dairy field trip (Table 6).

Table 6

Demographics of Participants in an On-Site Dairy Farm Field Trip (N=72)

Gender^a		
	Boy	37 (52.1%)
	Girl	34 (47.9%)
Ethnicity		
	Non-Hispanic White	53 (73.6%)
	Hispanic	8 (11.1%)
	African American	6 (8.3%)
	American Indian	0 (0.0%)
	Asian or Pacific Islander	3 (4.2%)
	Other	2 (2.8%)
Previous Agricultural Experience		
	Yes	No
Do you live on a farm? ^b	2 (2.9%)	68 (97.1%)
Have you ever visited a farm before today?	54 (75.0%)	18 (25.0%)
This is my first time visiting a dairy farm. ^c	36 (51.4%)	34 (48.6%)
This is my first time to see a cow in person. ^d	27 (39.1%)	42 (60.9%)

^a 1 student (1.4%) did not report

^b 2 students (2.8%) did not report

^c 2 students (2.8%) did not report

^d 3 students (4.2%) did not report

3.9. Results: Knowledge Gained

3.9.1. Science Standard

Science standard 3.2.5, “describe natural materials and give examples of how they sustain the lives of plants and animals” was assessed through two true/false questions, one matching, and one multiple choice question. Science standard 3.4.2, “define the uses and types of simple machines and utilize simple machines in the solution to a “real world” problem” was assessed using one multiple choice question. Table 7 identifies the variables that were assessed regarding the Science standards and study participants’ mean

pre-test and post-test percentage scores, as well as the percentage difference between the two tests.

Forty-six study participants (63.9%) on the pre-test were able to correctly identify that a dairy cow drinks a bathtub full of water a day. Sixty-eight study participants (97.1%) on the post-test were able to correctly identify that a dairy cow drinks a bathtub full of water a day and two study participants (2.8%) did not report. Twenty-two study participants (30.6%) on the pre-test were able to correctly identify that a cow must have a calf before it can start making milking. Twenty study participants (28.6%) on the post-test were able to correctly identify that a cow must have a calf before it can start making milk and two study participants (2.8%) did not report (Table 8).

On the matching portion of the pre-test, sixty-two on-site dairy farm field trip study participants (86.1%) were able to match the term “cow” to its correct definition of “an adult female.” Sixty-two study participants (86.9%) on the post-test were able to correctly match the term “cow” to its correct definition and three study participants (4.2%) did not report. Sixty-seven study participants (94.4%) on the pre-test were able to correctly match the term “calf” to its correct definition of “a baby that is either a boy or girl” and one student (1.4%) did not report. Sixty-seven study participants (97.1%) on the post-test correctly matched the term “calf” to its correct definition and three study participants (4.2%) did not report. Sixty-three study participants (88.7%) on the pre-test correctly matched the term “bull” to its correct definition of “an adult male” and one student (1.4%) did not report. Sixty-two study participants (89.9%) on the post-test correctly matched the term “bull” to its correct definition and three study participants (4.2%) did not report.

Twenty-five on-site dairy farm field trip study participants (34.7%) on the pre-test correctly identified a Holstein as the most popular breed of dairy cow. Fifty study participants (72.5%) on the post-test correctly identified a Holstein as the most popular breed of dairy cow and three study participants (4.2%) did not report. Thirty-two study participants (44.4%) on the pre-test correctly identified a picture of a Holstein cow. Fifty-six study participants (82.4%) on the post-test correctly identified a picture of a Holstein cow and four study participants (5.6%) did not report. Fifty study participants (69.4%) on the pre-test correctly identified that most dairy cows are milked using a milking parlor. Sixty-eight study participants (97.1%) on the post-test correctly identified that most dairy cows are milked using a milking parlor and two study participants (2.8%) did not report

Table 7

Pre-/Post-Test Mean Percentage Scores and Differences for On-Site Dairy Farm Field Trip Students for Questions Addressing Indiana Science Standards 3.2.5 and 3.4.2

Question (Standard Addressed)	Pre-Test % Correct (N=72)	Post-Test % Correct (N=72)	(+/-) % Difference
On average a dairy cow drinks a bathtub full of water a day (3.2.5).	63.9%	97.1%	+ 33.2
A cow must have a calf before it can make milk (3.2.5).	30.6%	28.6%	- 2.0
Definition- Cow (3.2.5)	86.1%	89.9%	+ 3.8
Definition- Calf (3.2.5)	94.4%	97.1%	+ 2.7
Definition- Bull (3.2.5)	88.7%	89.9%	+ 1.2
Which dairy cow is the most popular? (3.2.5)	34.7%	72.5%	+ 37.8
Which of the following picture shows a Holstein cow? (3.2.5)	34.7%	82.4%	+ 47.7
Please circle which pictures best shows how most dairy cows are milked today (3.4.2).	69.4%	97.1%	+ 27.7

Mean test scores for the items related to the Science standard increased from $63.89\% \pm 19.06$ to $78.30\% \pm 19.64$ ($p < .001$) with a medium effect size ($d = .74$) and t -value of -6.23 . Study participants had a mean percentage increase of 14.41% ($SD = 19.64$) on the post-test.

3.9.2. Social Studies Standard

On-site dairy farm field trip study participants were asked one multiple choice question and one ordering question (Appendices B and C) to address the Social Studies standard “give examples of goods and services provided by local business and industry” (3.4.2). Table 8 identifies the variables assessed regarding the Social Studies standard and study participants’ mean pre-test and post-test percentage scores, as well as the mean percentage difference between the two tests.

On-site dairy farm field trip study participants were also asked to order the seven steps of the process of getting milk from the cow to them. Forty-five study participants (62.5%) on the pre-test correctly identified the picture that represented step one of the process. Fifty-seven study participants (82.6%) on the post-test correctly identified the picture that represented step one of the process and three study participants (4.2%) did not report. Forty study participants (55.6%) on the pre-test correctly identified the picture that represented step two of the process. Forty-nine study participants (71.0%) on the post-test correctly identified the picture that represented step two of the process and three study participants (4.2%) did not report. Eleven study participants (15.3%) on the pre-test correctly identified the picture that represented step three of the process. Thirty-five study participants (50.7%) on the post-test correctly identified the picture that represented step

three of the process and three study participants (4.2%) did not report. Ten study participants (13.9%) on the pre-test correctly identified the picture that represented step four of the process and one student (1.4%) did not report. Twenty-seven study participants (39.7%) on the post-test correctly identified the picture that represented step four of the process and four study participants (5.6%) did not report (Table 8).

Three study participants (4.2%) on the pre-test correctly identified the picture that represented step five of the process. Twenty-seven study participants (37.5%) on the post-test correctly identified the picture that represented step five of the process and three study participants (4.2%) did not report. Thirty-nine study participants (54.2%) on the pre-test correctly identified the picture that represented step six of the process. Fifty-three study participants (76.8%) on the post-test correctly identified the picture that represented step six of the process and three study participants (4.2%) did not report. Sixty-eight study participants (94.4%) on the pre-test correctly identified the picture that represented step seven of the process. Sixty-six study participants (95.7%) on the post-test correctly identified the picture that represented step seven of the process and three study participants (4.2%) did not report.

Table 8

Pre-/Post-Test Mean Percentage Scores and Differences for On-Site Dairy Farm Field Trip Students for Questions Addressing Indiana Social Studies Standard 3.4.2

Questions (Standard Addressed)	Pre-Test % Correct (N=72)	Post-Test % Correct (N=72)	(+/-) % Difference
Steps of how milk gets from the cow to you- Step 1 (3.4.2)	62.5%	82.6%	+ 20.1
Steps of how milk gets from the cow to you- Step 2 (3.4.2)	55.6%	71.0%	+ 15.4
Steps of how milk gets from the cow to you- Step 3 (3.4.2)	15.3%	50.7%	+ 35.4
Steps of how milk gets from the cow to you- Step 4 (3.4.2)	14.1%	39.7%	+ 25.6
Steps of how milk gets from the cow to you- Step 5 (3.4.2)	4.2%	39.1%	+ 34.9
Steps of how milk gets from the cow to you- Step 6 (3.4.2)	54.2%	76.8%	+ 22.6
Steps of how milk gets from the cow to you- Step 7 (3.4.2)	94.4%	95.7%	+ 1.3

Mean test scores for the items related to the Social Studies standard increased from 43.06% \pm 19.55 to 62.30% \pm 29.78 ($p < .001$) with a moderate effect size ($d = .76$) and t-value of -6.09. Study participants had a mean percentage increase of 19.25% (SD= 26.82) on the post-test.

3.9.3. Health and Wellness Standard

On-site dairy farm field trip study participants were asked five multiple choice questions (Appendices B and C) to address the Health and Wellness standards “identify the link between healthy choice and being healthy” (3.1.1) and “name healthy behaviors” (3.7.1). Table 9 identifies the variables assessed regarding the Health and Wellness

standards and study participants' mean pre-test and post-test percentage scores, as well as the percentage difference between the two tests.

Sixty-nine on-site dairy farm field trip study participants (95.8%) on the pre-test correctly identified cheese as a dairy food. Sixty-nine study participants (98.6%) on the post-test correctly identified cheese as a dairy food and two study participants (2.8%) did not report. Sixty-seven study participants (93.1%) on the pre-test correctly identified that bacon is not a dairy food. Sixty-eight study participants (97.1%) on the post-test correctly identified that bacon is not a dairy food and two study participants (2.8%) did not report. Sixty-five study participants (90.3%) on the pre-test correctly identified that ham is not a dairy food. Sixty-nine study participants (98.6%) on the post-test correctly identified that ham is not a dairy food and two study participants (2.8%) did not report. Fifty-three study participants (73.6%) on the pre-test correctly identified ice cream as a dairy food. Sixty-eight study participants (97.1%) on the post-test correctly identified ice cream as a dairy food and two study participants (2.8%) did not report (Table 9).

Sixty-three study participants (87.5%) on the pre-test correctly identified cream cheese as a dairy food. Sixty-seven study participants (95.7%) on the post-test correctly identified cream cheese as a dairy food and two study participants (2.8%) did not report. Thirty-five study participants (48.6%) on the pre-test correctly identified whipped cream as a dairy food. Sixty-six study participants (94.3%) on the post-test correctly identified whipped cream as a dairy food and two study participants (2.8%) did not report. Seventy-two study participants (100.0%) on the pre-test correctly identified milk as a dairy food. Sixty-nine study participants (98.6%) on the post-test correctly identified milk as a dairy food and two study participants (2.8%) did not report.

Twenty-six study participants (36.1%) on the pre-test correctly identified that they needed three servings of dairy every day. Sixty-nine study participants (98.6%) on the post-test correctly identified that they needed three servings of dairy every day and two study participants (2.8%) did not report. Fifty-one study participants (70.8%) on the pre-test correctly identified that one serving of milk gives 30% of the mineral calcium. Sixty-nine study participants (98.6%) on the post-test correctly identified that one serving of milk gives 30% of the mineral calcium and two study participants (2.8%) did not report. Forty-two study participants (58.3%) on the pre-test correctly identified that calcium is needed to make strong bones and teeth. Fifty-five study participants (78.6%) on the post-test correctly identified that calcium is needed to make strong bones and teeth. Two study participants (2.8%) did not complete this question.

Seventy-two study participants (100.0%) on the pre-test correctly chose milk as the healthier choice compared to Coke. Seventy study participants (100.0%) on the post-test correctly chose milk as the healthier choice compared to Coke and two study participants (2.8%) did not report. Seventy study participants (97.2%) on the pre-test correctly chose string cheese as the healthier choice compared to chocolate. Sixty-nine study participants (98.6%) on the post-test correctly chose string cheese as the healthier choice compared to chocolate and two study participants (2.8%) did not report. Sixty-nine study participants (95.8%) on the pre-test correctly chose yogurt as the healthier choice compared to Jell-O. Sixty-eight study participants (97.1%) on the post-test correctly chose yogurt as the healthier choice compared to Jell-O. Two study participants (2.8%) did not complete this question.

Table 9

Pre-/Post-Test Mean Percentage Scores and Differences for On-Site Dairy Farm Field Trip Students for Questions Addressing Indiana Health and Wellness Standards 3.1.1 and 3.7.1

Questions (Standard Addressed)	Pre-Test % Correct (N=72)	Post-Test % Correct (N=72)	(+/-) % Difference
Dairy Foods- Cheese (3.1.1)	95.8%	98.6%	+ 2.8
Dairy Foods- Bacon (3.1.1)	93.1%	97.1%	+ 4.0
Dairy Foods- Ham (3.1.1)	90.3%	98.6%	+ 8.3
Dairy Foods- Ice Cream (3.1.1)	73.6%	97.1%	+ 23.5
Dairy Foods- Cream Cheese (3.1.1)	87.5%	95.7%	+ 8.2
Dairy Foods- Whipped Cream (3.1.1)	48.6%	94.3%	+ 45.7
Dairy Foods- Milk (3.1.1)	100.0%	98.6%	- 1.4
Dairy Foods- Eggs (3.1.1)	63.9%	88.6%	+ 24.7
How many servings of dairy do you need each day (3.1.1)?	36.1%	98.6%	+ 62.5
One serving of milk can give you 30% of what mineral needed (3.7.1)?	70.8%	98.6%	+ 27.8
Why do you need the mineral calcium (3.7.1)?	58.3%	78.6%	+ 20.3
Healthy Choice- Milk or Coke (3.7.1)?	100.0%	100.0%	0.0
Healthy Choice- Chocolate or String Cheese (3.7.1)?	97.2%	98.6%	+ 1.4
Healthy Choice- Yogurt or Jell-O (3.7.1)?	95.8%	97.1%	+ 1.3

Mean test scores for the items related to the Health and Wellness standard

increased from 79.37% \pm 13.59 to 93.55% \pm 17.39 ($p < .001$) with a large effect size ($d = .91$ and t -value of -5.66. Study participants had a mean percentage increase of 13.99% (SD= 20.99) on the post-test.

3.9.4. Enjoyment Scale

On-site dairy farm field trip study participants completed a twelve-item scale on the post-test (Appendix C) to measure their enjoyment of the on-site dairy farm field trip. Means and standards deviations are reported for each item. (Table 10).

3.9.5. Enjoyment Scale Frequencies

Participants were asked about their general enjoyment of the dairy farm tour. When asked to rate their agreement with the statement, “I enjoyed the tour,” participants responded as follows:

- Disagree a lot, 1.4% (1 student)
- Disagree, 2.8% (2 students)
- Not decided, 4.2% (3 students)
- Agree, 28.2% (20 students)
- Agree a lot, 63.4% (45 students)
- Did not report, 1.4% (1 student)

When asked to rate their agreement with the statement, “the tour was boring,” participants responded as follows:

- Disagree a lot, 62.9% (44 students)
- Disagree, 22.9% (16 students)
- Not decided, 8.6% (6 students)
- Agree, 4.3% (3 students)
- Agree a lot, 1.4% (1 student)
- Did not report, 2.8% (2 students)

When asked to rate their agreement with the statement, “I disliked the tour,” participants responded as follows:

- Disagree a lot, 44.9% (31 students)
- Disagree, 29.0% (20 students)
- Not decided, 8.7% (6 students)
- Agree, 4.3% (3 students)
- Agree a lot, 13.0% (9 students)
- Did not report, 4.2% (3 students)

When asked to rate their agreement with the statement, “I found the tour pleasurable,” participants responded as follows:

- Disagree a lot, 9.0% (6 students)
- Disagree, 1.5% (1 student)
- Not decided, 7.5% (5 students)
- Agree, 29.9% (20 students)
- Agree a lot, 52.2% (35 students)
- Did not report, 6.9% (5 students)

When asked to rate their agreement with the statement, “the tour was no fun at all,” participants responded as follows:

- Disagree a lot, 55.2% (37 students)
- Disagree, 22.4% (15 students)
- Not decided, 7.5% (5 students)
- Agree, 7.5% (5 students)
- Agree a lot, 7.5%, (5 students)
- Did not report, 6.9% (5 students)

When asked to rate their agreement with the statement, “the tour was very pleasant,” participants responded as follows:

- Disagree a lot, 10.4% (7 students)
- Disagree, 4.5% (3 students)
- Not decided, 9.0% (6 students)
- Agree, 25.4% (17 students)
- Agree a lot, 50.7% (34 students)
- Did not report, 6.9% (5 students)

When asked to rate their agreement with the statement, “the tour frustrated me,” participants responded as follows:

- Disagree a lot, 54.8% (34 students)
- Disagree, 17.7% (11 students)
- Not decided, 17.7% (11 students)
- Agree, 6.5% (4 students)
- Agree a lot, 3.2% (2 students)
- Did not report, 13.9% (10 students)

When asked to rate their agreement with the statement, “I learned several new things from the tour,” participants responded as follows:

- Disagree a lot, 4.5% (3 students)
- Disagree, 4.5% (3 students)
- Not decided, 4.5% (3 students)
- Agree, 21.2% (14 students)
- Agree a lot, 65.25% (43 students)
- Did not report, 8.3% (6 students)

When asked to rate their agreement with the statement, “the tour was very exciting,” participants responded as follows:

- Disagree a lot, 5.1% (3 students)
- Disagree, 5.1% (3 students)
- Not decided, 15.3% (9 students)
- Agree, 22.0% (13 students)
- Agree a lot, 52.5% (31 students)
- Did not report, 18.1% (13 students)

When asked to rate their agreement with the statement, “the tour was not at all interesting,” participants responded as follows:

- Disagree a lot, 61.9% (39 students)
- Disagree, 23.8% (15 students)
- Not decided, 7.9% (5 students)
- Agree, 3.2% (2 students)
- Agree a lot, 3.2% (2 students)
- Did not report, 12.5% (9 students)

When asked to rate their agreement with the statement, “the tour gave me a strong feeling of accomplishment,” participants responded as follows:

- Disagree a lot, 4.6% (3 students)
- Disagree, 12.3% (8 students)
- Not decided, 26.2% (17 students)
- Agree, 15.4% (10 students)
- Agree a lot, 41.5% (27 students)
- Did not report, 9.7% (7 students)

When asked to rate their agreement with the statement, “I felt as though I would rather be doing something else,” participants responded as follows:

- Disagree a lot, 56.5% (39 students)
- Disagree, 21.7% (15 students)
- Not decided, 11.6% (8 students)
- Agree, 2.9% (2 students)
- Agree a lot, 7.2% (5 students)
- Did not report, 4.2% (3 students)

Table 10

Means and Standard Deviations of Participant Enjoyment of the On-Site Dairy Farm Field Trip

Item	N	Mean (SD)
I enjoyed the tour.	72	4.49 (.83)
I learned several new things from the tour.	72	4.38 (1.08)
The tour was very exciting.	72	4.12 (1.16)
I found the tour pleasurable.	72	4.15 (1.21)
The tour was very pleasant.	72	4.02 (1.32)
The tour gave me a strong feeling of accomplishment.	72	3.77 (1.25)
I disliked the tour.	72	2.12 (1.38)
The tour was no fun at all.	72	1.90 (1.27)
The tour frustrated me.	72	1.86 (1.13)
I felt as though I would rather be doing something else.	72	1.83 (1.20)
The tour was not at all interesting.	72	1.62 (.99)
The tour was boring.	72	1.59 (.93)

Scale: 1= Disagree A Lot, 2=Disagree, 3= Not Decided, 4= Agree, 5= Agree A Lot

3.9.6. Pearson’s Correlations

Correlations between knowledge gained in Science, Social Studies, and Health and Wellness standards and previous agricultural experience were calculated. There was one significant correlation of .310 ($p = .009$) between knowledge gained in Social Studies

and the previous agricultural experience question “have you ever visited a farm before today.” However, while this is a statistically significant correlation, the value is moderate.

Furthermore, there was only one question, containing seven variables that addressed the Social Studies standard. There were no other significant correlations between study participants’ previous agricultural experience and the Science and Health and Wellness standards addressed. Correlations were also calculated between knowledge gained in Science, Social Studies, and Health and Wellness standards and on-site dairy farm field trip study participants’ responses on the enjoyment scale. There were no significant correlations between on-site dairy farm field trip study participants’ responses on the enjoyment scale and their knowledge gained in the learning standards addressed.

3.9.7. Summary and Conclusions

1. Does participation in an on-site dairy farm field trip increase knowledge gained in specific Science, Social Studies, and Health and Wellness standards?

Study participants in an on-site dairy farm field trip demonstrated significant knowledge gain between the pre-test and the post-test in the Science, Social Studies, and Health and Wellness standards that were addressed throughout the dairy field trip. After the field trip, post-test scores indicated that study participants demonstrated a greater amount of knowledge regarding topics such as the daily care of the dairy cows, why dairy foods are important, and the process of how milk gets from the cow to them. Study participants were able to experience the whole farm including sights and smells, as well as listen to the tour director discuss the importance of dairy cows and relate that

information to themselves, such as why getting three servings of dairy each day is important for them.

Therefore, the dairy field trip served as an effective way to teach students specific Science, Social Studies, and Health and Wellness standards. The success of this dairy field trip can provide further support for teachers to take their students on well-organized and planned field trips that support their in-class curriculum. Field trips that address state learning standards in their content provide an educational value that may help teachers work around barriers that may keep them from taking their students on a field trip.

2. Does the level of enjoyment of study participants in the on-site dairy farm field trip impact knowledge gained in specific Science, Social Studies, and Health and Wellness standards?

Study participants reported high levels of enjoyment regarding the dairy farm field trip, reported that they learned several new things from the field trip, had fun, and enjoyed the overall experience at the dairy farm. Despite study participants overall enjoyment of the on-site dairy farm field trip, there were no significant correlations between the mean enjoyment value for each item and knowledge gained in Science, Social Studies, and Health and Wellness standards. All study participants indicated a high level of enjoyment in the dairy farm field trip, independent of knowledge gained in the three standard areas addressed.

CHAPTER 4. VIRTUAL DAIRY FARM FIELD TRIP

4.1. Purpose of the Study

The purpose of this study was to assess if a virtual dairy farm field trip is enjoyable and an effective method of teaching specific Science, Social Studies, and Health and Wellness to 2nd grade students. This study assessed the enjoyment and effectiveness of a virtual dairy farm field trip.

4.2. Research Questions for the Study

The following questions guided the study:

1. Does participation in a virtual dairy farm field trip increase knowledge gained in specific Science (Sc), Social Studies (SS), and Health and Wellness (HW) standards?
2. Does the level of enjoyment of participants in the virtual dairy farm field trip impact knowledge gained in specific Science (Sc), Social Studies (SS), and Health and Wellness (HW) standards?

4.3. Materials and Methods

4.3.1. Virtual Dairy Farm Field Trip Development

A virtual dairy farm field trip was created by the researcher and patterned after the on-site dairy farm field trip described in Chapter 3. The virtual dairy farm field trip was designed to target the specific 2nd grade Indiana learning standards for Science, Health and Wellness, and Social Studies that were defined by the learning objectives set by the educational tour coordinator at the dairy farm (Table 11). Activities and standards addressed in the dairy farm tour were determined by the educational tour coordinator. The educational tour coordinator has an extensive experience in her seven years of providing educational tours to the public and is one of the family members that assist in running the dairy farm.

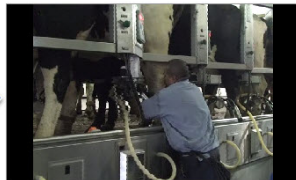
A 2nd grade field trip to an on-site dairy farm was recorded and used to inform the development of the virtual dairy farm field trip. Furthermore, all information that was presented during the on-site dairy farm field trip was presented in the virtual dairy farm field trip. The virtual dairy farm field trip consists of information regarding the different breeds of dairy cows and then asks study participants to complete a matching activity. Study participants must match the name of the breed to its' correct picture of that breed. Information was provided that details the daily care and management of dairy cows, including nutrition and the type of barn that most dairy cows live in.

The virtual dairy farm field trip contained information regarding the process of milking and included a video of a milking parlor in use. Study participants were provided information about how many times a day the dairy cows get milked and how many gallons of milk a dairy cow can produce in one day. A photo album feature of the

technology tool used included information about the seven steps that it takes to get milk from the farm to the home. After the photo album activity, study participants were asked to complete a self-assessment which asked them to correctly order the seven pictures that represented the seven steps of getting milk from the farm to the home. There was also information included about previous methods of milking cows compared to today's modern milking parlors and technology used.

Information was also included regarding why dairy foods are so important and how it affects study participants' overall health. Images such as the food pyramid were included, which informed study participants of how many servings of dairy they should have each day. Images and text organized into a table and images in a short slideshow were also used to demonstrate to study participants the different examples of dairy foods and what one serving of a dairy might look like. Three self-assessment activities were included that asked study participants to demonstrate their knowledge of making healthy choices. One self-assessment activity presenting study participants with four snack or drink choices and then asking them to select the healthier choice. After the dairy farm virtual field trip was created, the educational tour coordinator reviewed the virtual field to ensure that all information presented was accurate.

The Milking Parlor



Dairy cows have not always been milked by machines. Cows used to be milked by hand and the milk was put into a bucket or pail and then into a can. Now most farms have their cows come into the milking parlor and they use machines to milk the cows which works a lot better and much faster.

- On average it only takes 5 minutes to milk a cow using a machine and 1 dairy cow can produce 8 gallons of milk in one day.

Different Ways of Milking

Cows used to be milked by hand into a bucket.

Figure 2 Screenshot of a Video in the Virtual Dairy Farm Field

Do You Know Your Dairy Foods???

Click the card deck to view a card. Drag the card from the bottom to the correct category.

Dairy Product	Non-Dairy Product
Cheese	Ham
8/10	Cottage Cheese

Press SPACE to show next card, ENTER to drop



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Figure 3 Screenshot of an Activity in the Virtual Dairy Farm Field Trip

Table 11

Indiana Second Grade Standards Addressed through Participation in a Virtual Dairy Farm Field Trip

Indiana Standard^a	Description of Standard	Learning Objectives: After completing the online Virtual dairy farm field trip, students will be able to...
Sc 2.3	Observe, ask questions about and describe how organisms change their forms and behaviors during their life cycles.	Recognize Holstein dairy cows and distinguish the differences between the dairy cow breeds. Match the definition of a cow, calf, and bull to their correct key terms.
Sc 2.4.2	Identify technologies developed by humans to meet human needs. Investigate the limitations of technologies and how they have improved quality of life.	Recognize how cows are milked by milking machines today.
SS 2.4.4.	Research goods and services produced in the local community and describe how people can be both producers and consumers.	Recall and order the steps in getting milk from the cow to the grocery store.
HW 2.1.1.	Identify that healthy behaviors affect personal health.	Recognize different dairy foods.
HW 2.7.1.	Demonstrate healthy practices and behaviors to maintain or improve personal health.	Recall why dairy foods are nutritious.

^aIndiana Department of Education (2014)

An on-site dairy farm field trip was videotaped to ensure that all information presented during the field trip was used to inform the virtual dairy farm field trip. The online learning module was created by the researcher using Softchalk™, a commercially available web-based content authoring program. This program allowed the integration of learning activities, videos, and pictures. The module was reviewed by a panel of experts, including the educational tour coordinator and the major professor, to ensure content

validity and to assure that it was comparable to the on-site dairy farm field trip. To reduce any technological difficulties with the online lesson, the module was sent to the participating elementary schools IT personnel to ensure that all activities and assessments worked in their computer laboratories.

4.3.2. Participants

The one hundred and twenty-five virtual dairy farm field trip study participants for this study were selected using a convenience sample of 2nd grade students from a Southwestern Indiana elementary school and a Central Indiana elementary school.

An e-mail (Appendix F) was sent to the principals in each participating school. The e-mail for the two elementary schools informed them of the purpose and specific procedure of the study, as well as the specific Indiana learning standards that were addressed in the online learning module. Teachers were asked for their willingness and consent to participate in the study.

4.4. Instrumentation and Data Sources

The design of this study was descriptive and the research method used was pre-/post-tests. Each student was assigned a unique number that allowed for pre-/post-tests to be linked to assess knowledge gain, without collecting any personal information regarding the student. The unique number was assigned to study participants at their assigned seat in the classroom. The format of the unique number started with the number assigned to the school, followed by the classroom number then the study participant's unique identification number.

Learning objectives for the pre-/post-tests were derived from 2nd grade Indiana learning standards for Science, Health and Wellness, and Social Studies (Table 11). The learning standards and activities were determined by the educational tour coordinator and then applied to the dairy virtual field trip.

4.4.1. Pre-Test Instrumentation

Student knowledge was measured using a pre-/post-test design. Pre-tests (Appendix G) included the questions listed in Table 12. Eight variables were measured to assess student knowledge in the Science standard. These variables assessed species knowledge, daily nutritional needs of the dairy cows, and the process of milking cows. The Social Studies standard was measured using seven variables that assessed processing knowledge. Each variable represented a step in the process of getting milk from the farm to the student. The Health and Wellness standard was measured by fourteen variables. These variables assessed study participants' knowledge regarding healthy choices and knowledge of dairy foods and why they are important for study participants' health.

Table 12

Pre and Post Test Questions, and the Standard they address, for a Virtual Dairy Farm Field Trip

Standard	Pre-/Post-Test Questions
Science	Please circle how most dairy cows are milked today. ^a
	On average a dairy cow drinks a bathtub full of water a day. ^b
	A cow must have a calf before they can make milk. ^b
	Please match the word to its correct definition-Cow ^d
	Please match the word to its correct definition-Calf ^d
	Please match the word to its correct definition- Bull ^d
	Which dairy cow is the most popular? ^a
Which of the following pictures shows a Holstein cow? ^a	
Social Studies	Please put in order (from first to last) the steps of how milk gets from the cow to you by numbering the blanks next to each picture. ^c
Health and Wellness	Which of the following are dairy foods? Please circle all of the dairy foods in the list. ^a
	How many servings of dairy do you need each day? ^a
	One serving of milk can give you 30% of what mineral needed? ^a
	Why do you need the mineral calcium? ^a
	Please circle the healthy choice in each row. Milk or Coke? ^a
	Please circle the healthy choice in each row. Chocolate or String Cheese? ^a
	Please circle the healthy choice in each row. Yogurt or Jell-O? ^a

^aMultiple Choice Question

^bTrue or False Question

^cOrdering Question

^dMatching Question

Pre-tests included a demographics section which included questions regarding the extent of student's previous agricultural experience. Because the young target audience, pictures were included as answer choices for multiple choice questions and the ordering question to assist study participants with clarity.

Study participants at the local elementary schools were given the pre-test in their home classrooms and then were taken to a computer lab where they participated in the

online dairy tour module. Study participants were then taken back to their home classrooms and completed the post-test.

4.4.2. Post-Test Instrumentation

In order to determine what knowledge was gained from the virtual dairy farm field trip, the post-tests (Appendix H) contained identical questions to the pre-tests listed in Table 12. The post-test also included an enjoyment scale (Table 13). The enjoyment scale included on the post-test was modified from Moore, Yin, Hanes, and Duda's (2009) Physical Activity Enjoyment Scale (PACES). The modified scale included 12 bipolar statements regarding the online dairy lesson. Enjoyment was measured on a 5 point Likert-scale (1- Disagree A Lot, 2- Disagree, 3- Not Decided, 4- Agree, & 5- Agree A Lot).

Table 13

*Virtual Dairy Farm Field Trip Enjoyment Scale Items**

I enjoyed the lesson
The lesson was boring
I disliked the lesson
I found the lesson pleasurable
The lesson was no fun at all
The lesson was very pleasant
The lesson frustrated me
I learned several new things from the lesson
The lesson was very exciting
The lesson was not at all interesting
The lesson gave me a strong feeling of accomplishment
I felt as though I would rather be doing something else

*Adapted from Moore et al., 2009

The research questions in this study are listed in Table 14 with corresponding measures, variable, and data analyses procedures. A quantitative methods approach was used for data collection. All survey instruments were reviewed by 2nd grade teachers from the participating schools to ensure face validity of the questions.

Table 14

Research Questions and Variables Measured

Research Question	Measure(s)/Evidence(s)	Variables
1. Does participation in a dairy virtual field trip increase knowledge gained in Science, Social Studies, and Health and Wellness standards?		Knowledge
2. Does the level of enjoyment of participants in the virtual and on-site dairy field trip impact knowledge gained in Science, Social Studies, and Health and Wellness standards?	Moore, Yin, Hanes, & Duda (2009)	Enjoyment

4.5. IRB Approval

The protocol for this study was reviewed by the Human Research Protection Program Institutional Review Board and approved on January 31, 2014 with protocol number 1312014349 (Appendix D). The Institutional Review Board for Purdue University accepted the study approval letters that were sent from School 1 (Appendix I) and School 2 (Appendix J).

4.6. Data Collection

Data collection occurred in the spring of 2014. Before the study began, virtual dairy farm field trip participants were informed that their participation in the study was

completely voluntary. Those students who chose not to participate were provided worksheets and other educational activities to do, without penalty, while the rest of the study participants completed the surveys and online learning module. Students at the local elementary schools who did choose to participate in the study were given a pre-test (Appendix G) in their home classrooms. All directions and questions were read aloud to the classroom of study participants; however study participants were allowed to work at their own pace. Teachers were allowed to assist study participants if any questions were too difficult for them to read or answer. Upon completion of the pre-test, tests were collected. Study participants were then taken to a computer lab where they participated in the online dairy tour module.

Virtual dairy farm field trip participants who worked through the module did so individually and at their own pace. Once study participants completed the module they remained seated and in the computer lab until all study participants had completed the learning module. Teachers were allowed to assist study participants with any questions or difficulty they may have regarding readability of the module and the testing instruments. After all study participants had finished working through the learning module, study participants were taken back to their home classrooms and given the post-test to complete in their assigned seats (Appendix H). As with the pre-test, all directions and questions on the post-test were read to the classroom. Study participants were allowed to work at their own pace and remained seated and quiet until all study participants had completed the post-test.

4.7. Data Analysis

All levels of measurement, central tendencies, and variance for the quantitative study variables are presented in Table 15. Column one in Table 15 identifies the study variables and column two lists their corresponding levels of measurement for the study. Columns three and four in Table 15 lists the statistics that were reported for the study variables. Column five lists the statistical test that was used to compare study participants' knowledge gain amongst other schools in the study.

Table 15

Study Variables for Data Analysis

Variables	Level of Measurement	Central Tendency	Variance	Statistical Test
Knowledge	Item: Ordinal Scale: Interval	Frequency % Mean	Standard Deviation	Paired t-test
Enjoyment	Item: Ordinal Scale: Interval	Frequency % Mean	Standard Deviation	
Gender	Nominal	Frequency		
Agricultural Experience	Nominal	Frequency		

Pre-/post-tests were used to assess knowledge gain. After collection of the post-test, the researcher matched pre-tests and post-tests for each participant. The items on the pre-/post-tests were categorized by the 2nd grade Indiana learning standards for Social Studies, Health and Wellness, and Science. Descriptive statistics were computed and analyzed to determine normality of the data. All data was normally distributed and therefore parametric test were used for analysis. The values representing each specific standard were calculated by determining a mean score value and then converting that value the mean percentage. The mean percentage represents the percentage of correct

answers for the variables assessed. All negative items on the enjoyment scale were reverse-coded before analyzing. Cronbach's alpha for the twelve enjoyment scale items was .831.

Data collected from the pre-/post-tests were entered into SPSS and analyzed to find and compare mean values. A one-tailed paired t-test was also used to determine differentials for the pre-/post-tests. A correlation coefficient for the interval by nominal variable was calculated with Spearman's rho between participating virtual dairy farm field trip students' previous agricultural experience and their knowledge gained in Science, Social Studies, and Health and Wellness standards: and between participating virtual dairy farm field trip students' enjoyment and their knowledge gained in Science, Social Studies, and Health and Wellness standards. SPSS defines Spearman's rho as a special case of the Pearson Product Moment Correlation and the Pearson R is reported. Cohen's D was calculated to determine effect sizes.

4.8. Results for the Study

4.8.1. Demographic Information of Participants

Table 16 identifies characteristics, frequencies, and percentages that represent the amount of boys and girls that participated in the virtual dairy farm field trip, as well as the different ethnicities of the study participants. The second column in Table 16 identifies the frequencies and percentages of characteristics of study participants of the virtual dairy farm field trip. Study participants of the virtual dairy farm field trip were also asked two questions regarding their agricultural experience. These questions were

used to gauge how much previous agricultural experience study participants may have before completing the dairy virtual field trip.

Table 16

Demographics of Participants in the Virtual Dairy Farm Field Trip (N=125)

Gender		
Boy	66 (52.8%)	
Girl	59 (47.2%)	
Ethnicity		
Non-Hispanic White	99 (79.2%)	
Hispanic	10 (8.0%)	
African American	11 (8.8%)	
American Indian	1 (.8%)	
Asian or Pacific Islander	0 (0.0%)	
Other	4 (3.2%)	
Agricultural Experiences^a		
	Yes	No
Do you live on a farm?	9 (7.7%)	108 (92.3%)
Have you ever visited a farm before today?	81 (69.2%)	36 (30.8%)

^a 8 students did not report for agricultural experience.

4.9. Results: Knowledge Gained

4.9.1. Science Standard

Science standard 2.3, “observe, ask questions about and describe how organisms change their forms and behaviors during their life cycles” was assessed through two true/false questions, one matching, and one multiple choice question. Science standard 2.4.2, “identify technologies developed by humans to meet human needs. Investigate the limitations of technologies and how they have improved quality of life” was assessed using one multiple choice question. Table 17 identifies the variables that were assessed

regarding the Science standards and study participants' mean pre-test and post-test percentage scores, as well as the percentage difference between the two tests.

Sixty-eight study participants of the virtual dairy farm field trip (54.4%) correctly answered on the pre-test that dairy cows drink a bathtub full of water a day and ninety-one study participants (77.8%) correctly answered this question on the post-test and eight study participants (6.4%) did not report. Only fifty study participants (40.7%) on the pre-test knew that a cow must have a calf before it can start making milk and two study participants (1.6%) did not report. On the post-test, seventy-six study participants (66.1%) correctly answered that a cow must have a calf before it can start making milk and ten study participants (8.0%) did not report (Table 17).

On the matching portion of the pre-test, eighty-two of the study participants of the virtual field trip (68.9%) correctly matched the term "cow" to its correct definition of "an adult female" and six study participants (4.8%) did not report. On the post-test, eighty-eight study participants (75.9%) correctly matched the term "cow" to its correct definition and nine study participants (7.2%) did not report. On the pre-test, ninety-nine study participants (82.5%) correctly matched the term "calf" to its correct definition of "a baby that is either a boy or a girl" and five study participants (4.0%) did not report. On the post-test, one hundred and two study participants (88.7%) correctly matched the term "calf" to its correct definition and ten study participants (8.0%) did not report. On the pre-test, eighty-seven of the study participants of the virtual dairy farm field trip (72.5%) correctly matched the term "bull" to its correct definition of "an adult male" and five study participants (4.0%) did not report. On the post-test, eighty-nine study participants

(77.4%) of study participants matched the term “bull” to its correct definition and ten study participants (8.0%) did not report.

Thirty-six study participants (29.5%) on the pre-test were able to correctly identify a Holstein as the most popular breed of dairy cow and three study participants (2.4%) did not report. On the post-test, ninety-eight study participants (83.1%) were able to correctly identify a Holstein as the most popular breed of dairy cow and ten study participants (8.0%) did not report. Sixty-three study participants (50.8%) on the pre-test were able to identify a picture of a Holstein cow and one student (.8%) did not report. On the post-test, ninety-eight study participants (83.1%) were able to correctly identify a picture of a Holstein cow and seven study participants (5.6%) did not report. Seventy-six study participants (60.8%) on the pre-test were able to correctly identify that most dairy cows today are milked using a milking parlor. Ninety-nine study participants (81.8%) on the post-test were able to correctly identify that most dairy cows today are milked using a milking parlor and four study participants (3.2%) did not report.

Table 17

Pre-/Post-Test Mean Percentage Scores and Differences for Virtual Dairy Farm Field Trip Participants for Questions Addressing Indiana Science Standards 2.3 and 2.4.2

Question (Standard Addressed)	Pre-Test % Correct (N=125)	Post-Test % Correct (N=125)	(+/-) % Difference
On average a dairy cow drinks a bathtub full of water a day (2.3).	54.4%	77.8%	+ 23.4
A cow must have a calf before it can make milk (2.3).	40.7%	66.1%	+ 25.4
Definition- Cow (2.3)	68.9%	75.9%	+ 7.0
Definition- Calf (2.3)	82.5%	88.7%	+ 6.2
Definition- Bull (2.3)	72.5%	77.4%	+ 4.9
Which dairy cow is the most popular (2.3)?	29.5%	66.1%	+ 36.6
Which of the following picture shows a Holstein cow (2.3)?	50.8%	83.1%	+ 32.3
How most dairy cows are milked today (2.4.2).	60.8%	81.8%	+ 21.0

Mean test scores for the items related to the Science standard for study participants of the virtual dairy farm field trip increased from 56.20% \pm 20.12 to 71.90% \pm 27.57 ($p < .001$), with a medium effect size ($d=.65$) and a t-value of -7.84. Study participants had a mean percentage increase of 15.70% (SD= 22.39) on the post-test.

4.9.2. Social Studies Standard

Study participants of the virtual dairy farm field trip were asked one ordering question (Appendices G and H) to address the Social Studies standard “research goods and services produced in the local community and describe how people can be both producers and consumers” (2.4.4). Table 18 identifies the variables assessed regarding

the Social Studies standard and study participants' mean pre-test and post-test percentage score, as well as the percentage difference between the two tests.

Study participants of the virtual dairy farm field trip were also asked to order the seven steps of how milk gets from the cow to them. Eighty-seven study participants (70.2%) on the pre-test were able to correctly identify step one of the process and one student (.8%) did not report. One hundred study participants (82.0%) on the post-test were able to correctly identify step one of the process and three study participants (2.4%) did not report. Sixty-five study participants (52.0%) on the pre-test were able to correctly identify step two of the process. Eighty-eight study participants (72.1%) on the post-test were able to correctly identify step two of the process and three study participants (2.4%) did not report. Only twenty-seven study participants (21.6%) on the pre-test were able to correctly identify step three of the process. Sixty-three study participants (51.6%) on the post-test were able to correctly identify step three of the process and three study participants (2.4%) did not report. Fifteen study participants (12.0%) on the pre-test were able to correctly identify step four of the process. Thirty-seven study participants (30.6%) on the post-test were able to correctly identify step four of the process and four study participants (3.2%) did not report. Thirty-seven study participants (30.6%) on the post-test incorrectly identified the picture representing step six as being step four.

Nine study participants (7.2%) on the pre-test were able to correctly identify step five of the process (Table 21). Forty-one study participants (33.6%) on the post-test were able to correctly identify step five of the process and three study participants (2.4%) did not report. Fifty-three study participants (42.4%) on the pre-test were able to correctly identify step six of the process. Sixty-five study participants (53.7%) on the post-test

were able to correctly identify step six of the process and four study participants (3.2%) did not report. One hundred and eighteen study participants (94.4%) on the pre-test were able to correctly identify step seven in the process. One hundred and fifteen study participants (94.3%) on the post-test were able to correctly identify step seven of the process and three study participants (2.4%) did not report.

Table 18

Pre-/Post-Test Mean Percentage Scores and Differences for Virtual Dairy Farm Field Trip Participants for Questions Addressing Indiana Social Studies Standard 2.4.2

Questions (Standard Addressed)	Pre-Test % Correct (N=125)	Post-Test % Correct (N=125)	(+/-) % Difference
Steps of how milk gets from the cow to you- Step 1 (2.4.2)	70.2%	82.0%	+ 11.8
Steps of how milk gets from the cow to you- Step 2 (2.4.2)	52.0%	72.1%	+ 20.1
Steps of how milk gets from the cow to you- Step 3 (2.4.2)	21.6%	51.6%	+ 30.0
Steps of how milk gets from the cow to you- Step 4 (2.4.2)	12.0%	30.6%	+ 18.6
Steps of how milk gets from the cow to you- Step 5 (2.4.2)	7.2%	33.6%	+ 26.4
Steps of how milk gets from the cow to you- Step 6 (2.4.2)	42.4%	53.7%	+ 11.3
Steps of how milk gets from the cow to you- Step 7 (2.4.2)	94.4%	94.3%	- .1

Mean test scores for the items related to the Social Studies standard for study participants of virtual dairy farm field trip increased from 47.74% \pm 19.07 to 58.17% \pm 27.64 ($p < .001$), with a small effect size ($d = .44$) and a t -value of -6.03. Study participants had a mean percentage increase of 15.43% (SD= 28.61) on the post-test.

4.9.3. Health and Wellness Standard

Study participants of the virtual dairy farm field trip were asked five multiple choice questions (Appendices G and H) to address the Health and Wellness standards “identify that healthy behaviors affect personal healthy” (2.1.1) and “demonstrate healthy practices and behaviors to maintain or improve personal healthy” (2.7.1). Table 19 lists the variables assessed regarding the Health and Wellness standard and study participants’ mean pre-test and post-test percentage score, as well as the percentage difference between the two tests.

Ninety-three of the study participants of the virtual dairy farm field trip (74.4%) correctly identified that cheese was a dairy food on the pre-test. One hundred and ten study participants (90.2%) on the post-test were able to correctly identify that cheese was a dairy food and three study participants (2.4%) did not report. One hundred and fourteen study participants (91.2%) on the pre-test correctly identified that bacon was not a dairy food. One hundred and thirteen study participants (92.6%) on the post-test correctly identified that bacon was not a dairy food and three study participants (2.4%) did not report. One hundred and eight study participants (86.4%) on the pre-test correctly identified that ham was not a dairy food. One hundred and fourteen study participants (93.4%) on the post-test correctly identified that ham was not a dairy food and three study participants (2.4%) did not report. Seventy-two study participants (57.6%) on the pre-test correctly identified that ice-cream was a dairy food. One hundred study participants (82.0%) on the post-test correctly identified that ice-cream was a dairy food and three study participants (2.4%) did not report (Table 19).

Seventy-eight study participants (62.4%) on the pre-test correctly identified that cream cheese was a dairy food. Ninety-eight study participants (80.3%) on the post-test correctly identified that cream cheese was a dairy food and three study participants (2.4%) did not report. Forty study participants (32.0%) on the pre-test correctly identified that whipped cream was a dairy food. One hundred study participants (82.0%) on the post-test correctly identified that whipped cream was a dairy food and three study participants (2.4%) did not report. One hundred and fifteen study participants (92.0%) on the pre-test correctly identified that milk was a dairy food. One hundred and sixteen study participants (95.1%) on the post-test correctly identified that milk was a dairy food and three study participants (2.4%) did not report. Eighty-five study participants (68.0%) on the pre-test correctly identified that eggs were not a dairy food. One hundred and one study participants (82.8%) on the post-test correctly identified that eggs were not a dairy food and three study participants (2.4%) did not report.

Thirty-eight study participants (30.6%) on the pre-test were able to correctly identify that they need three servings of dairy a day and one student (.8%) did not report. Thirty-seven study participants (30.6%) on the post-test were able to correctly identify that they need three servings of dairy a day and four study participants (3.2%) did not report. Seventy-five study participants (60.5%) on the pre-test were able to correctly identify that one serving of milk gives you 30% of calcium. Eighty-five study participants (70.2%) on the post-test were able to correctly identify that one serving of milk gives you 30% of calcium and four study participants (3.2%) did not report. Seventy-two study participants (57.6%) on the pre-test were able to correctly identify that calcium is important to make strong bones and teeth. Eighty-one study participants (67.5%) on the

post-test were able to correctly identify that calcium is important to make strong bones and teeth and five study participants (4.0%) did not report.

One hundred and twenty-five study participants (100.0%) on the pre-test were able to correctly identify milk as the healthier choice compared to Coke. One hundred and twenty-one study participants (100.0%) on the post-test were able to correctly identify milk as the healthier choice compared to Coke and four study participants did not report (3.2%). One hundred and nineteen study participants (96.7%) on the pre-test correctly identified string cheese as the healthier choice as compared to chocolate and two study participants (1.6%) did not report. One hundred and twenty-one study participants (99.2%) on the post-test correctly identified string cheese as the healthier choice as compared to chocolate and three study participants (2.4%) did not report. One hundred and fourteen study participants (95.8%) on the pre-test correctly identified yogurt as the healthy choice as compared to Jell-O and six study participants (4.8%) did not report. One hundred and thirteen study participants (95.8%) on the post-test correctly identified yogurt as the healthier choice compared to Jell-O and seven study participants (5.6%) did not report.

Table 19

Pre-/Post-Tests Mean Percentage Scores and Differences for Virtual Dairy Farm Field Trip Participants for Questions Addressing Indiana Health and Wellness Standards 2.1.1 and 2.7.1

Questions (Standard Addressed)	Pre-Test % Correct (N=125)	Post-Test % Correct (N=125)	(+/-) % Difference
Dairy Foods- Cheese (2.1.1)	74.4%	90.2%	+ 15.8
Dairy Foods- Bacon (2.1.1)	91.2%	92.6%	+ 1.4
Dairy Foods- Ham (2.1.1)	86.4%	93.4%	+ 7.0
Dairy Foods- Ice Cream (2.1.1)	57.6%	82.0%	+ 24.4
Dairy Foods- Cream Cheese (2.1.1)	62.4%	80.3%	+ 17.9
Dairy Foods- Whipped Cream (2.1.1)	32.0%	82.0%	+ 50.0
Dairy Foods- Milk (2.1.1)	92.0%	95.1%	+ 3.1
Dairy Foods- Eggs (2.1.1)	68.0%	82.8%	+ 14.8
How many servings of dairy do you need each day (2.1.1)?	30.6%	30.6%	0.0
One serving of milk can give you 30% of what mineral needed (2.7.1)?	60.5%	70.2%	+ 9.7
Why do you need the mineral calcium (2.7.1)?	57.6%	67.5%	+ 9.9
Healthy Choice- Milk or Coke (2.7.1)?	100.0%	100.0%	0.0
Healthy Choice- Chocolate or String Cheese (2.7.1)?	96.7%	99.2%	+ 2.5
Healthy Choice- Yogurt or Jell-O (2.7.1)?	95.8%	95.8%	0.0

Mean test scores for the items related to the Health and Wellness standards for study participants of virtual dairy farm field trip increased from 71.31% \pm 16.65 to 80.57% \pm 20.26 ($p < .001$), with a medium effect size ($d = .50$) and a t -value of -6.13. Study participants had a mean percentage increase of 9.26% ($SD = 16.90$) on the post-test.

4.9.4. Enjoyment Scale

Study participants completed a twelve-item scale on the post-test (Appendix H) to measure their enjoyment of the virtual dairy farm field trip. Means and standards deviations were reported (Table 20).

4.9.5. Virtual Dairy Farm Field Trip Study Participants' Enjoyment Scale Frequencies

Study participants of the virtual dairy farm field trip were asked about their general enjoyment of the virtual dairy farm field trip. When asked to rate their agreement with the statement, "I enjoyed the lesson," participants responded as follows:

- **Disagree a lot** 3.4% (4 students)
- **Disagree** 4.3% (5 students)
- **Not decided** 10.3% (12 students)
- **Agree** 29.9% (35 students)
- **Agree a lot** 52.1% (61 students)
- **Did not report** 6.4% (8 students)

When asked to rate their agreement with the statement, "the lesson was boring," participants responded as follows:

- **Disagree a lot** 54.7% (64 students)
- **Disagree** 22.2% (26 students)
- **Not decided** 12.8% (15 students)
- **Agree** 5.1% (6 students)
- **Agree a lot** 5.1% (6 students)
- **Did not report** 6.4% (8 students)

When asked to rate their agreement with the statement, “I disliked the lesson,”

participants responded as follows:

- **Disagree a lot** 48.2% (55 students)
- **Disagree** 22.8% (26 students)
- **Not decided** 13.2% (15 students)
- **Agree** 7.0% (8 students)
- **Agree a lot** 8.8% (10 students)
- **Did not report** 8.8% (11 students)

When asked to rate their agreement with the statement, “I found the lesson pleasurable,”

participants responded as follows:

- **Disagree a lot** 12.5% (14 students)
- **Disagree** 8.9% (10 students)
- **Not decided** 8.0% (9 students)
- **Agree** 24.1% (27 students)
- **Agree a lot** 46.4% (52 students)
- **Did not report** 10.4% (13 students)

When asked to rate their agreement with the statement, “the lesson was no fun at all,”

participants responded as follows:

- **Disagree a lot** 47.8% (55 students)
- **Disagree** 24.3% (28 students)
- **Not decided** 13.0% (15 students)
- **Agree** 3.5% (4 students)
- **Agree a lot** 11.3% (13 students)
- **Did not report** 8.0% (10 students)

When asked to rate their agreement with the statement, “the lesson was very pleasant,” participants responded as follows:

- **Disagree a lot** 5.2% (6 students)
- **Disagree** 5.2% (6 students)
- **Not decided** 10.3% (12 students)
- **Agree** 25.0% (29 students)
- **Agree a lot** 54.3% (63 students)
- **Did not report** 7.2% (9 students)

When asked to rate their agreement with the statement, “the lesson frustrated me,” participants responded as follows:

- **Disagree a lot** 43.1% (50 students)
- **Disagree** 25.0% (29 students)
- **Not decided** 19.0% (22 students)
- **Agree** 7.8% (9 students)
- **Agree a lot** 5.2% (6 students)
- **Did not report** 7.2% (9 students)

When asked to rate their agreement with the statement, “I learned several new things from the lesson,” participants responded as follows:

- **Disagree a lot** 5.9% (7 students)
- **Disagree** 3.4% (4 students)
- **Not decided** 5.9% (7 students)
- **Agree** 24.6% (29 students)
- **Agree a lot** 60.2% (71 students)
- **Did not report** 5.6% (7 students)

When asked to rate their agreement with the statement, “the lesson was very exciting,” participants responded as follows:

- **Disagree a lot** 7.1% (8 students)
- **Disagree** 3.5% (4 students)
- **Not decided** 14.2% (16 students)
- **Agree** 23.9% (27 students)
- **Agree a lot** 51.3% (58 students)
- **Did not report** 9.6% (12 students)

When asked to rate their agreement with the statement, “the lesson was not at all interesting,” participants responded as follows:

- **Disagree a lot** 58.5% (69 students)
- **Disagree** 17.8% (21 students)
- **Not decided** 8.5% (10 students)
- **Agree** 4.2% (5 students)
- **Agree a lot** 11.0% (13 students)
- **Did not report** 5.6% (7 students)

When asked to rate their agreement with the statement, “the lesson gave me a strong feeling of accomplishment,” participants responded as follows:

- **Disagree a lot** 9.3% (11 students)
- **Disagree** 5.9% (7 students)
- **Not decided** 17.8% (21 students)
- **Agree** 23.7% (28 students)
- **Agree a lot** 43.2% (51 students)
- **Did not report** 5.6% (7 students)

When asked to rate their agreement with the statement, “I felt as though I would rather be doing something else,” participants responded as follows:

- **Disagree a lot** 54.2% (64 students)
- **Disagree** 17.8% (21 students)
- **Not decided** 11.0% (13 students)
- **Agree** 3.4% (4 student)
- **Agree a lot** 13.6% (16 students)
- **Did not report** 5.6% (7 students)

Table 20

Enjoyment of the Virtual Dairy Farm Field Trip (N=125)

Item	Mean (SD)
I enjoyed the lesson.	4.23 (1.03)
I learned several new things from the lesson.	4.30 (1.12)
The lesson was very pleasant.	4.18 (1.14)
The lesson was very exciting.	4.09 (1.20)
The lesson gave me a strong feeling of accomplishment.	3.86 (1.30)
I found the lesson pleasurable.	3.83 (1.42)
The lesson frustrated me.	2.07 (1.19)
I disliked the lesson.	2.05 (1.30)
The lesson was no fun at all.	2.06 (1.33)
I felt as though I would rather be doing something else.	2.04 (1.42)
The lesson was not at all interesting.	1.92 (1.36)
The lesson was boring.	1.84 (1.15)

Scale: 1= Disagree A Lot, 2=Disagree, 3= Not Decided, 4= Agree, 5= Agree A Lot

4.9.6. Pearson’s Correlations

Correlations between knowledge gained in Science, Social Studies, and Health and Wellness standards and previous agricultural experience were calculated for study participants of the virtual dairy farm field trip. There were no significant correlations between study participants’ previous agricultural experience and knowledge gained in the specific Science, Social Studies, and Health and Wellness standards addressed.

Correlations were also calculated between study participants' enjoyment of the virtual dairy farm field trip and their knowledge gained in the specific Science, Social Studies, and Health and Wellness standards addressed. While study participants reported to have enjoyed the virtual dairy farm field trip, there were no significant correlations between study participants' enjoyment and their knowledge gained in the specific standards addressed.

4.9.7. Summary and Conclusions

1. Does participation in a dairy virtual field trip increase knowledge gained in selected Science, Social Studies, and Health and Wellness standards?

After participation in the virtual dairy farm field trip, study participants showed significant knowledge gain between the pre-test and the post-test in the specific Science, Social Studies, and Health and Wellness standards. Post-test scores indicated that study participants demonstrated a greater amount of knowledge regarding topics discussed on the virtual dairy farm field trip such as the daily care of dairy cows, why dairy foods are important, and the process of how milk gets from the cow the students.

Therefore, the classroom-based virtual field trip served as an effective method of teaching students these specific standards in the context of agriculture, specifically the dairy industry. While the dairy virtual field trip cannot provide students with the sense of experiencing an on-site field trip to a dairy farm, the virtual field trip can effectively teach the standards that are addressed in the dairy field trip.

2. Does the level of enjoyment of participants in the virtual dairy farm field trip impact knowledge gained in Science, Social Studies, and Health and Wellness standards?

Overall, study participants responded positively to the virtual dairy farm field trip based on the enjoyment scale. Participants reported that they enjoyed the virtual dairy farm field trip and that they learned several new things from the lesson. Participants willingly told the researcher that they had fun working through the virtual dairy farm field trip and doing the activities that were included in it.

Study participants of the virtual dairy farm field trip reported high levels of enjoyment on the positive items, as well as high levels of knowledge gained from the pre-test to the post-test. Students' enjoyment of the virtual dairy farm field trip did not significantly impact knowledge gained the specific standards addressed. All study participants indicated a high level of enjoyment of the virtual dairy farm field trip, independent of knowledge gained in the three standards areas addressed.

CHAPTER 5. CONCLUSION

5.1. Purpose of the Study

The purpose of this study was to assess if a virtual dairy farm field trip is an effective method of teaching specific Science, Social Studies, and Health and Wellness to 2nd grade students. This study assessed if an on-site dairy field trip is an effective method of teaching selected Science, Social Studies, and Health and Wellness standards to 3rd grade students.

5.2. Research Questions for the Study

The following questions guided the study:

1. Does participation in a virtual dairy farm field trip increase knowledge gained in specific Science, Social Studies, and Health and Wellness standards?
2. Does participation in an on-site dairy farm field trip increase knowledge gained in specific Science, Social Studies, and Health and Wellness standards?
3. Does the level of enjoyment of participants in the virtual and on-site dairy farm field trip impact knowledge gained in specific Science, Social Studies, and Health and Wellness standards?

5.3. Conclusions for Research Questions 1 and 2

This study found that overall study participants showed statistically significant knowledge gain in the specific Science, Social Studies, and Health and Wellness standards addressed in the virtual and on-site dairy field trip. The effectiveness of the dairy virtual field trip in teaching students standards addressed in the on-site dairy field trips supports Kirchen's (2011) contention that virtual field trips can serve as a way to prepare students for an actual field trip or act as a review for when students return from the field trip.

The connection of the virtual field trip to state learning standards allows teachers the opportunity to incorporate the virtual field trip into their curriculum. An example is the Health and Wellness portion of the dairy virtual field trip, which could be integrated into a classroom lesson discussing healthy nutritional choices. The importance of the connection to standards and curriculum assists students with knowing why they went on the field trip and not just what they did on the field trip (Kisiel, 2006).

While on-site dairy farm field trip study participants represented students who were in 3rd grade and virtual dairy farm field trip study participants represented students that were in 2nd grade, there was overlap between the standards that were addressed and the questions that were asked on the pre-test and the post-test. The difference in age between groups did not affect the results of the study because there were no comparisons drawn to determine if one method of delivery is more effective than the other type of delivery method.

On-site dairy farm field trip study participants demonstrated a higher percentage mean difference from the pre-test to the post-test in the Social Studies and Health and

Wellness standards than virtual dairy farm field trip study participants. This difference could be due to the sensory opportunities and experiences that the on-site dairy farm field trip students were exposed to. Virtual field trips simply do not provide students with the same experiences (Garner & Gallo, 2005) or sensory opportunities (Tuthill & Klemm, 2002) as a physical field trip. While students using the dairy virtual field trip were able to watch and hear cows being milked in a milking parlor, they were unable to have the full sensory experience of those students who visited the actual milking parlor. The sensory experience of an on-site field trip can help students' develop personal connections with the context of the field trip (Harrington, 2009), which helps reinforce concepts and ideas presented during the on-site field trip.

There were no statistically significant relationships between virtual dairy farm field trip study participants' previous agricultural experience and knowledge gained in the standards. There was one moderate significant correlation between the question "have you ever visited a farm before today" and knowledge gained in the Social Studies standard for on-site dairy farm field trip study participants. While this is a significant, positive relationship, there was only one question that contained seven variables that addressed the Social Studies standard. This question asked study participants to correctly order the seven pictures that represented the seven steps of the process of getting milk from the farm to the home. Overall, study participants struggled with this question, especially the middle steps of the question. All responses were dependent on all other responses and overall study participants incorrectly ordered the middle steps of the seven step process. Also, more variation in the questions asked addressing this standard may show a different relationship between this standard and this particular question asked.

5.4. Conclusions for Research Question 3

Study participants' overall responses on the enjoyment scale were positive. Study participants were interested in the dairy farm field trips, whether in person or virtually. However, there were no significant correlations between study participants' enjoyment and knowledge gained in the specific standards that were addressed in the virtual and on-site dairy farm field trips. Study participants reported consistently high levels of enjoyment; therefore there was little variation for any significant correlations. Those study participants who showed high levels of knowledge gained, as well as low levels of knowledge gained, consistently reported an overall high level of enjoyment. This may contribute to the lack of association between study participants' enjoyment and their knowledge gained.

While enjoyment and knowledge gained were not associated, the reported high levels of enjoyment contribute to the full experience of both the virtual and on-site field trip. Anderson, Kisiel, and Storksdieck (2006) found that enjoyment of the field trip, as well as how the field trip fits into the curriculum, help shape and contribute to the overall field trip experience. Students were visibly excited about the content of both the on-site and virtual dairy field trip, which led to discussion amongst students, the teacher, and adult volunteers about what they were reading, hearing, or in the case of the on-site field trip, smelling.

5.5.Recommendations for Future Research

While qualitative methods have been used to measure enjoyment of an online game, surveys are more appropriate when the research design includes larger numbers of participants and will help identify the strengths and weaknesses of the module (Fu, Su, and Yu, 2009). For this study, a quantitative method provided more information when determining students' knowledge gained from pre-tests to post-tests. However, future studies could use a mixed-methods approach to provide further detail and insight into students' overall experiences regarding the virtual field trip and the strengths and weaknesses of the module created. Determining strengths and weaknesses of the module could contribute to future development of modules similar to this one. A mixed-methods approach could provide more detailed information that could be used to make further comparisons between enjoyment and knowledge gained in the standards that are addressed.

Further studies should look at how a virtual field trip enhances an on-site field trip, such as how a virtual field trip may provide focus for students during the on-site field trip. Wood suggests that virtual field trips should serve to enhance and support rather than replace an actual physical field trip (as cited in Placing & Fernandez, 2002, p. 42), as well as enhance in-class activities (Tuthill & Klemm, 2002). Using the virtual field trip as a tool for a pre-visit activity for an on-site field trip can help familiarize students with content. When students are familiar with the content of the field trip, their enjoyment of the field trip is enhanced (Killerman, 1998). Future studies could examine the effectiveness of both a virtual field trip and an on-site field trip compared to just a virtual field trip alone, on-site field trip alone, or the more traditional didactic teaching.

5.6. Implications to Practice

Application of the virtual dairy farm field trip in effectively teaching study participants specific Science, Social Studies, and Health and Wellness standards in the context of the dairy industry can be applied and used a resource in formal and informal learning environments. Application of the dairy farm virtual field in formal learning environments can be a resource that the teacher can use for an effective alternative to an on-site field trip. The virtual field trip can help educators eliminate many of the barriers that prevent them from taking their students on field trips, such as funding, weather, and time.

The learning objectives of the virtual and on-site field trips assessed in this research were connected to the state learning standards, which can allow students to connect their in-class learning to their out-of-class learning. The connection of the virtual and on-site field trips in this research to state standards supports research findings by Kisiel (2006), Noel (2007), and Stoddard (2009) that when connected to the curriculum, field trips provide opportunities for students to connect their in-class learning and create an overall meaningful learning experience. Furthermore, when connected to classroom curriculum, students will be more likely to view field trips as an educational experience rather than as a separate activity (Morentin & Guisasola, 2014). Part of the virtual dairy farm field trip, as well as the on-site dairy farm field trip, showed youth examples of dairy products they may eat or drink every day. This helps students establish a more personal connection with the field trips because they recognize many of the dairy products they use or see every day.

Application of the virtual field trip might serve to enhance an on-site field trip by serving as a pre-visit activity or a post-visit activity. Pre and post-visit activities can help orient students to the on-site field trip or provide follow-up activities to help reinforce what students saw, read, and heard on the field trip. Furthermore, an on-site field trip can be more effective and successful when educators relate and connect content being learned in class to the future field trip or refer back to the field trip (Cassady, Kozlowski, and Kommann's, 2008). Additionally, younger youth gain more from field trips when teachers prepare and integrate activities regarding the field trip into the classroom (Davidson, Passmore, & Anderson, 2009). On-site field trips provide many sensory experiences for youth. However, a virtual field trip that is used in conjunction with an on-site field trip can help students focus on the content addressed during the actual field trip (Raskind, Smedley, & Higgins, 2005).

Beyond an on-site field trip, the application of the virtual dairy farm field trip has potential to be used in other informal learning environments, such as in extension education. Extension educators could use the virtual dairy farm field trip as an educational tool for the public or to enhance youth events or programs, such as Ag Days or county fairs. With this tool, youth are able to work through the lesson and activities at their own pace and by themselves. While this could be an effective tool for extension educators to utilize, it is limited in its ability to meet the needs of a variety of audiences that may visit informal events. This dairy farm virtual field assessed in the current research was designed to target a younger youth audience and therefore cannot accommodate differing audiences, backgrounds, or ages.

However, the success of the design of the virtual dairy farm field trip in effectively teaching students specific Science, Social Studies, and Health and Wellness standards, and the use of the Cognitive Theory of Multimedia Learning (Mayer, 2001) as a design theory, can assist in the development of future virtual field trips for students. With all of the features that make an effective virtual field trip, the Cognitive Theory of Multimedia Learning (Mayer, 2001) assists with being able to provide these features while not overwhelming the audience with extraneous information.

5.7. Research Summary

This study found that both the on-site and virtual dairy farm field trip were effective methods of teaching specific Science, Social Studies, and Health and Wellness standards to 2nd and 3rd grade students. Study participants reported an overall positive response on the enjoyment scale regarding both the on-site and virtual dairy field trips; however, this study found that enjoyment and knowledge gained were not associated.

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[9c93-5ee6b40a0c47%40sessionmgr4001&vid=2&hid=4107](http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=d4c7c94c-1f31-4da7-9c93-5ee6b40a0c47%40sessionmgr4001&vid=2&hid=4107)

APPENDICES

Appendix A. Dairy Farm Teacher E-mail

Dear (Principal Name Here) and Third Grade Teachers,

My name is Abby Sweet and I am a graduate student from Purdue University and I am working on my Masters' thesis project, with the assistance of Purdue University faculty members, I will be developing an online learning module to compare student learning and enjoyment between a live dairy farm tour and an online learning module regarding dairy cattle. I obtained your plans to visit Kelsay Farms from Amy Kelsay.

This letter is to inform you what participants will be asked to do. Students will need to complete a short survey before beginning the dairy farm tour and after completion of the tour. These surveys will take approximately 20 minutes each. I understand that you will be on a strict time schedule for the trip and therefore could do the pre-test in the classrooms the day before you leave for the field trip and the post-test once you return back to your classroom.

Furthermore, participation in this study is completely voluntary. Children who choose not to participate will be provided other worksheets and supplemental educational activities, without penalty, to do while others are completing the surveys. Students will still be able to go on the dairy farm tour regardless if they complete the surveys or not. The information obtained from these surveys will help determine if an online module has similar levels of enjoyment and student learning as a live dairy farm tour experience. All educational surveys associated with this project are used solely to determine knowledge gained and level of enjoyment. No sensitive information about the student or his/her family will be collected. All components of this project will be kept completely confidential. Participants will be identified by a unique number.

If you have any questions or would like further information about the study, please do not hesitate to e-mail us at the provided addresses. We thank you for your time, and we hope that you strongly consider this opportunity.

Sincerely,

Abby Sweet
Graduate Research Assistant
Specialist
asweet@purdue.edu

Colleen Brady
Associate Professor/Extension
bradyc@purdue.edu

Appendix B. Dairy Farm Pre-Test
Dairy Tour Pre-test Instrument

Participant Number _____

IRB Approval #1312014349

Approval Date: January 31, 2014

Student Pre Assessment

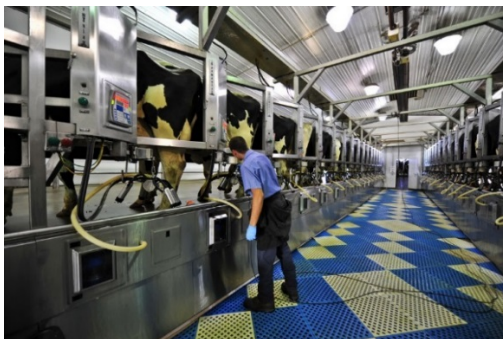
Directions: Please choose the best answer

1. Please circle which picture best shows how most dairy cows are milked today.
(Science Standard 3.4.2)

a.



b.



c.



Please choose the best answer.

2. On average a dairy cow drinks a bathtub full of water a day. (Science Standard 3.2.5)

True False

3. A cow must have a calf before they can make milk. (Science Standard 3.2.5)

True False

4. Which of the following are dairy foods? Please circle all of the dairy foods in the list. (Health & Wellness Standard 3.1.1)

Cheese

Cream Cheese

Bacon

Whipped Cream

Ham

Milk

Ice Cream

Eggs

5. How many servings of dairy do you need each day? Please circle the correct answer. (Health & Wellness Standard 3.1.1)

- a. 1
- b. 2
- c. 3
- d. 4

6. One serving of milk can give you 30% of what mineral needed? Please circle the correct answer. (Health & Wellness Standard 3.7.1)

- a. Iron
- b. Calcium
- c. Potassium
- d. Zinc

7. Why do you need the mineral in question 6? Please circle the correct answer. (Health & Wellness Standard 3.7.1)

- a. To have healthy blood
- b. To make strong bones and teeth
- c. To build strong muscles
- d. So you don't get sick

8. Please circle the healthy choice in each of the rows. (Health & Wellness Standard 3.7.1)

a.



b.



c.



9. Please put in order (from first to last) the steps of how milk gets from the cow to you by numbering the blanks next to the pictures. (Social Studies 3.4.2)















10. Please match the word in **bold print** to its correct definition. (Science Standard 3.2.5)

- a. **Cow** _____ An adult male
b. **Calf** _____ An adult female
c. **Bull** _____ A baby that is either a boy or girl

11. Which dairy cow is the most popular? Please circle the correct answer. (Science Standard 3.2.5)

- a. Brown Swiss
b. Ayrshire
c. Holstein
d. Milking Shorthorn
e. Jersey
f. Guernsey

12. Which of the following pictures shows a Holstein cow? Please circle the correct picture. (Science Standard 3.2.5)

a.



b.



c.



d.



Please circle the answer for each sentence.

- | | | |
|--|-----|------|
| 1. I am a: | Boy | Girl |
| 2. This is my first time visiting a dairy farm. | Yes | No |
| 3. This is my first time to see a cow in person. | Yes | No |
| 4. Have you ever visited a farm before today? | Yes | No |
| 5. Do you live on a farm? | Yes | No |

Please circle your race/ethnicity?

- a. Non-Hispanic White
- b. Hispanic
- c. African American
- d. American Indian
- e. Asian or Pacific Islander
- f. Other

Appendix C. Dairy Farm Post-Test
Dairy Tour Post-test Instrument

Participant Number _____

IRB Approval #1312014349
Approval Date: January 31, 2014

Student Post Assessment

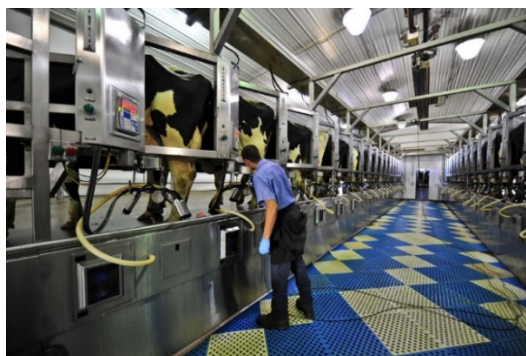
Directions: Please choose the best answer

1. Please circle which picture best shows how most dairy cows are milked today.
(Social Studies 2.4.4)

a.



b.



c.



Please choose the best answer.

2. On average a dairy cow drinks a bathtub full of water a day. (Science Standard 3.2.5)
True False
3. A cow must have a calf before they can make milk. (Science Standard 3.2.5)
True False
4. Which of the following are dairy foods? Please circle all of the dairy foods in the list. (Health & Wellness Standard 3.1.1)
- | | |
|-----------|---------------|
| Cheese | Cream Cheese |
| Bacon | Whipped Cream |
| Ham | Milk |
| Ice Cream | Eggs |
5. How many servings of dairy do you need each day? Please circle the correct answer. (Health & Wellness Standard 3.1.1)
- 1
 - 2
 - 3
 - 4
6. One serving of milk can give you 30% of what mineral needed? Please circle the correct answer. (Health & Wellness Standard 3.7.1)
- Iron
 - Calcium
 - Potassium
 - Zinc
7. Why do you need the mineral in question 6? Please circle the correct answer. (Health & Wellness Standard 3.7.1)
- To have healthy blood
 - To make strong bones and teeth
 - To build strong muscles
 - So you don't get sick

8. Please circle the healthy choice in each of the rows. (Health & Wellness Standard 3.7.1)

a.



b.



c.



9. Please put in order (from first to last) the steps of how milk gets from the cow to you by numbering the blanks next to the pictures. (Social Studies 3.4.2)















10. Please match the word in **bold print** to its correct definition. (Science Standard 2.3)

- d. **Cow** _____ An adult male
e. **Calf** _____ An adult female
f. **Bull** _____ A baby that is either a boy or girl

11. Which dairy cow is the most popular? Please circle the correct answer. (Science Standard 2.3)

- a. Brown Swiss
- b. Ayrshire
- c. Holstein
- d. Milking Shorthorn
- e. Jersey
- f. Guernsey

12. Which of the following pictures shows a Holstein cow? Please circle the correct picture. (Science Standard 2.3)

a.



b.



c.



d.



13. For the following questions, please mark how much you agree or disagree with the statements about the dairy tour you just finished.

	Disagree A Lot	Disagree	Not Decided	Agree	Agree A Lot
I enjoyed the tour.					
The tour was boring.					
I disliked the tour.					
I found the tour pleasurable.					
The tour was no fun at all.					
The tour was very pleasant.					
The tour frustrated me.					
I learned several new things from the tour.					
The tour was very exciting.					
The tour was not at all interesting.					
The tour gave me a strong feeling of accomplishment.					
I felt as though I would rather be doing something else.					

Appendix D. IRB Protocol Ref. #1312014349



HUMAN RESEARCH PROTECTION PROGRAM
INSTITUTIONAL REVIEW BOARDS

To: COLLEEN BRADY
AGAD 219

From: JEANNIE DICLEMENTI, Chair
Social Science IRB

Date: 01/31/2014

Committee:

Action: **Exemption Granted IRB Action Date:** 01/31/2014

IRB Protocol #: 1312014349

Study Title: An online dairy farm tour as an effective alternative to an on-site dairy farm tour.

The Institutional Review Board (IRB) has reviewed the above-referenced study application and has determined that it meets the criteria for exemption under 45 CFR 46.101(b)(1) .

If you wish to make changes to this study, please refer to our guidance "**Minor Changes Not Requiring Review**" located on our website at <http://www.irb.purdue.edu/policies.php>. For changes requiring IRB review, please submit an **Amendment to Approved Study** form or **Personnel Amendment to Study** form, whichever is applicable, located on the forms page of our website www.irb.purdue.edu/forms.php. Please contact our office if you have any questions.

Below is a list of best practices that we request you use when conducting your research. The list contains both general items as well as those specific to the different exemption categories.

General

- To recruit from Purdue University classrooms, the instructor and all others associated with conduct of the course (e.g., teaching assistants) must not be present during announcement of the research opportunity or any recruitment activity. This may be accomplished by announcing, in advance, that class will either start later than usual or end earlier than usual so this activity may occur. It should be emphasized that attendance at the announcement and recruitment are voluntary and the student's attendance and enrollment decision will not be shared with those administering the course.
- If students earn extra credit towards their course grade through participation in a research project conducted by someone other than the course instructor(s), such as in the example above, the students participation should only be shared with the course instructor(s) at the end of the semester. Additionally, instructors who allow extra credit to be earned through participation in research must also provide an opportunity for students to earn comparable extra credit through a non-research activity requiring an amount of time and effort comparable to the research option.
- When conducting human subjects research at a non-Purdue college/university, investigators are urged to contact that institution's IRB to determine requirements for conducting research at that institution.
- When human subjects research will be conducted in schools or places of business, investigators must obtain written permission from an appropriate authority within the organization. If the written permission was not submitted with the study application at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval, etc.), the investigator must submit the written permission to the IRB prior to engaging in the research activities (e.g., recruitment, study procedures, etc.). This is an institutional requirement.

Category 1

- When human subjects research will be conducted in schools or places of business, investigators must obtain written permission from an appropriate authority within the organization. If the written permission was not submitted with the study application at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval, etc.), the investigator must submit the written permission to the IRB prior to engaging in the research activities (e.g., recruitment, study procedures, etc.). This is an institutional requirement.

Categories 2 and 3

- Surveys and questionnaires should indicate
 - only participants 18 years of age and over are eligible to participate in the research;
 - and
 - that participation is voluntary; and
 - that any questions may be skipped; and

- include the investigator's name and contact information.
- Investigators should explain to participants the amount of time required to participate. Additionally, they should explain to participants how confidentiality will be maintained or if it will not be maintained.
- When conducting focus group research, investigators cannot guarantee that all participants in the focus group will maintain the confidentiality of other group participants. The investigator should make participants aware of this potential for breach of confidentiality.
- When human subjects research will be conducted in schools or places of business, investigators must obtain written permission from an appropriate authority within the organization. If the written permission was not submitted with the study application at the time of IRB review (e.g., the school would not issue the letter without proof of IRB approval, etc.), the investigator must submit the written permission to the IRB prior to engaging in the research activities (e.g., recruitment, study procedures, etc.). This is an institutional requirement.

Category 6

- Surveys and data collection instruments should note that participation is voluntary.
- Surveys and data collection instruments should note that participants may skip any questions.
- When taste testing foods which are highly allergenic (e.g., peanuts, milk, etc.) investigators should disclose the possibility of a reaction to potential subjects.

Appendix E. Dairy Farm Study Approval Letter

Human Research Protection Program
Ernest C. Young Hall
10th Floor, Room 1032
155 S. Grant Street
West Lafayette, IN

Kelsay Farms, gives permission to Abby Sweet, Purdue University Graduate Student, to conduct the assessment titled “An online dairy farm tour as an effective alternative to an on-site dairy farm tour”.

This will be of benefit to Kelsay Farms to participate in because a program assessment will help better the already existing tours that take place in the fall and spring. These tours have specific learning objectives, which are derived from the following Indiana Learning Standards:

- Science 3.2.5
 - Describe natural materials and give examples of how they sustain the lives of plants and animals.
- Science 3.4.2
 - Define the uses and types of simple machines and utilize simple machines in the solution to a “real world” problem.
- Social Studies 3.4.2
 - Give examples of goods and services provided by local business and industry.
- Health and Wellness 3.1.1
 - Identify the link between healthy choices and being healthy.
- Health and Wellness 3.7.1
 - Name healthy behaviors

The information gained from participation in this study will help Kelsay Farms determine areas of the tour to improve and better themselves as an educational resource to the community.

Amy Kelsay
Owner; Kelsay Farm Tours, LLC
480 N. Front St. Whiteland, IN 46184
317-535-4136

Appendix F. Schools 1 and 2 Teacher E-mail

Dear Principal (Name Here) and the Second Grade Teachers,

My name is Abby Sweet and I am a graduate student from Purdue University. I am working on my Masters' thesis project, with the assistance of Purdue University faculty members, I will be developing an online learning module to compare student learning and enjoyment between a live dairy farm tour and an online learning module regarding dairy cattle. If you are interested in your students using this online learning module, there is an opportunity for you to be involved in this study!

This letter is to inform you what participants will be asked to do. Students will need to complete a short survey before beginning the online module. Students will then work through the online learning module, which is about the dairy industry. Following the completion of the module, the students will be asked to do another short survey. These surveys will take approximately 10 minute each and the module will take 20 minutes.

Furthermore, participation in this study is completely voluntary. Children who choose not to participate will be provided other worksheets and supplemental educational activities, without penalty, to do while others are completing the surveys and module. The information obtained from these surveys will help determine if an online module such as this has similar levels of enjoyment and student learning as a live dairy farm tour experience. All educational surveys associated with this project are used solely to determine knowledge gained and level of enjoyment. No sensitive information about the student or his/her family will be collected. All components of this project will be kept completely confidential. Participants will be identified by a unique number.

If you have any questions or would like further information about the study, please do not hesitate to e-mail us at the provided addresses. We thank you for your time, and we hope that you strongly consider this opportunity.

Sincerely,

Abby Sweet
Graduate Research Assistant
Specialist
asweet@purdue.edu

Colleen Brady
Associate Professor/Extension
bradyc@purdue.edu

Appendix G. Dairy Virtual Field Trip Pre-Test

Online Lesson Pre-test Instrument

Participant Number _____

IRB Approval #1312014349

Approval Date: January 31, 2014

Student Pre Assessment

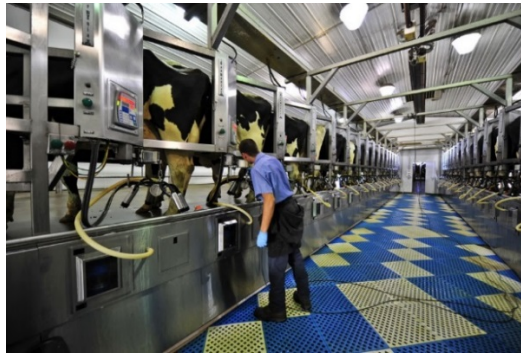
Directions: Please choose the best answer

1. Please circle which picture best shows how most dairy cows are milked today.
(Science Standard 2.4.2)

a.



b.



c.



Please choose the best answer.

2. On average a dairy cow drinks a bathtub full of water a day. (Science Standard 2.3)

True False

3. A cow must have a calf before they can make milk. (Science Standard 2.3)

True False

4. Which of the following are dairy foods? Please circle all of the dairy foods in the list. (Health & Wellness Standard 2.1.1)

Cheese

Cream Cheese

Bacon

Whipped Cream

Ham

Milk

Ice Cream

Eggs

5. How many servings of dairy do you need each day? Please circle the correct answer. (Health & Wellness Standard 2.1.1)
- 1
 - 2
 - 3
 - 4
6. One serving of milk can give you 30% of what mineral needed? Please circle the correct answer. (Health & Wellness Standard 2.7.1)
- Iron
 - Calcium
 - Potassium
 - Zinc
7. Why do you need the mineral in question 6? Please circle the correct answer. (Health & Wellness Standard 2.7.1)
- To have healthy blood
 - To make strong bones and teeth
 - To build strong muscles
 - So you don't get sick

8. Please circle the healthy choice in each of the rows. (Health & Wellness Standard 2.7.1)

a.



b.



c.



9. Please put in order (from first to last) the steps of how milk gets from the cow to you by numbering the blanks next to the pictures. (Social Studies 2.4.2)



10. Please match the word in **bold print** to its correct definition. (Science Standard 2.3)

- | | |
|----------------|---|
| g. Cow | _____ An adult male |
| h. Calf | _____ An adult female |
| i. Bull | _____ A baby that is either a boy or girl |

11. Which dairy cow is the most popular? Please circle the correct answer. (Science Standard 2.3)

- a. Brown Swiss
- b. Ayrshire
- c. Holstein
- d. Milking Shorthorn
- e. Jersey
- f. Guernsey

12. Which of the following pictures shows a Holstein cow? Please circle the correct picture. (Science Standard 2.3)

a.



b.



c.



d.



Please circle the answer for each sentence.

- | | | |
|----------------------------------|-----|------|
| 2. I am a: | Boy | Girl |
| 3. Do you live on a farm? | Yes | No |
| 4. Have you ever visited a farm? | Yes | No |

Please circle your race/ethnicity?

- a. Non-Hispanic White
- b. Hispanic
- c. African American
- d. American Indian
- e. Asian or Pacific Islander
- f. Other

Appendix H. Dairy Virtual Field Trip Post-Test

Online Lesson Post-test Instrument

Participant Number _____

IRB Approval #1312014349

Approval Date: January 31, 2014

Student Post Assessment

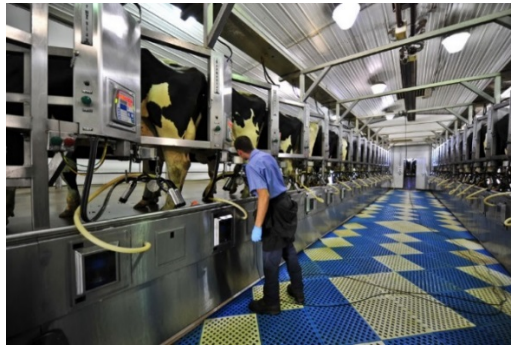
Directions: Please choose the best answer

1. Please circle which picture best shows how most dairy cows are milked today.
(Science Standard 2.4.2)

a.



b.



c.



Please choose the best answer.

2. On average a dairy cow drinks a bathtub full of water a day. (Science Standard 2.3)

True False

3. A cow must have a calf before they can make milk. (Science Standard 2.3)

True False

4. Which of the following are dairy foods? Please circle all of the dairy foods in the list. (Health & Wellness Standard 2.1.1)

Cheese

Cream Cheese

Bacon

Whipped Cream

Ham

Milk

Ice Cream

Eggs

5. How many servings of dairy do you need each day? Please circle the correct answer. (Health & Wellness Standard 2.1.1)

- a. 1
- b. 2
- c. 3
- d. 4

6. One serving of milk can give you 30% of what mineral needed? Please circle the correct answer. (Health & Wellness Standard 2.7.1)

- a. Iron
- b. Calcium
- c. Potassium
- d. Zinc

7. Why do you need the mineral in question 6? Please circle the correct answer. (Health & Wellness Standard 2.7.1)

- a. To have healthy blood
- b. To make strong bones and teeth
- c. To build strong muscles
- d. So you don't get sick

8. Please circle the healthy choice in each of the rows. (Health & Wellness Standard 2.7.1)

a.



b.



c.



9. Please put in order (from first to last) the steps of how milk gets from the cow to you by numbering the blanks next to the pictures. (Social Studies 3.4.2)















10. Please match the word in **bold print** to its correct definition. (Science Standard 2.3)

- j. **Cow** _____ An adult male
 k. **Calf** _____ An adult female
 l. **Bull** _____ A baby that is either a boy or girl

11. Which dairy cow is the most popular? Please circle the correct answer. (Science Standard 2.3)

- a. Brown Swiss
- b. Ayrshire
- c. Holstein
- d. Milking Shorthorn
- e. Jersey
- f. Guernsey

12. Which of the following pictures shows a Holstein cow? Please circle the correct picture. (Science Standard 2.3)

a.



b.



c.



d.



13. For the following questions, please mark how much you agree or disagree with the statements about the dairy tour you just finished.

	Disagree A Lot	Disagree	Not Decided	Agree	Agree A Lot
I enjoyed the tour.					
The tour was boring.					
I disliked the tour.					
I found the tour pleasurable.					
The tour was no fun at all.					
The tour was very pleasant.					
The tour frustrated me.					
I learned several new things from the tour.					
The tour was very exciting.					
The tour was not at all interesting.					
The tour gave me a strong feeling of accomplishment.					
I felt as though I would rather be doing something else.					

Appendix I. School 1 Study Approval Letter

Human Research Protection Program

Ernest C. Young Hall

10th Floor Room 1032

155 S. Grant Street

West Lafayette, IN

I, Jeff Gambill, give permission to Abby Sweet, Purdue University Graduate Student, to conduct the assessment of the online learning module that teaches Science, Social Studies, and Health and Wellness in the context of a dairy farm tour with the 2nd grade students at Shakamak Elementary School. This online learning module fits into our already existing curriculum since the module's learning objectives are derived from the following Indiana Learning Standards:

- Science 2.3
 - Observe, ask questions about and describe how organisms change their forms and behaviors during their life cycles.
- Science 2.4.2
 - Identify technologies developed by humans to meet human needs. Investigate the limitations of technologies and how they have improved quality of life.
- Social Studies 2.4.4
 - Research goods and services produced in the local community and describe how people can be both producers and consumers.
- Health and Wellness 2.1.1
 - Identify that healthy behaviors affect personal health.
- Health and Wellness 2.7.1
 - Demonstrate healthy practices and behaviors to maintain or improve personal health.

Sincerely yours,



Jeff Gambill Elementary Principal
9233 Shakamak School Rd., Jasonville, IN
47438 (812) 665-3550 ext. 200

Appendix J. School 2 Study Approval Letter

Human Research Protection Program
Ernest C. Young Hall
10th Floor, Room 1032
155 S. Grant Street
West Lafayette, IN

I, Mike Pomeranke, give permission to Abby Sweet, Purdue University Graduate Student, to conduct the assessment of the online learning module that teaches Science, Social Studies, and Health and Wellness in the context of a dairy farm tour with the 2nd grade students at Allisonville Elementary School. This online learning module fits into our already existing curriculum since the module's learning objectives are derived from the following Indiana Learning Standards:

- Science 2.3
 - Observe, ask questions about and describe how organisms change their forms and behaviors during their life cycles.
- Science 2.4.2
 - Identify technologies developed by humans to meet human needs. Investigate the limitations of technologies and how they have improved quality of life.
- Social Studies 2.4.4
 - Research goods and services produced in the local community and describe how people can be both producers and consumers.
- Health and Wellness 2.1.1
 - Identify that healthy behaviors affect personal health.
- Health and Wellness 2.7.1
 - Demonstrate healthy practices and behaviors to maintain or improve personal health.

Mike Pomeranke
Principal-Allisonville Elementary
4900 East 79th Street, Indianapolis, Indiana
317-845-9441

Appendix K. School 1 Standards Results

Table 21

Pre-/Post-Test Mean Percentage Scores and Differences from School 1 for Questions Addressing Indiana Science Standards 2.3 and 2.4.2

Question (Standard Addressed)	Pre-Test % Correct (N=57)	Post-Test % Correct (N=57)	(+/-) % Difference
On average a dairy cow drinks a bathtub full of water a day (2.3).	57.9%	81.8%	+ 23.9
A cow must have a calf before it can make milk (2.3).	40.0%	52.8%	+ 12.8
Definition- Cow (2.3)	64.2%	67.3%	+ 3.1
Definition- Calf (2.3)	85.5%	85.4%	- .1
Definition- Bull (2.3)	66.0%	64.6%	- 1.4
Which dairy cow is the most popular (2.3)?	18.5%	58.0%	+ 39.5
Which of the following pictures shows a Holstein cow (2.3)?	58.9%	84.3%	+ 25.4
How most dairy cows are milked today (2.4.2).	50.9%	74.1%	+ 23.2

Table 22

Pre-/Post-Test Mean Percentage Scores and Differences from School 1 for Questions Addressing Indiana Social Studies Standard 2.4.2

Questions (Standard Addressed)	Pre-Test % Correct (N=57)	Post-Test % Correct (N=57)	(+/-) % Difference
Steps of how milk gets from the cow to you- Step 1 (2.4.2)	62.5%	74.5%	+ 12.0
Steps of how milk gets from the cow to you- Step 2 (2.4.2)	40.4%	59.6%	+ 19.2
Steps of how milk gets from the cow to you- Step 3 (2.4.2)	10.5%	34.5%	+ 24.0
Steps of how milk gets from the cow to you- Step 4 (2.4.2)	12.3%	12.7%	+ .4
Steps of how milk gets from the cow to you- Step 5 (2.4.2)	5.3%	23.6%	+ 18.3
Steps of how milk gets from the cow to you- Step 6 (2.4.2)	43.9%	51.9%	+ 8.0
Steps of how milk gets from the cow to you- Step 7 (2.4.2)	87.7%	92.7%	+ 5.0

Table 23

Pre-/Post-Tests Mean Percentage Scores and Differences for School 1 for Questions Addressing Indiana Health and Wellness Standards 2.1.1 and 2.7.1

Questions (Standard Addressed)	Pre-Test % Correct (N=57)	Post-Test % Correct (N=57)	(+/-) % Difference
Dairy Foods- Cheese (2.1.1)	59.6%	83.6%	+ 24.0
Dairy Foods- Bacon (2.1.1)	86.0%	87.3%	+ 1.3
Dairy Foods- Ham (2.1.1)	77.2%	89.1%	+ 11.9
Dairy Foods- Ice Cream (2.1.1)	35.1%	69.1%	+ 34.0
Dairy Foods- Cream Cheese (2.1.1)	36.8%	69.1%	+ 32.3
Dairy Foods- Whipped Cream (2.1.1)	21.1%	70.9%	+ 49.8
Dairy Foods- Milk (2.1.1)	87.7%	92.7%	+ 5.0
Dairy Foods- Eggs (2.1.1)	54.4%	70.9%	+ 16.5
How many servings of dairy do you need each day (2.1.1)?	28.6%	24.1%	- 4.5
One serving of milk can give you 30% of what mineral needed (2.7.1)?	42.1%	55.6%	+ 13.5
Why do you need the mineral calcium (2.7.1)?	40.4%	51.9%	+ 11.5
Healthy Choice- Milk or Coke (2.7.1)?	100.0%	100.0%	0.0
Healthy Choice- Chocolate or String Cheese (2.7.1)?	92.7%	98.2%	+ 5.5
Healthy Choice- Yogurt or Jell-O (2.7.1)?	94.1%	92.2%	- 1.9

Appendix L. School 2 Standards Results

Table 24

Pre-/Post-Test Mean Percentage Scores and Differences from School 2 for Questions Addressing Indiana Science Standards 2.3 and 2.4.2

Question (Standard Addressed)	Pre-Test % Correct (N=68)	Post-Test % Correct (N=68)	(+/-) % Difference
On average a dairy cow drinks a bathtub full of water a day (2.3).	51.5%	74.2%	+ 22.7
A cow must have a calf before it can make milk (2.3).	41.2%	77.4%	+ 36.2
Definition- Cow (2.3)	72.7%	82.1%	+ 9.4
Definition- Calf (2.3)	80.0%	91.0%	+ 11.0
Definition- Bull (2.3)	77.6%	86.6%	+ 9.0
Which dairy cow is the most popular (2.3)?	38.2%	72.3%	+ 34.1
Which of the following pictures shows a Holstein cow (2.3)?	44.1%	82.1%	+ 38.0
How most dairy cows are milked today (2.4.2).	69.1%	88.1%	+ 19.0

Table 25

Pre-/Post-Test Mean Percentage Scores and Differences from School 2 for Questions Addressing Indiana Social Studies Standard 2.4.2

Questions (Standard Addressed)	Pre-Test % Correct (N=68)	Post-Test % Correct (N=68)	(+/-) % Difference
Steps of how milk gets from the cow to you- Step 1 (2.4.2)	76.5%	88.1%	+ 11.6
Steps of how milk gets from the cow to you- Step 2 (2.4.2)	61.8%	80.6%	+ 18.8
Steps of how milk gets from the cow to you- Step 3 (2.4.2)	30.9%	65.7%	+ 34.8
Steps of how milk gets from the cow to you- Step 4 (2.4.2)	11.8%	45.5%	+ 33.7
Steps of how milk gets from the cow to you- Step 5 (2.4.2)	8.8%	41.8%	+ 33.0
Steps of how milk gets from the cow to you- Step 6 (2.4.2)	41.2%	55.2%	+ 14.0
Steps of how milk gets from the cow to you- Step 7 (2.4.2)	100%	95.5%	- 4.5

Table 26

Pre-/Post-Tests Mean Percentage Scores and Differences for School 2 for Questions Addressing Indiana Health and Wellness Standards 2.1.1 and 2.7.1

Questions (Standard Addressed)	Pre-Test % Correct (N=68)	Post-Test % Correct (N=68)	(+/-) % Difference
Dairy Foods- Cheese (2.1.1)	86.8%	95.5%	+ 8.7
Dairy Foods- Bacon (2.1.1)	95.6%	97.0%	+ 1.4
Dairy Foods- Ham (2.1.1)	94.1%	97.0%	+ 2.9
Dairy Foods- Ice Cream (2.1.1)	76.5%	92.5%	+ 16.0
Dairy Foods- Cream Cheese (2.1.1)	83.8%	89.6%	+ 5.8
Dairy Foods- Whipped Cream (2.1.1)	41.2%	91.0%	+ 49.8
Dairy Foods- Milk (2.1.1)	95.6%	97.0%	+ 1.4
Dairy Foods- Eggs (2.1.1)	79.4%	92.5%	+ 13.1
How many servings of dairy do you need each day (2.1.1)?	32.4%	35.8%	+ 3.4
One serving of milk can give you 30% of what mineral needed (2.7.1)?	76.1%	82.1%	+ 6.0
Why do you need the mineral calcium (2.7.1)?	72.1%	80.3%	+ 8.2
Healthy Choice- Milk or Coke (2.7.1)?	100.0%	100.0%	0.0
Healthy Choice- Chocolate or String Cheese (2.7.1)?	100.0%	100.0%	0.0
Healthy Choice- Yogurt or Jell-O (2.7.1)?	97.1%	98.5%	+ 1.4