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Family and Consumer Sciences Teacher Needs Assessment of a STEM-Enhanced Food and Nutrition Sciences Curriculum

Cathy A. Merrill

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FAMILY AND CONSUMER SCIENCES TEACHER NEEDS ASSESSMENT OF A STEM-ENHANCED FOOD AND NUTRITION SCIENCES CURRICULUM

by

Cathy A. Merrill

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Family and Consumer Sciences Education and Extension

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UTAH STATE UNIVERSITY
Logan, Utah
2016
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ABSTRACT

Family and Consumer Sciences Teacher Needs Assessment of a
STEM-Enhanced Food and Nutrition Sciences Curriculum

by

Cathy A. Merrill, Master of Science
Utah State University, 2016

Science, technology, engineering and mathematics (STEM) education concepts are naturally contextualized in the study of food and nutrition. In 2014 a pilot group of Utah high school Career and Technical Education Family and Consumer Sciences teachers rewrote the Food and Nutrition Sciences curriculum to add and enhance the STEM-related content. This study is an online needs assessment by Utah Food and Nutrition 1 teachers on the implementation of the STEM-enhanced curriculum after its first year of use in 2015-2016. A Borich needs assessment model was used to create mean weighted discrepancy scores between teacher-perceived levels of importance and teacher-perceived competence for each objective in the new curriculum in order to prioritize professional development needs felt by the teachers. The survey also gathered data on educational backgrounds, teaching experience, demographics, and recommendations from the teachers about barriers and aids to implementation. While it was found that
teachers felt moderately competent to teach the new curriculum, the most needed areas of professional development were in the objectives with the highest concentration of STEM-related concepts. In order bring teacher feelings of competence up to the levels of teacher perceptions of the importance of these STEM-related objectives, teachers need to deepen their own knowledge of STEM education concepts through substantive, on-going professional development. Focused webinars and facilitated online collaborations for the teachers would call attention to new and previously missed resources and help the teachers apply them in the classroom.

(107 pages)
PUBLIC ABSTRACT

Family and Consumer Sciences Teacher Needs Assessment of a
STEM-enhanced Food and Nutrition Sciences Curriculum

Cathy A. Merrill

Career and Technical Education (CTE) has long taught abstract science, technology, engineering, and mathematics (STEM) concepts in contextualized settings. In 2014, a new CTE Food and Nutrition Sciences curriculum was written by a pilot group of CTE family and consumer sciences teachers, enhancing the STEM education teaching opportunities available in a food and nutrition course. This study is a teacher needs assessment of the implementation of the new STEM-enhanced curriculum.

The curriculum objectives were measured for perceived importance and self-perceived ability to teach by the teachers. Curriculum feedback, educational background and general demographics were also gathered. The curriculum objectives data created a Borich needs assessment model of mean-weighted discrepancy scores to prioritize areas needed for professional development.

Recommendations included aggressive advertising of new materials and resources and more in-depth STEM education training through online webinars and facilitated collaborations for the teachers. Other recommendations included the creation of an advanced level Nutrition and Food Science endorsement. As the teachers deepen their personal knowledge of STEM-related concepts, their ability to adapt STEM learning to the understanding of their students will also increase.
ACKNOWLEDGMENTS

Theses do not occur in isolation, even for online students. I would like to thank my committee members for their roles in creating this thesis, basically in order of appearance.

Dr. Karin Allen not only volunteered to be on my committee before I had a committee, but hired me as a long-distance intern for the project that became the basis for this thesis. Dr. Debra Spielmaker, first as an incredible online professor and then as the Agriculture Systems Technology Education (ASTE) graduate advisor, pulled my degree out of the fire when a crisis arose, and then agreed to be on my committee to see it through. To Dr. Rebecca Lawver, I owe special thanks for agreeing to be my committee chair in the midst of the flames. Her clear-sighted patience under pressure made everything possible. I cannot thank any of these women enough.

I have been blessed with a husband, children, and friends who encouraged me. I have also been blessed with answers to frequent, fervent prayers throughout the entire process. I am only sorry that my professional educator father did not live long enough to see the final outcome—but he saw the beginning and was very proud.

(Cathy A. Merrill)
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CHAPTER I
INTRODUCTION

Background and Setting

Explosions begin with the lighting of a small fuse. The much-vaunted educational “STEM Crisis in America” did not suddenly appear in 2009. Educators were aware there were shortfalls in education in 1983, resulting in the publication of A Nation at Risk: The Imperative for Educational Reform, which called for the upgrading and creation of educational standards that would better prepare the rising generation for the workforce. This led eventually to the passage in 1994 of the Improving America’s Schools Act, requiring states to create standards and appropriate assessments to measure student achievement. The No Child Left Behind (NCLB) Act of 2001 became the Federal government’s way of making sure standards were being met: If a school failed to measure up, Federal funding could be pulled or otherwise impacted.

Career and Technical Education (CTE), historically the “vocational” training segment of secondary education, was also impacted by the increasing demand for more rigorous education and more educational accountability. In 1990, the Commission on the Skills of the American Workforce published America’s Choice: High Skills or Low Wages, a report warning that technology was changing the needs of the entry-level workforce, requiring “more judgment and responsibility on the part of front-line workers…[necessitating] changes to the constellation of knowledge, skills, and attitudes that entry-level workers needed” (Castellano, Harrison, & Schneider, 2008, p. 26).
With the passage of Perkins IV, Career and Technical Education teachers were charged to integrate higher level academic skills into their applied teaching coursework (Threeton, 2007). President Obama’s 2009 *Educate to Innovate* initiative (“President Obama Launches ‘Educate to Innovate’ Campaign for Excellence in Science, Technology, Engineering & Math [STEM] Education,” 2009) gave specific academic areas of concentration: science, technology, engineering and math (STEM). As one of the many responses to this campaign, in 2014 a Division of Workforce Services Inschool grant was written to revamp the Foods and Nutrition 1 curriculum with the intent to increase the science and math rigor in this course. The Food and Nutrition 1 curriculum (see Appendix D) was implemented at the beginning of the 2015-2016 school year. A teacher needs assessment regarding this implementation is the subject of this research.

The new curriculum was written by five Food and Nutrition 1 teachers with some of the highest skills test pass rates in the state. As they drafted the curriculum, it was put in a shared dropbox for the entire group of 19 teachers who were to pilot the revisions in their classrooms. They shared feedback and suggestions during the process. Once the curriculum and resources were finalized, they were posted to the UEN filing cabinet where the rest of the state teachers could have access to the new information. The new curriculum was introduced at the Nutrition and Food Science Conference in June 2015. Four 1-hour-long workshops were offered twice at the Nutrition conference, by members of pilot group teachers concerning some of the changes to the coursework and how to deal with them. Continuing with the “train the trainers” teaching model, three other workshops were presented surrounding the new standards at the 2015 CTE and Family
and Consumer Sciences summer conference that followed the 2015 Nutrition Conference (S. Barnum, M. Milburn, & L. Schiers, personal communications, November 14 and 15, 2016).

A preliminary evaluation by Utah State University’s (USU) STE²M Center on the enhanced curriculum of Food and Nutrition Sciences was done as a pre- and post-seminar questionnaire surrounding the Family and Consumer Science (FACS or FCS) Summer Conference in June of 2015 (Maahs-Fladung & Feldon, 2015). The pretest questionnaire was a paper-and-pencil questionnaire available that day. The posttest was an online survey emailed to all the conference attendees two weeks after the conference. A reminder email of the survey was sent in August 2015, which was when 69% of the teachers responding filled out the questionnaire. Results showed little change between the pre- and posttest. In light of the fact that the evaluation was done and results tabulated prior to actual implementation of the coursework, a deeper evaluation needed to be done now that the course had been taught.

The social cognitive theory of Albert Bandura (1986, as cited in Smith, Rayfield, & McKim, 2015) posited that people, in this case teachers, who perceive they can teach a concept effectively will likely be successful in teaching that concept to students. The purpose of this project was to survey Food and Nutrition 1 teachers to measure perceived levels of importance and perceived levels of “self-efficacy” (confidence in their ability to do something, in this case teach a concept) for each of the objectives in the six standards of the new Food and Nutrition 1 curriculum. By measuring the difference between the teachers’ perception of importance and their perception of self-efficacy in each area, the
study provides information from the teachers about concepts in the new curriculum they feel less confident teaching to the students. This provides a measurement of areas needing professional development to enhance training of the teachers in their perceived areas of weakness. Other items addressed in the survey were barriers to the implementation that have been experienced, as well as the teachers’ educational background, experience and general demographics.

Statement of the Problem

In response to the national STEM education crisis, a plethora of programs have been developed in an attempt to raise STEM literacy in the U.S. As this effort continues, two major findings have surfaced: (1) in order to educate students in STEM, the most effective methods are applied, contextualized or integrated learning situations (Becker & Park, 2011; Kennedy & Odell, 2014); and (2) teachers need to have ongoing, substantive professional development in order to feel competent to teach the cross-disciplinary concepts needed to contextualize STEM education (Sturko & Gregson, 2009).

Career and Technical Education (CTE) addresses STEM education issues by incorporating these topics in their applied coursework. These courses already use teaching strategies that apply science principles to real-world context and applications (Advance CTE, 2013, p. 4). The Perkins IV Act of 2006 defined CTE as “Organized educational activities that offer a sequence of courses [of] coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills” (as cited in Threeton, 2007, p. 70).
Research has been conducted on agriculture-related CTE programs which were evaluated for both their STEM content and professional development needs (Christensen, Warnick, Spilemaker, Tarpley, & Straquadine, 2009; Garton & Chung, 1997; Smith et al., 2015). However, there is very little literature dealing with the efficacy of STEM-related integration in high school food and nutrition coursework. This disconnect between STEM concepts integration and Family and Consumer Science (FCS) may be due to the lack of preservice education for FCS Education (FCSE) students in Food Science and Nutrition (i.e., the scientific side of food and nutrition). FCSE students at Brigham Young University (BYU) can graduate with minimal science and nutrition credits (“2013-2014 Undergraduate Catalog | BS in Family and Consumer Sciences Education,” n.d.). Utah State University (USU) requires more Nutrition, Dietetics and Food Science (NDFS) courses (“Program: Family and Consumer Sciences Education - BA, BS - Utah State University - Acalog ACMS™,” n.d.-a), but in general the FCS Education major tends to concentrate instead on what has been called the “nurturance” aspect of food (Liquori, 2001). With the more rigorous, science-enhanced curriculum now in the CTE programs at the high schools and middle schools, the FCS teachers may be at a disadvantage trying to teach concepts for which they have not been trained.

According to Bandura’s social cognitive theory, the teachers will teach more effectively if they feel competent to do so (Bandura, 2001; Smith et al., 2015). Research is needed to determine the areas that FCS teachers are required to teach because of the new curriculum requirements, but have difficulty teaching due to gaps in their educational background or experience.
Purpose and Objectives

The purpose of this study was to evaluate teacher perceptions involving the new Food and Nutrition 1 STEM-enhanced curriculum implemented in Utah public high schools in the 2015-2016 school year. The following five research objectives were addressed by this study.

1. Describe the FCS teachers’ perceived level of importance to teach the objectives in the enhanced Food and Nutrition 1 curriculum.

2. Describe the FCS teachers’ perceived level of ability to teach the objectives in the enhanced Food and Nutrition 1 curriculum.

3. Identify and prioritize the inservice needs of FCS teachers by objective in the enhanced Food and Nutrition 1 curriculum.

4. Describe the barriers to implementation of the enhanced Food and Nutrition 1 curriculum.

5. Describe the characteristics of FCS teachers (educational background, age, gender, years teaching, etc.)

The study hoped to gain a professional profile of the average Utah Food and Nutrition Sciences teacher; to discern what academic or technical areas seemed important to the teachers and how competent they felt to teach them; and if there were administrative, funding or student barriers to implementation. This aggregate of knowledge will aid in crafting professional development courses to help the teachers gain the confidence needed to implement the STEM-oriented areas of the new curriculum.

Definitions and Abbreviations

The following is a list of definition of terms that were used in this study and will be used throughout this document.
**Academic courses:** Traditional courses of study in secondary schools that are oriented towards gaining entrance into a 4-year college or university. English, math, sciences, social sciences are areas of “academic” courses. Science, Technology, Engineering and Mathematics (STEM) courses are considered “academic” courses.

**Applied learning courses:** Courses that rely on hands-on instruction to teach. Career and Technical Education (CTE) courses fall in this category. In the past, applied learning courses were geared toward a vocational certificate or two-year college degree. With the integration of STEM into CTE classwork, CTE students are particularly well-prepared to enter universities and pursue advanced technical degrees (Hyslop, 2010).

**Inservice learning:** Learning for teachers in the form of workshops, continuing education or other professional development that goes on after they are already employed as teachers.

**Preservice learning:** Learning for teachers that takes place prior to being employed as a teacher. This would typically refer to a post-secondary program.

**Self-efficacy:** “…the core belief that one has the power to produce effects by one’s actions” (Bandura, 2001, p. 10).

**Standards and objectives:** This is the format of the curriculum. In Food and Nutrition 1, Standards were the general areas of study with specific objectives outlined underneath. In 2016, the "Standards and Objectives" were renamed "Strands and Standards" respectively. The content did not change. For the purposes of this study, Standards and Objectives will be used in order to match with the survey instrument.

**Traditionally trained:** This refers to a 4-year (or more) college or university
training in education, rather than having a vocational certificate and experience, and rather than having a degree in something other than education.

Throughout the paper are many names and abbreviations that are interchangeable and common to education or Family and Consumer Science. A list of these will help clarify the paper.

BYU: Brigham Young University, located in Provo, Utah.

CTE: Career and Technical Education. Historically, CTE has been the vocational wing of education. Family and Consumer Science teachers fall under this umbrella.

DGA: Dietary Guidelines for Americans. This government publication is the foundation for the MyPlate recommendations, and one of the objectives taught to the Food and Nutrition 1 students in Standard 6.

FCS or FACS: Family and Consumer Science.

FCSE: Family and Consumer Science Education.

MWDS: Mean weighted discrepancy score, used in the Borich Needs Assessment Model (Borich, 1980).

USBE: Utah State Board of Education. The new name for the USOE.

USOE: Utah State Office of Education.

USU: Utah State University, with a main campus located in Logan, Utah.

Limitations

While the study results are only generalizable to the specific population of the Food and Nutrition 1 teachers who responded to the survey, further research may be done
building on the professional development strategies developed after the survey. We were unable to get demographics for the entire population of Food and Nutrition 1 teachers in the state of Utah. Additionally, there may have been some attrition in the 2015-2016 teacher population over the summer, so the entire group of teachers who implemented the enhanced curriculum for the first time did not have a voice because we did not have access to the list of those who taught the course during the 2015-2016 school year. We tried to accommodate for this lack of accessibility by sending a general email to all the FCS teachers asking if we had missed any who had taught Food and Nutrition 1 during the 2015-2016 school year.

**Basic Assumptions**

Several assumptions were made about the basis of this study.

1. The list of Food and Nutrition 1 teachers given to the researcher was as complete and accurate as possible.

2. Most CTE Food and Nutrition 1 teachers have a minimal background of STEM education.

**Significance of Study**

In an analysis of international testing scores, the U.S. student scores were lowest in relating science and math concepts to “real-world problems” (Organisation for Economic Co-operation and Development [OECD], n.d.). CTE courses have a foundation of project-based learning and applied teaching strategies which have proven beneficial in contextualizing STEM concepts to real-world problems. CTE courses are targeted to particular occupations and skills, so the STEM-related concepts are taught in problem-
based learning experiences (Asunda & Mativo, 2016). Because of the sequencing of courses, it allows the STEM concepts taught in one course to lead into deeper content learning in the succeeding courses.

Currently, the Family and Consumer Sciences Education degrees in Utah do not include strong requirements in STEM education. For example, BYU Family and Consumer Science Education program requires one sophomore level food science class with its lab, and only requires freshman level chemistry. USU is more rigorous, requiring sophomore level chemistry and a junior level food science class. Neither school requires more than freshman level engineering (physics) and mathematics (see BYU’s “Family & Consumer Sciences Education | Undergraduate Catalog,” n.d.; and “Program: Family and Consumer Sciences Education - BA, BS - Utah State University - Acalog ACMS™,” n.d.-a). Taking the minimal requirements in STEM-specific courses, a BYU FCSE major could graduate with as few as 16 credits in STEM coursework, and a USU FCSE major could graduate with as little as 30 STEM-specific credit hours.

It is important when change comes in education that the changes are addressed and evaluated by the teachers who are teaching the courses that have changed. Evaluations of student impact from STEM-enhanced curricula have been done (Stone, 2004), but evaluations from teachers on these programs is less common. In particular, the Food and Nutrition area of CTE has a dearth of literature regarding STEM implementation. CTE has a strong foundation to contextualize STEM learning, but if the teachers do not feel confident teaching the STEM concepts, the students cannot take advantage of that foundation.
This was a small study examining only one revamped class of Food and Nutrition 1. However, the information gathered here can be of use to revamp other food classes, and to provide professional development for integrating deeper science concepts into the resources for teaching this class. In this way both the teachers and students will gain more STEM knowledge to be used in real-world settings.
CHAPTER II

REVIEW OF LITERATURE

CTE has responded to the STEM education crisis in U.S. high schools by increasing the STEM rigor of their project-based, applied learning courses. The current gap in the literature concerning STEM integration is in the area of CTE food and nutrition courses. Too often, these newly-enhanced courses are being taught by teachers trained in traditional university teacher education settings that have not included rigorous STEM classes (i.e., science, technology, engineering or math classes beyond a freshman or sophomore level). At BYU, out of 76 hours of degree-specific coursework, only 16 hours are directly related to STEM education (21%; “Family & Consumer Sciences Education | Undergraduate Catalog,” n.d.). At USU, there are 94 degree-specific credits, with 30 hours STEM-related (32%), which is much better (“Program: Family and Consumer Sciences Education - BA, BS - Utah State University - Acalog ACMS™,” n.d.b). With a possible knowledge gap between preservice training and inservice requirements, it was important to evaluate the perceptions of the teachers concerning the STEM-enhanced Food and Nutrition 1 curriculum.

The 2015 STEM-enhancements of the Food and Nutrition 1 curriculum included science labs from the Institute of Food Technologists’ website, as well as other labs developed by USU. These labs are standard scientific method labs: setting up hypotheses, gathering data, recording and reporting the data, and answering questions about the results. It is a change of viewpoint and procedures for this class. Other resources were developed to deepen the understanding of the student: The food safety and sanitation unit
was deepened from lecture to application: the students take the State Food Handlers Examination as the unit exam; the teachers were given a Quick Reference Guide for each standard that gave a science background of the topic, an outline of online references to further student learning, and a vocabulary list; and labs were developed that specifically also satisfied other core curriculum requirements in chemistry, biology, and physics.

The enhanced curriculum standards are meant to cross discipline boundaries to bolster learning in food and nutrition by adding science or math, and giving a context to support learning in science or math by applying it to food and nutrition.

As mentioned previously, Bandura’s social cognitive theory supports the idea that if a teacher feels they are capable of teaching something, then the teacher will be able to more effectively teach the concept (Bandura, 2001; Miles, 2013; Smith et al., 2015). This review of literature was to gather information particularly from and about CTE teachers, on how the teachers feel about their abilities to implement more rigorous coursework, how professional development needs should be addressed, and the typical barriers to implementation and professional development. Of the literature reviewed, there were ten studies of particular interest used for this review.

**Conceptual Framework**

In 1986, Alfred Bandura put forward his triangular theory of social cognitive learning. It is based on the premise that people have agency to control their behavior. Personal factors, environmental factors and behavioral factors interact with each other to determine actions. Bandura coined the term “self-efficacy,” meaning a personal belief
that a person can do something translates strongly into that person actually doing it (Bandura, 2001). It is The Little Engine That Could concept. Using this triad of person ↔ environment ↔ behavior (see Figure 1) to determine action then becomes the rationale for measuring a teacher’s perception of the level of the importance of a concept (environmental), and comparing it to the teacher’s perception of their own ability to teach a concept (personal/ self-efficacy), since those two factors then determine the way in which the teacher implements that concept in coursework (behavioral).

Using Bandura’s social cognitive theory also gives a rationale for measuring the implementation of new curricula. The Borich Needs Assessment model (Borich, 1980) has teachers rate their perceived level of importance for concepts taught in the classroom, then has them rate their perceived self-efficacy in teaching the concept. These scores are compared and a mean weighted discrepancy score is generated. The highest discrepancy score is the area most needed for professional development and training.

Taking the analysis a step further, Bandura’s concept of reciprocal interaction

![Figure 1. Albert Bandura’s reciprocal determinism model.](image)
between personal, environmental and behavioral, gives a reason to provide teacher professional development: if the teachers feel more confident, then their teaching will be more effective. Intervention in any of the three areas will impact the other two and affect the behavioral outcome, but the personal self-efficacy component is perhaps the most influential and easiest to affect with professional development.

The literature reviewed for the proposal is mainly research of professional development needs assessments. Any needs assessment is, practically speaking, based on Bandura’s social cognitive theory that humans are agents unto themselves: they can change. Therefore, needs assessments are done to discern where needed areas of change exist so that teachers can progress in their abilities.

**Review Objectives**

The objectives for this review of literature are listed below.

1. To describe the current state of the research literature on professional development needs and needs assessments for CTE teachers.
2. To discuss issues, strengths and weaknesses in previous research.
3. To draw conclusions based on this research to form research strategies that will assess the implementation of new curricula and the professional development needs of CTE teachers to help with that implementation.

**Inclusion/Exclusion Criteria**

Peer-reviewed journal articles were selected based on content of CTE professional development, programs integrating STEM concepts (including Common Core State Standards) into CTE courses, or teacher evaluations of educational change. Articles were
excluded if they were evaluating students rather than teachers, and, with the exception of a few seminal documents, articles were excluded if they were older than 2009. Although CTE and STEM integration articles were top priority, articles evaluating the integration of Common Core State Standards were also useful in evaluating teachers, change, and assessments of professional development needs. Other articles and various government reports were referenced for background information and statistics. Of the articles surveyed, ten peer-reviewed articles have been specifically chosen for this review.

**Systematic Review**

In general, the studies chosen were studies of teachers dealing with increased science and math rigor, either with the implementation of Common Core State Standards, or in relation to the national STEM initiatives. Most of these studies either assessed professional development needs, or evaluated professional development strategies. There was one meta-analysis of longitudinal data about student math-course-taking comparing CTE concentrators vs. general academic concentrators. This was considered valuable due to the length of the study, the enormous amount of data analyzed and its connection with the legislative reforms for CTE. There were no peer-reviewed journal studies found dealing specifically with CTE Food and Nutrition teachers, either on evaluating curriculum or on professional development.

**Sample Characteristics**

Excluding the student data meta-analysis concerning sample size, of the nine
remaining studies, six had sample sizes less than 50, and three had sample sizes over 100. All the studies garnered similar conclusions, so sample size does not seem to be a major issue, except in cases where low response or attrition may have skewed the results. Only three studies included gender information, and only two of those included age ranges. Gender and age information would seem to be less important than questioning whoever is currently teaching.

Included in the demographic information was educational training and years of experience. Eight of the nine teacher studies specified the participants were CTE/Agriculture teachers. Four of the studies included whether the teachers were university trained (“traditionally trained in teacher education”). Three of the studies did not address years of teaching, three did not specify a breakdown in CTE or teaching categories, and the four remaining studies used beginning teachers (0 to 5 years’ experience) for more than 40% of their participants. The demographics of preservice training and current years of experience have a bearing on the proposed study: most CTE teachers are coming from traditional university teacher training experiences. If the current teachers, particularly the beginning ones, are lacking in areas of training as they enter the workforce, then those needs should be addressed at the preservice level. Professional development time would then be spent on keeping current with new trends and technologies, rather than remedial teaching preparation.

Research Design Characteristics

The majority of the study designs could be described as descriptive research
designs that primarily use surveys as the data collection technique. Two of the studies mentioned they were based on educational theory—social-cognitive theory by Bandura in one study, and the other referred to Engagement, Capacity and Continuity (EEC) by Jolly, Campbell, and Perlman (see Asunda, Finnell, & Berry, 2015).

The research questions, with the exception of the student meta-analysis, typically hovered around evaluations by CTE teachers. Eight of the study research questions evaluated CTE teachers’ perceptions of curriculum, and six of those also evaluated or assessed professional development. The survey instrument (methodology) for six of the studies was based on a Borich Needs Assessment model. The teachers were asked to give their opinion on a list of teaching standards, both for their importance to be taught and for the teachers’ ability to teach them. One of the studies compared the findings of a Borich Needs Assessment model with a Quadrant Analysis Model (Garton & Chung, 1997). There were no significant differences between the two models.

Reliability measures and validity threats were either carefully attended to, or nearly ignored. Four mentioned Cronbach’s alpha scores > .94 or other post hoc reliability scores, and the multi-case study had numerous cross-check strategies. On the other extreme were three studies that had no measures mentioned, or “a panel of experts” who examined the survey instrument. A panel of experts is an acceptable research methodology, but those same cases also had validity threats of low response and poor sample selections that skewed the results, so the claim of “experts” is also suspect.

Since eight out of ten of the studies were online surveys, the data collection was done automatically. Most of those studies also noted a pre-survey email, the survey
email, and then two reminders for doing the survey. The meta-analysis study gathered national data statistics already on record. The multi-case study collected qualitative data through pre-scheduled, taped interviews, observation field notes, researcher and participant reflections and when everything was written up the case studies were peer reviewed by a faculty member and each participant. There was one study where the follow-up was a year to two years after the original survey took place, depending on when the teacher completed the course and where they were in the program when they took the initial survey. The attrition rate seemed high (only 16 out of 26 finished the follow-up), and the researcher tried to balance it with ten randomized phone follow-ups, which may or may not have surveyed participants twice, who may or may not have given the same answers they gave before (see O’Connor, 2012). It didn’t fit with the rest of the data collection.

Research Outcomes and Conclusions

Overall, the statistics from the research suggest that most teachers felt competent to teach new standards, but were seldom given appropriate professional development to do so in areas they did not feel competent to teach. Typically, science integration was viewed as important to teach, and teachers were fairly confident in their ability to integrate it. Engineering was usually the area of least confidence for teachers, with integration of technology running a close second.

The statistical findings were interesting but limited especially in circumstances where validity concerns were not addressed in the conclusions. The most problematic
example was the study of the CTE licensure program whose purpose was to “evaluate the effectiveness of the program for academic teachers coming into CTE positions.” The implication of the statement was that the program was to be evaluated for a broad spectrum of teachers, until it was mentioned that if the two veteran teachers with 23 and 31 years of experience were excluded from the average, the mean years of teaching was under two years, and that 10 out of the 26 teachers in the licensure program had never taught at all. The teacher evaluations of the mentoring segment of the course were 4.14 on a 5-point scale, and all of the 21 standards were rated as equally important. This does not seem surprising when considering that a new teacher would appreciate and benefit from a mentor bridging the gap between the postsecondary world of supervised learning and the new world of being an educator. It also seems reasonable to assume a new teacher would consider all standards equally important to teach until years of experience gave them a larger perspective. If the study had been to evaluate the program for beginning teachers, then the later conclusions would have been more justified. As it was, these points were not even mentioned (O’Connor, 2012).

The meta-analysis of math-course-taking of CTE student concentrators gave strong evidence that the math reforms dictated through the 1990’s were resulting in positive outcomes for CTE concentrator students (i.e., a student who takes more than a specified number of CTE credits during high school). The CTE concentrators were shown to have higher instances of math course taking, and tended to take more difficult courses, than the general academic concentrator students. This encouraging data seems to indicate that CTE reforms are working in increasing the STEM achievements of their
Most of the studies mentioned limitations—such as varying personal definitions of terms in their instruments—that might make a difference in the data. Other limitations were low or no response rates or a census of the population being the sample so generalizations could not be made beyond those populations. The O’Connor (2012) study did not bring up any limitations, yet tried to generalize the CTE licensure program as being effective for all teachers, beginning or veteran. That generalization would seem to be inaccurate considering the overabundance of novice teachers in the sample.

Qualitative findings were limited to two studies: the multi-case study and open-ended comments from one of the surveys. The latter commented that teachers wanted more personally focused professional development, and the former that the two types of professional development studied complemented each other and were both needed. Both studies were strong and well-documented, so these findings are worth trying to replicate.

Generally, the conclusions and recommendations were that the teachers could use more content specific professional development when faced with changing the rigor of their courses. There were two studies that evaluated particular types of professional development strategies, one of which could only be generalized to new teachers. The other, stronger study used a traditional classroom setting and colleague study group to complement and support each type of learning.

Several of the studies evaluated teacher motivation to get professional development and inservice practical strategies to integrate new content. The recommendations were that professional development in a teacher’s specific CTE content
area with continuing education or university credit would be very motivating.

Finally, the Borich (1980) needs assessment model was judged an effective tool in discerning teachers’ perception of important teaching standards and their competence to teach them. Using a mean weighted discrepancy score of the results of the survey gives data to prioritize professional development needs. Although nine of the studies asked teachers to question their competence in teaching new, rigorous content, all nine concluded that teachers generally felt confident in their ability to teach old or new content. The tenth study, the meta-analysis of students, strongly indicates that this conclusion is true: CTE students are successfully taking more math classes than before the CTE reforms of the 1990s. Since the students by nature move on, it must be the teachers who are improving the learning.

This review of literature shows a clear picture of how to assess professional development areas and which demographic areas seem to be the most important indicators of variability: years of teaching experience impacts the professional development need areas overall more than gender and teacher age. The studies that reported gender and age found little evidence of variability due to those variables. The largest areas of validity threats were low or no response to the surveys.

More studies need to be done on larger groups of mid-career and experienced teachers, which will give a better picture of whole group needs. A larger picture should translate into targeted professional development programs for inservice teachers in CTE.
CHAPTER III

METHODS AND PROCEDURES

State standards for the Food and Nutrition I curriculum were revised in 2014 to be implemented in the 2015-2016 school year, embedding science and math concepts into the coursework. This study evaluated the implementation of this new curriculum, and assessed the needs for professional development and resource support for these teachers.

The specific research objectives were as follows.

1. Describe the FCS teachers’ perceived level of importance to teach the objectives in the enhanced Food and Nutrition Sciences curriculum.

2. Describe the FCS teachers’ perceived level of ability to teach the objectives in the enhanced Food and Nutrition Sciences curriculum.

3. Identify and prioritize the inservice needs of FCS teachers by objective in the enhanced Food and Nutrition Sciences curriculum.

4. Describe the barriers to implementation of the enhanced Food and Nutrition Sciences curriculum.

5. Describe the characteristics of FCS teachers (educational background, age, gender, years teaching, etc.)

Research Design

This research study was a nonexperimental, quantitative assessment of Food and Nutrition I teachers in Utah. The purpose of this study was to evaluate the implementation of the enhanced curriculum for Food and Nutrition Sciences: which areas teachers felt were important, where they felt a need for more training, barriers to implementation, which resources worked best to help them, and what kind of educational background the teachers were bringing to the class. With this aggregate knowledge, the
study provided a framework for recommendations of professional development, inservice resources, and preservice education to better prepare the teachers of tomorrow.

Participants

The population for this study included all Food and Nutrition 1 teachers in the state of Utah ($N = 206$), who taught the Food and Nutrition 1 class in the 2015-2016 school year. The frame for the population was obtained from the USOE. An announcement was made at the 2016 FACS Summer Conference to watch for the survey coming at the end of the summer. No identifiers were collected from the survey.

The addresses were developed from the USOE Cactus list of teachers ($N = 206$) who had signed up to teach the course in the 2016-2017 school year. There were 12 email addresses that bounced, giving $N = 194$ teachers receiving the invitation email. An additional mailing was sent through the FACS Listserv to all FCS teachers specifically asking if any Food and Nutrition 1 teacher from 2015-2016 had been missed in the August 11 mailing. Four additional teachers responded and were sent the survey, bringing the total receiving an invitation to the survey to $N = 198$.

Methods

The researcher-designed instrument was developed, housed and administered through Qualtrics online survey software. Qualtrics served as the data collection instrument for this study. The survey is located in the Appendix B of this document. The survey instrument was based on a Borich needs assessment model (Borich, 1980), which
has been shown to be a reliable method of evaluation (Garton & Chung, 1997). Section I had the objectives of each of the six standards for Food and Nutrition Sciences listed for importance and, separately, for competence. A 1-to-5 Likert-type scale is used, 1 = not important or not competent, and 5 = very important or very competent. Section II used the same Borich model to rate perceived importance and perceived competence for specific new labs added to the curriculum last year. Section III ranked the new resources in the curriculum. Section IV asked for demographic and educational background information.

The first section of the instrument consisted of a double-matrix containing 23 objectives representing the objectives of the Food and Nutrition Sciences course. Teachers were asked to respond to each statement twice on a 5-point, summated rating scale: once rating their perceived importance of each objective, and once rating the individual’s perceived ability or competence to teach each objective. The second section of the instrument included six questions designed to evaluate new resources added to the Utah Education Network (UEN) File Cabinet to assist implementation of the new STEM-enhanced curriculum. Once again the teachers were asked to respond to each statement twice on a 5-point, summated rating scale rating perceived importance of each resource and rating the individual’s perceived ability to use each resource. The third section of the instrument included five resources as questions that asked teachers to rank the STEM-enhanced resources from 1 to 5 (1 = most important; 5 = least important). The last section of the instrument asked for basic demographics, educational background and a series of open-ended opinion questions regarding barriers to implementation, personal STEM
interest, and recommendations.

Dillman’s data collection protocol served as the guide for the design and format of the data collection (as summarized in University of New England [UNE], Center for Community and Public Health, 2012). A link to the instrument was distributed to a panel of experts to establish face and content validity. The panel consisted of three university faculty with expertise in research design and Family and Consumer Sciences Education.

Reliability of the instrument was determined by conducting a pilot test using 19 high school Family and Consumer Science teachers who were the pilot group for the rewriting and then taught the Food and Nutrition 1 course in 2015-2016. Eleven responded to the invitation. Cronbach’s alpha coefficients calculated for scales (importance and ability) in Sections 1 and 2 are shown in Table 1. An alpha over .70 is considered good reliability, which is indicated in all the standards with the exception of Standard 6: Dietary Guidelines and MyPlate.

An invitation to participate in an anonymous survey to assess the STEM-enhanced Food and Nutrition 1 curriculum was emailed August 11, 2016, to a list of 206

Table 1

*Cronbach’s Alpha for Curriculum Objectives—Reliability Panel*

<table>
<thead>
<tr>
<th>Standard</th>
<th>Cronbach’s alpha for importance</th>
<th>Cronbach’s alpha for ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard 1</td>
<td>.767</td>
<td>.913</td>
</tr>
<tr>
<td>Standard 2</td>
<td>.838</td>
<td>.961</td>
</tr>
<tr>
<td>Standard 3</td>
<td>.813</td>
<td>.947</td>
</tr>
<tr>
<td>Standard 4</td>
<td>.869</td>
<td>.961</td>
</tr>
<tr>
<td>Standard 5</td>
<td>.857</td>
<td>.965</td>
</tr>
<tr>
<td>Standard 6</td>
<td>.491</td>
<td>.966</td>
</tr>
</tbody>
</table>
Food and Nutrition 1 teachers throughout Utah. Qualtrics reported that 12 emails bounced, so 194 teachers received the initial invitation email. The addresses were developed from the Cactus list of teachers who had signed up to teach the course in the 2016-2017 school year. An additional mailing was sent through the FACS Listserv to all FCS teachers specifically asking if any Food and Nutrition 1 teacher from 2015-2016 had been missed in the August 11 mailing. Four additional teachers responded and were sent the survey, bringing the total receiving an invitation to the survey to $N = 198$. Two reminder emails were sent out on August 25 and September 12. The survey was closed September 20, 2016, with a total of 50 responses, a 25% response rating.

**Materials**

An IRB-approved Letter of Information form was the first question in the survey. This form assured the participants that participation was voluntary and participants could leave the survey at any time without consequence to their employment or person. A copy of the Letter of Information is in Appendix A. The form also let the potential participants know that the survey was for the purpose of assessing both the implementation of the new Food and Nutrition 1 curriculum and possible areas of professional development needs. The potential participants were told that this survey was part of a Master’s degree project for USU, in the School of Applied Sciences, Technology and Education (ASTE). Risks for the study were minimal. The participant names and emails were obtained from the USOE. Emails were sent to each potential participant inviting them to the study and providing an anonymous link to complete the survey or opt out of taking it. A general
email to all FCS teachers was sent after the initial, targeted email to see if any Food and Nutrition 1 teacher had been inadvertently left off of the targeted list. Contact information to obtain the link to the survey was given in the email.

The benefits from the data gathered with this survey was a better understanding of professional development areas needed for the Food and Nutrition 1 teachers, which will translate into the development of continuing education or workshops for them.

Data was analyzed using SPSS versions 18.0 and 24.0. The Borich needs assessment model (Borich, 1980) was used to determine where discrepancies existed for Research Objectives 1 and 2. Mean weighted discrepancy scores (MWDS) were calculated for each curriculum objective using the MWDS calculator add-on for SPSS (McKim & Saucier, 2011). Objectives were separated and ranked from high to low using the MWDS; objectives with the highest MWDS indicated areas most in need of professional development (Borich, 1980). Results were analyzed and reported in the aggregate in Chapter IV, and will be given both to the CTE division of the USOE, and USU.

Other than personal computers and copy machines, there was no hardware connected with this survey.

**Procedures**

Access to the participant list was given through the Utah State Office of Education. A list of email addresses of all Food and Nutrition 1 teachers in 2016-2017 was used with the assumption that if the teachers taught in 2015-2016, they would be
teaching the course again. To verify this assumption, the second question on the survey asked if they taught Food and Nutrition 1 in 2015-2016. If the answer was negative, the survey skipped to the end and the respondent was finished. An announcement of the survey was made in the opening session of the FACS Summer Conference, encouraging the teachers to watch for and participate in the survey at the end of the summer.

The invitation email with an anonymous survey link was sent to potential participants on August 11, when the teachers were once again in their classrooms preparing for the new school year. A general FACS ListServ email was sent shortly after to ascertain if a Food and Nutrition 1 teacher had been missed in the August 11 mailing. Two reminder emails were sent August 25 and September 12 (see Appendix A for Letter of Information, Appendix B for the Questionnaire, and Appendix C for the emails). The survey closed September 20 and data analysis began.

**Data Analysis**

Data analysis used a Borich needs assessment model (Borich, 1980; Christensen et al., 2009). The average level of self-efficacy or perceived ability was subtracted from the average level of perceived importance of each objective and the sum multiplied by the number of responses in order to have a weighted average. The weighted discrepancies were then averaged to attain MWDS. The MWDS were calculated using the Excel-based Mean Weighted Discrepancy Calculator developed by McKim and Saucier (2011). The MWDS was used to determine the difference between the teachers’ perceptions of levels of importance for each objective in the six curriculum standards for Food and Nutrition
Sciences, and the teachers’ perceptions of their level of ability to teach the objectives. The Borich Needs Assessment model has been tested for reliability against a quadrant analysis format (Garton & Chung, 1997) where the two assessment models were found to have consistent results and no significant differences in analysis.

The data gathered from Research Objectives 1 and 2 were used to generate data for the MWDS and to gain an idea of teacher views of importance and abilities separately. Research Objective 3 used the data from 1 and 2 to calculate the MWDS for the curriculum objectives. The highest professional development needs have the highest MWDS, so recommendations have been made in Chapter V for areas perceived by the teachers as desirable professional development topics for the future.

Open-ended questions concerning barriers to the implementation of the new curriculum were analyzed for patterns and categorized to show frequencies of response. This information will be used to inform the USOE of problem areas. The USOE does not have access to individualized survey names, emails or responses. Recommendations have been made from a review of pertinent literature and an analysis of the data and opinions gathered from the survey.

The education and demographic areas, Research Objectives 4 and 5, were also analyzed for patterns and gaps in preservice STEM education. Recommendations will be made available to the USOE as well as to BYU and USU regarding possible program upgrades for their Family and Consumer Science Education graduates.
CHAPTER IV
DATA AND RESULTS

The purpose of this study was to gain teacher feedback of the new Food and Nutrition Sciences STEM-enhanced curriculum implemented in the classrooms in the 2015-2016 school year. The five research objectives addressed by the study were:

1. Describe the FCS teachers’ perceived level of importance to teach the objectives in the enhanced Food and Nutrition Sciences curriculum.
2. Describe the FCS teachers’ perceived level of ability to teach the objectives in the enhanced Food and Nutrition Sciences curriculum.
3. Identify and prioritize the inservice needs of FCS teachers by objective in the enhanced Food and Nutrition Sciences curriculum.
4. Describe the barriers to implementation of the enhanced Food and Nutrition Sciences curriculum.
5. Describe the characteristics of FCS teachers (educational background, age, gender, years teaching, etc.).

With this aggregate of knowledge, professional development goals can be targeted and barriers addressed.

The survey was emailed August 11, 2016, to a list of 206 teachers throughout Utah. Qualtrics reported that 12 emails bounced, so 194 teachers received the initial invitation email. The addresses were developed from the Cactus list of teachers who had signed up to teach the course in the 2016-2017 school year. An additional mailing was sent through the FACS Listserv to all FCS teachers specifically asking if any Food and Nutrition Sciences teacher from 2015-2016 had been missed in the August 11 mailing. Four additional teachers responded, bringing the total to \( N = 198 \). Reminder emails were sent out on August 25 and September 12. The survey was closed September 20, 2016,
with a total of 50 responses, a 25% response rating. Average response rate for a targeted, employee survey is 30-40%, so this is a little low (Fryrear, 2015).

**Research Objectives 1 and 2: Levels of Importance and Ability**

The first two sections of the Qualtrics survey were set up in a Borich needs assessment (Borich, 1980) double matrix format containing the curriculum’s six standards outlined into 23 Objectives. The teachers were requested to rank on a 1 to 5 Likert scale what they felt was the importance of teaching each objective. The teachers then ranked their perception of their own ability to teach that same objective. They did this for all 23 objectives.

The Likert scale for both importance and perceived ability had a range of 1 to 5, with 1 as lowest, “not important” or “not competent,” and 5 as the highest, “very important” and “very competent,” respectively. As shown in Table 2, the high ranges of the means in importance and ability would seem to indicate the teachers on average perceive all of the objectives in the new curriculum to be important to be taught, and also that they perceive they have the ability to teach them.

**Research Objective 3: Mean Weighted Discrepancy Scores**

The Borich needs assessment (Borich, 1980) is used to determine areas of professional development by taking the Importance scores and subtracting the Ability scores to determine the discrepancy between the two for each respondent. Each discrepancy score is weighted by multiplying it by the mean of the Importance scores.
Table 2

Importance and Ability Statistics Per Objective

<table>
<thead>
<tr>
<th>Importance</th>
<th>Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>4.84</td>
<td>.424</td>
</tr>
<tr>
<td>4.58</td>
<td>.583</td>
</tr>
<tr>
<td>4.89</td>
<td>.318</td>
</tr>
<tr>
<td>4.84</td>
<td>.367</td>
</tr>
<tr>
<td>4.69</td>
<td>.514</td>
</tr>
<tr>
<td>4.38</td>
<td>.716</td>
</tr>
<tr>
<td>4.53</td>
<td>.726</td>
</tr>
<tr>
<td>4.53</td>
<td>.661</td>
</tr>
<tr>
<td>4.67</td>
<td>.564</td>
</tr>
<tr>
<td>4.47</td>
<td>.625</td>
</tr>
<tr>
<td>4.47</td>
<td>.661</td>
</tr>
<tr>
<td>4.31</td>
<td>.763</td>
</tr>
<tr>
<td>4.36</td>
<td>.712</td>
</tr>
<tr>
<td>4.22</td>
<td>.795</td>
</tr>
<tr>
<td>4.22</td>
<td>.823</td>
</tr>
<tr>
<td>4.47</td>
<td>.726</td>
</tr>
<tr>
<td>4.32</td>
<td>.800</td>
</tr>
<tr>
<td>4.27</td>
<td>.817</td>
</tr>
<tr>
<td>4.57</td>
<td>.587</td>
</tr>
<tr>
<td>4.49</td>
<td>.668</td>
</tr>
<tr>
<td>4.22</td>
<td>.850</td>
</tr>
<tr>
<td>4.27</td>
<td>.899</td>
</tr>
<tr>
<td>4.60</td>
<td>.720</td>
</tr>
</tbody>
</table>

Note. Scale: 1 = not important; 2 = of little importance; 3 = somewhat important; 4 = important; 5 = very important---1 = not competent; 2 = little competence; 3 = somewhat competent; 4 = competent; 5 = very competent; mode for all objectives was 5 in both importance and ability, with the exception of importance for eggs and milk, which was 4.
The weighted discrepancy scores are then averaged, giving the MWDS for each of the objectives. The highest MWDS indicates the most needed area for professional development. Figure 2 illustrates the MWDS results.

The majority of the MWDS showed very little discrepancy between how important the teachers perceived an objective and how competent they felt they were to teach the objective. In fact, a little over a fourth of the MWDS show the teachers felt more capable to teach the objective than the objective was important to them. The only MWDS’s with scores of more than 1 were all Standard 1 objectives regarding sanitation, 

![MWDS FOR OBJECTIVES](image)

**Objectives**
- **Standard 1**
  1. Safety
  2. First Aid
  3. Hygiene
  4. Sanitation
  5. Pathogens
- **Standard 2**
  6. Equipment
  7. Measurement
  8. Math
  9. Terminology
- **Standard 3**
  10. Grains/Carbs
  11. Fiber
  12. Quickbreads
- **Standard 4**
  13. Proteins
  14. Eggs
  15. Milk
  16. Lipids
- **Standard 5**
  17. Vitamins
  18. Minerals
  19. Water
  20. Produce
- **Standard 6**
  21. DGA
  22. MyPlate
  23. Healthy Eat

**Note.** The average MWDS was 0.2696, Average n = 42.

*Figure 2.* Curriculum objectives MWDS in ascending order.
hygiene, food safety and food-borne pathogens (i.e., food contamination). The new curriculum Standard 1 unit is now tested by having the students pass the State Food Handler’s examination, so it is arguably a more theoretically rigorous standard than the standards regarding food groups, which are more hands-on food preparation learning.

However, as Figures 3 and 4 illustrate, by showing only the importance and ability means of the various objectives, the discrepancy appears to come more from a feeling that Standard 1 is more important than the other standards, rather than the teachers feeling any less competent to teach its concepts than the other objectives.

Objectives 8 (Integrating Math), 17 (Vitamins), and 19 (Water) were the only other standards over 0.75. The discrepancy for Objective 8, which integrates math into the kitchen, may have its roots in a recommendation to the USOE from several of the teachers about the “need to understand how to teach math.” In other words, the math concepts may not be as difficult as knowing how best to teach the math to the students.

![Average Survey Responses: Importance](image)

Figure 3. Average importance survey responses.
Objective 17 on Vitamins has a range of perceived ability to teach of 4, and an Ability standard deviation (SD) of over 1, the only objective with an SD that high. This indicates the teachers are widely stretched on the competence spectrum with this objective: some teachers feel “very competent,” and others feel “not competent” at all. In fact, Figure 3 shows the teachers feel much less competent to teach about vitamins and minerals than they do any other objectives. However, because the teachers also do not feel that vitamins are very important to teach, the MWDS is lower than those in Standard 1. Further research on this competency spread is needed.

Objective 19 on Water has a MWDS of 0.78. The Ability SD is fairly large at 0.805, but further research is needed to discover the reason for the 0.78 MWDS on the sources and functions of water in the body.
Research Objective 4: Barriers to Implementation of New Curriculum

In order to assess barriers to the implementation of the new curriculum, Sections II and III of the survey questioned the teachers on their usage of specific labs developed for the curriculum as well as some new general resources. Section IV had five open-ended questions. Two asked specifically about barriers to implementation of the new curriculum. Two asked about personal STEM enthusiasm and if they saw benefits to adding STEM in FCS classes. The last question requested teacher recommendations for courses preservice teachers should take. The bulk of Section IV asked for educational and demographic backgrounds, which will be considered under Research Objective 5. Section II concerning the STEM-enhanced labs continued to use the Borich needs assessment matrix of 1 to 5, with an additional answer of “DN,” or “Did not use.” The DN responses were taken out of the MWDS scoring.

The Borich scoring for importance vs. ability in this section did not result in significant differences between Importance and Ability ratings. The more enlightening data was the number of respondents who did not use the new labs at all. Figure 5 illustrates the point using the DN from the Importance scoring because many respondents, having marked DN in Importance did not bother marking DN in the Ability section.

A total of 32 respondents explained why they did not use the labs. Of the 32, 59% (n = 19) were unaware the labs existed. Other reasons for passing by the labs were: having their own resources (n = 10, 31%); not being able to access or find the labs
Figure 5. Percentages of “Did not use” responses for new STEM labs.

accounted for 25% (n = 8); and planning time or time in class to use them accounted for 16% (n = 5).

Section III asked the teachers to rank the general resource areas that were developed to aid in the implementation of the new curriculum. The ranking was 1 to 5, this time with 1 being the highest or most useful resource, and 5 being the lowest or least useful resource. The June Summer Conferences were ranked by 46% (the highest percentage of any resource) of the respondents as the most useful resource, and 40% as the second most useful resource. Ranked as the least useful resource was the IFT Website with 41% of the respondents putting it as #5 on their list. The other resources were fairly evenly split with the teachers putting them in the middle rankings.

Two open-ended opinion questions from Section IV concerned implementation
barriers: “What do you see as the main barriers to implementation of the new curriculum?” and “What could the USOE do to help remove or prevent these barriers?”

There were 38 respondents to the question of barriers to implementation. The main areas seen as barriers for the teachers were TIME, RESOURCES, and CURRICULUM. Thirty-seven percent of the respondents listed some sort of time barrier, with 42% of those mentioning time needed to integrate the change into their regular curriculum (i.e., creating the lesson plans, becoming familiar with the new requirements, or ordering supplies).

Resource barriers were mentioned by 34% of the respondents, and fell roughly into three categories: those who were unaware there were new resources available, 31%; those who were asking for more lesson plans, ready-made lab kits, or training, 46%; and those who mentioned “funding” or “cost” of supplies or just needing “resources,” 23%.

Curriculum-related barriers were mentioned by 24% of the respondents, nearly half (44%) of whom were frustrated with a “jam-packed” curriculum. The other two areas mentioned were concerns that the curriculum was too difficult for the typical foods students, and there were too many changes too often in the curriculum: “change is hard,” one teacher plaintively wrote.

After asking for perceived barriers to implementation by the teachers, the survey asked what they felt USOE could do to help remove some of these barriers (see Table 3). Only 27 respondents answered here. These varied responses have been separated into fairly evenly split major categories of administration, curriculum, and resources (see Table 4).
Table 3

**Coded Barriers to Implementation Response**

<table>
<thead>
<tr>
<th>Coded barrier tag</th>
<th>n</th>
<th>Characteristic responses</th>
</tr>
</thead>
</table>
| **Attitude**      | 3 | • “Social stigma of… Just providing home skills”  
|                   |   | • “students want to simply cook”  
|                   |   | • “…students don’t need [STEM] in every class.”  |
| **Curriculum**    | 9 | • “I teach everything …the Standards require…and I can barely do it.”  
|                   |   | • “We already have so many balls to juggle….”  
|                   |   | • “The curriculum keeps changing.”  |
| **No barriers**   | 6 | |
| **Politics**      | 3 | • “Most lawmakers don’t see the importance of our subject.” “Has come in the form of a mandate and has not been sold to us.”  |
| **Resources**     | 16 | • “not included in the grant funding” “denied access to ServSafe books”  
|                   |   | • “lesson plans”  
|                   |   | • “I didn’t even know about the resources on the UEN website. That would have been great to know!”  
|                   |   | • “…finding appropriate supplies that aren’t really expensive”  |
| **Time**          | 14 | • “The main barrier for me is time to make changes in curriculum and lesson plans.”  
|                   |   | • “…short class periods”  |

*Note.* Teachers were allowed more than one response.

Table 4

**Coded Recommendations to USOE on Barriers**

<table>
<thead>
<tr>
<th>Coded USOE help category</th>
<th>n</th>
<th>Characteristic responses</th>
</tr>
</thead>
</table>
| **ADMINISTRATION**       | 9 | • “Food classes are necessary for all students. They all need to learn to cook….”  
|                          |   | • “Be more realistic in the implementation time frame”  
|                          |   | • “Food classes become a class where students are put when they don’t know what else to do with that student!”  
|                          |   | • “Too much change”  |
| **CURRICULUM**           | 10 | • “Don’t add anything more unless something is taken out.”  
|                          |   | • “Remove these performance objectives.”  
|                          |   | • “It needs to be more about the end result of what the students can do.”  
|                          |   | • “…differentiated assignments for student abilities”  
|                          |   | • “…make labs …that fit in 45-minute class periods”  |
| **RESOURCES**            | 9 | • “Link web pages together. Make it easier to find the updates”  
|                          |   | • “Give us more time to collaborate with other teachers…on how they are implementing the new stuff”  
|                          |   | • “Better introduction [at] summer conference, better advertised nutritional workshops”  |

*Note.* Teachers were allowed more than one response.
Research Objective #5: Education and Demographics of FCS Teachers

In the hopes of getting a profile of the average FCS teacher in Utah, the survey asked a number of educational background and demographic questions.

Demographics

Two percent of the respondents were male, 98% percent of the respondents were female, and the median age was 49 with the average age of 46.5. The age range was 38 years, with modes at 27, 50, and 58. The median years teaching was 10 years, and the average years teaching was 12 years with a range of 33 years and a mode of 5 years. In terms of length of time teaching, gender, and age, we are looking at a majority of female, mid-career, middle-aged teachers. The scatterplot in Figure 6 illustrates the respondent population age and years of teaching.

Note. Mean age = 46.5; Mean years teaching = 12.

Figure 6. Years teaching and age of teachers.
Educational Background

It was found that 28 out of 56 respondents (50%) had a Level 2 Licensure for teaching, that 30% got their degree at USU, and 27% received theirs from BYU. Of those who responded to the question, 64% have a BS or BA, and 34% have an MS or MA. Over the years, names of degrees have changed, but assuming that “Home Ec Education” is the forerunner of Family and Consumer Science Education (FACSE or FCSE), then 56% of those who responded to the question are trained specifically in what we now call FCSE, with an additional 28% trained in “Home Ec” or FCS/FCS Composite degrees (81% overall in FCSE-related fields).

In order to gauge STEM education background, the respondents were asked to mark the most advanced classes they took in various STEM-related disciplines. The percentages with their course levels are mentioned in each discipline (see Table 5).

As the table shows, the highest percentages were in Food Science and Nutrition/Dietetics, as well as the most advanced classes. This is reasonable because

Table 5

<table>
<thead>
<tr>
<th>STEM Class</th>
<th>Fresh. (%)</th>
<th>Soph. (%)</th>
<th>Junior (%)</th>
<th>Senior (%)</th>
<th>Grad. (%)</th>
<th>Did not take (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td>41.5</td>
<td>24.4</td>
<td>4.9</td>
<td>4.9</td>
<td>2.4</td>
<td>22.0</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>9.8</td>
<td>7.3</td>
<td>19.5</td>
<td>2.4</td>
<td>--</td>
<td>61.0</td>
</tr>
<tr>
<td>Chemistry</td>
<td>24.4</td>
<td>36.6</td>
<td>24.4</td>
<td>7.3</td>
<td>--</td>
<td>7.3</td>
</tr>
<tr>
<td>Chemical Eng.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>100.0</td>
</tr>
<tr>
<td>Engineering</td>
<td>5.4</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>94.6</td>
</tr>
<tr>
<td>Food Science</td>
<td>2.4</td>
<td>14.6</td>
<td>39.0</td>
<td>34.1</td>
<td>--</td>
<td>9.8</td>
</tr>
<tr>
<td>Mathematics</td>
<td>28.9</td>
<td>34.2</td>
<td>7.9</td>
<td>5.3</td>
<td>2.6</td>
<td>21.1</td>
</tr>
<tr>
<td>Nutrition/dietetics</td>
<td>4.9</td>
<td>17.1</td>
<td>46.3</td>
<td>22.0</td>
<td>--</td>
<td>9.8</td>
</tr>
<tr>
<td>Physics</td>
<td>15.4</td>
<td>2.6</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>82.1</td>
</tr>
<tr>
<td>Statistics</td>
<td>7.7</td>
<td>5.1</td>
<td>10.3</td>
<td>2.6</td>
<td>5.1</td>
<td>69.2</td>
</tr>
</tbody>
</table>

*Note.* These classes could be preservice or those taken for licensure points.
Food Science and Nutrition/Dietetics are the most directly related to FCS food and nutrition classes. The highest level of “Did Not Take” was in the Engineering fields.

Because USU and BYU are the only in-state universities with Family and Consumer Sciences Education degrees, and because the 57% of the respondents received their degrees from one of those schools, additional data shown in Table 6 was tallied gauging MWDS scores on the curriculum objectives separately for the alumni, with a third category of “Other” universities.

Although this table is of interest, the usefulness is somewhat limited because university curriculums are as much in flux as secondary curriculums: there was no information gathered about individual respondent’s programs at the time of their graduation, nor the date of their graduation. The probability of curriculum changes could be significant.

Table 6

Comparisons of Universities

<table>
<thead>
<tr>
<th>University</th>
<th>MWDS Range</th>
<th>Average MWDS</th>
<th>Average age</th>
<th>Average years taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utah State University</td>
<td>-2.2 to 1.87</td>
<td>-0.14</td>
<td>45</td>
<td>13.5</td>
</tr>
<tr>
<td>Brigham Young University</td>
<td>-1.73 to 1.97</td>
<td>0.11</td>
<td>50</td>
<td>12.4</td>
</tr>
<tr>
<td>Other universities</td>
<td>-0.79 to 2.7</td>
<td>0.89</td>
<td>46</td>
<td>10.1</td>
</tr>
</tbody>
</table>
CHAPTER V
SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Overall Summary

The purpose of this project was to gain a teacher evaluation of the new STEM-enhanced (science, technology, engineering and mathematics) Food and Nutrition 1 curriculum developed using a Department of Workforce Services (DWS) grant in 2014 and implemented for the first time in the 2015-2016 school year. This evaluation has pinpointed some possible areas for future professional development to aid in teacher implementation of this new curriculum, and garnered some demographics and opinions from the teachers that should be useful in addressing some of the barriers to implementation.

Overall, the teachers feel the STEM-enhanced objectives in the Food and Nutrition Sciences curriculum are important to be taught, and, overall, the teachers feel competent to teach these objectives. The teachers are generally enthusiastic about science and math as being integral to the study of food and nutrition, and all but a few of the teachers see benefits to the students by inculcating more STEM education into Family and Consumer Science (FCS) instruction. The single largest barrier to the curriculum implementation is “time.” This encompasses the time needed for creating new lesson plans, investigating new resources, and being able to cover what most teachers consider too much curriculum during short class periods or a semester-length class.

One glaring logistical barrier that came to light in the evaluation is 84% of those
responding did not realize, or could not access in the UEN file cabinet, the new resources and labs created along with the curriculum by Utah State University. Better advertising of new aids and more clearly defined access to the new information needs to be a priority.

The Research Objectives of this study were as follows.

1. Describe the FCS teachers’ perceived level of importance to teach the objectives in the enhanced Food and Nutrition 1 curriculum.
2. Describe the FCS teachers’ perceived level of ability to teach the objectives in the enhanced Food and Nutrition 1 curriculum.
3. Identify and prioritize the inservice needs of FCS teachers by objective in the enhanced Food and Nutrition 1 curriculum.
4. Describe the barriers to implementation of the enhanced Food and Nutrition 1 curriculum.
5. Describe the characteristics of FCS teachers (educational background, age, gender, years teaching, etc.)

Conclusions and Recommendations

Research Objectives 1, 2 and 3

Research Objectives 1, 2 and 3 specifically dealt with the FCS teachers’ perceptions of the individual curriculum standards. The teachers were asked to describe their perceived level of importance and their perceived level of ability for each of the objectives within the six curriculum standards. Given these two parameters, the MWDS between those numbers was calculated using an Excel-based Mean Weighted Discrepancy Score Calculator developed by McKim and Saucier (2011).

The range of means for the Importance scores was 4.19 to 4.9 on a 5-point Likert scale. This relatively high score for Importance seemed to indicate that, on average, the
teachers felt strongly the concepts represented by the curriculum were important to be taught to their students. The range of means for the perceived ability scores was 4.12 to 4.67 on a similar 5-point Likert scale. This only slightly lower score seemed to point to the conclusion that the teachers felt competent to teach the new curriculum, but not Very Competent which was the definition for a 5 rating.

The MWDS for the individual objectives ranged from -1.2 to 1.8, with an average of 42 respondents. The areas with the largest MWDS fall into Standard 1: Kitchen safety procedures and sanitation techniques: food handling safety rules and guidelines, First Aid, food handler health and hygiene, sanitation guidelines, and the identification and prevention of food-borne illnesses and contamination. Standard 1 is foundational knowledge not only for the students to cook at home or commercially, but to have a safe food environment in the classroom. Essentially, this is the laboratory management standard for the curriculum.

In an article about a similar problem of high MWDS with laboratory management safety competencies in an agricultural mechanics course (Saucier, McKim, Terry, & Schumacher, 2014), it was recommended that “…pertinent and continuous inservice education should be facilitated each year and focused on one agricultural mechanics laboratory management competency at a time, beginning with the highest priority construct…” (Saucier et al., 2014, p. 40). It was also suggested the Missouri Board of Education offer graduate level credit for this inservice as an incentive to take the courses.

The idea of concentrated inservice, throughout the year, at an advanced level, for one objective at a time might also be the best way to approach Standard 1. Standard 1
objectives areas have frequently been the topic of workshops at the summer conferences. If these objectives were routinely taught in rotation throughout the year on webcasts or other online resources, as well as having hands-on labs at the summer conferences, the teachers would become more deeply educated in this content area, leading to higher competency ratings to match the higher levels of importance.

**Research Objective 4**

Research Objective 4 sought to describe the barriers to implementation of the new curriculum through open-ended opinion questions: “What do you see as the main barriers to implementation of the new curriculum?” and “What could the USOE do to help remove or prevent these barriers?” Additional opinion questions were asked about personal enthusiasm toward STEM and what benefits, if any, respondents saw in including STEM in Family and Consumer Science classes. These last questions were asked to ascertain if personal biases were causing barriers to implementation and to gain an understanding of the personal views of STEM education by the teachers. As mentioned in Chapter IV, 37% mentioned “time” specifically as a barrier to implementation. The other barriers mentioned, “resources” and “curriculum” have their foundation in “time.” The teachers want ready-made resources because they don’t have time to make their own, or the time to research other resources preparatory to forming a lesson plan. The lab “kits” some of the teachers requested would free the teachers from not only creating the lab but also the time required in finding and ordering the supplies necessary for the labs.

The curriculum being “too full” also impacted time: The teachers do not have
enough class or course time to cover all the requirements; similarly, the impediment of “too much change” to the curriculum was not just the confusion of changing, but involved more time from the teachers in planning and integrating more changes, once again, into a new lesson plan.

Respondents to the survey suggested the USOE could alleviate this time barrier in several areas. Because of the different class formats—classes lasting anywhere from 45-minutes to 90 minutes, once a day or twice a week—current lesson plans and labs in the UEN File Cabinet do not always work for some teachers. The resources created for professional development can address this problem by preparing labs that could easily be split between two sessions, or shorter labs and activities that still cover the concepts.

As far as resource barriers go, Standard 1 illustrated the need for better advertising of the resources already available. There are many ideas for teaching the kitchen safety and sanitation unit already listed in the UEN file cabinet: short (1:38 minutes), humorous videos from the FDA food safety website (“Recipes for Disaster”); ServSafe PowerPoints on kitchen safety and food-borne illnesses; USU’s Sanitation Experiment Lab created specifically for the new curriculum; as well as posters, fact sheets, and news articles from the Center for Disease Control (CDC). In short, resources have been provided, but in the case of the specific new resources mentioned in the survey 59% of the respondents were unaware the new resources existed.

In addition to being unaware of the availability of the resources, some teachers complained that they did not know where to access the new resources, while others never tried to look because they felt they had their own resources already. The USOE tries to
keep the site updated, the access to resources clear: The effort needs to continue to keep the technology fresh. One difficulty with the UEN File Cabinet is information overload. There is so much material in the cabinet it is difficult to sort through to discover the particular idea that might work best. Therefore, it might be worthwhile to feature the resources individually in an email or a Food and Nutrition e-newsletter that goes out only to the Food and Nutrition 1 teachers weekly or monthly.

The teachers are willing and even enthusiastic about integrating more STEM into the teaching of foods. They need support with new lesson plans, shorter labs, and easily accessible resources that are intriguing enough to make the switch from their “tried-and-true” lessons. As mentioned previously, support can come in the guise of more hands-on labs at the Nutrition and FACS Summer Conferences, a weekly e-newsletter featuring current resources, or collaboration with other teachers by way of focused webinars and online study groups, or a combination of all these paths.

The teachers complained that there was too much change too often in the curriculum, however, they also were frustrated with the overabundance of material to be covered in the curriculum. Although it would be yet another change, one way of lightening the load is to cut down some of the requirements in the performance objectives found in each standard.

Performance objectives are the CTE-documented skills portion of the curriculum required for each student. They are the application of the unit instruction. For example, Performance Objective 3 is successful completion of the ServSafe Food Handlers Exam, with the option to use the exam to get a Utah State Food Handlers Permit.
Performance Objectives 5, 6, 7, and 8 are basically identical. They apply knowledge by preparation of a food studied in the unit, then also ask for a Nutrition and Cost Analysis comparison of preparation of the same food by different methods. While these analyses teach the student a great deal of math (cost comparisons) and the nutrition concepts (product nutrient comparisons) they are undeniably long, similar assignments. Given the time required to put a variety of desirable STEM lab experiences into the curriculum, perhaps the students or teachers could have the option of choosing to complete just one or two of the nutrition and cost analysis portion of the performance objectives, rather doing them on all four. It would make performance objectives easier to complete.

As another way to address some of the concerns the teachers raised about “change is hard,” the USOE should take advantage of the high level of personal enthusiasm for STEM claimed by 65% of the teachers (22% had a medium level, meaning they liked some, but not all, of the STEM education areas): encouraging professional collaboration between the FCS teachers as well as FCS with STEM education teachers should be a target for the USOE.

The last, sometimes vociferously mentioned, barrier for the teachers was the feeling that the new standards are too difficult for high school students. This is a paradoxical concern for the teachers because all but one teacher surveyed saw great benefits in using STEM to teach FCS. The standards were written by teachers, piloted by teachers, and introduced in workshops at the 2015 summer conferences by these same teachers. Although even the pilot group of teachers admitted the curriculum was too full
when they piloted the survey on implementation, they did not feel the curriculum was too difficult.

In the same breath as the complaint of “too hard,” the teachers decried what one survey respondent called “the social stigma of FCS”: that FCS “only teaches home skills, not STEM.” This social stigma was evident as one respondent huffed, “Most lawmakers don’t see the importance of our subject and think that we do not know how to implement the STEM resources…into our classrooms.” Implementing the new STEM-enhanced curriculum will make headway in changing perceptions as to the importance of Food and Nutrition 1 as a method of learning STEM concepts.

Yet another respondent, talking about negative student attitudes remarked, “Students want to simply cook…. They have an attitude when we are just ‘learning.’” This last conundrum of overcoming student attitudes as well as the FCS “social stigma” is an area for future research, but in the meantime, more STEM-related professional development could help the teachers learn ways of presenting the material more clearly to the students. As the students catch on to the STEM concepts inherent in food and nutrition, they will start making the cross-disciplinary connections with chemistry, math, and biology: Real-world applications will start making sense.

The extensive meta-analysis of a decade of math course-taking trends for CTE student concentrators (Stone, 2004) is solid evidence, due to the breadth of the study, that as the educational establishment increased the rigor of the requirements, the teachers and students met to the challenge. What was considered “too hard for the student,” (in the meta-analysis case, advanced levels of mathematics) became part of the normal CTE
pathway of learning. This researcher strongly believes it will also happen with STEM education taught in the FCS classrooms: It just needs a decade to make the change.

**Research Objective 5**

Research Objective 5 described the characteristics of Utah’s FCS teachers: the educational background, age, gender, years teaching, licensure levels, educational degrees, and STEM-related classes taken.

As mentioned in Chapter IV, the survey showed demographic information of a preponderance of female teachers in this subject area, experienced teachers with an average of 12 years of teaching behind them, as well as a more mature population group (median age 49, average age 46.5).

Over one-third of the teachers who responded to the survey have earned a master’s degree in a family and consumer sciences-related field. Sixty-four percent have a bachelor’s degree. The majority of the teachers who responded to the survey (84%) specifically majored in some version of family and consumer sciences.

In asking about STEM education background, food science and nutrition were the most frequently taken STEM-related college classes, and the ones where the students went on to the more advanced Junior and Senior level classes, which would typically be outside of general education requirements. Biology, biochemistry, and chemistry were the next highest percentages in terms of course taking. Engineering was largely ignored, as well as physics. There was no class that was taken by more than 34% of those surveyed.

This indicates that two thirds of the teachers do not have a formal educational
background of science, technology, engineering and math. Since in the objectives portion of the survey instrument the teachers indicated they felt comfortable teaching the new curriculum in spite of the increased science rigor, the lack of a more rigorous STEM education background must not negatively impact teaching Foods and Nutrition 1.

However, based on Bandura’s concepts of self-efficacy, more professional development training in STEM-related fields would deepen the understanding of the majority of the teachers, leading not only to a higher feeling of competency for them, but hopefully the ability to create a better learning environment for the students, giving the students a higher level of self-efficacy in STEM education.

A specific Nutrition, Dietetics, and Food Science endorsement, especially with higher level or graduate courses, would target specific concepts needed for Food and Nutrition 1, as well as allowing for further educational scaffolding by better preparing the teacher to teach the more advanced food classes. Incentives by the districts or the USOE to gain this endorsement would encourage the teachers to continue their own learning. Collaboration with individual high schools’ science departments would also be beneficial for the teacher to see the science point-of-view on a lesson plan.

**Final Conclusions and Recommendations for Future Research**

**Conclusions**

The purpose of this study was to evaluate teacher perceptions involving the new Food and Nutrition 1 STEM-enhanced curriculum developed by a DWS grant in 2014 and implemented for the first time in the 2015-2016 school year. This assessment has
garnered the following conclusions from the teachers who taught the new STEM-enhanced curriculum for Food and Nutrition 1 and responded to the survey.

1. The teachers feel the objectives presented in the curriculum are important, and they feel they are competent to teach them (see Research Objectives 1, 2 and 3).

2. The majority of the teachers were personally excited about STEM-related topics and saw benefits to integrating STEM-education into FCS classes: Most of the teachers felt STEM concepts were indigenous to food and nutrition (see Research Objective 4).

3. The teachers felt the curriculum was too crowded and has been changed too often, leaving them too little time to effectively teach the class (see Research Objective 4).

4. Nearly sixty percent of the teachers were unaware of the new resources created to aid in the implementation of the new Food and Nutrition 1 curriculum (see Research Objective 4).

5. Nearly two-thirds of the teachers had taken little or no formal STEM education classes at the university level, yet still felt competent, although not highly competent, to teach the new curriculum. This would seem to indicate the curriculum is appropriate to high school level students, but also opens up an area of professional development to deepen the understanding of the connection between STEM education and food and nutrition for the current teachers (see Research Objective 5).

6. Nearly two-thirds of the teachers who took the survey have BA/BS degrees and one-third have MA/MS degrees in areas related to Family and Consumer Science Education. They are experienced teachers with an average of 12 years of teaching behind them (see Research Objective 5).

Recommendations

The final question of the survey instrument asked those responding to make recommendations regarding preservice training. Since the demographics showed experienced teachers, it seems wise to take these recommendations seriously.

Forty-five percent of the respondents recommended more food science courses for
preservice teachers and 35% recommended more nutrition classes, the two largest single percentages in their recommendations.

With this preservice teacher recommendation in mind, it would strengthen existing FCS teachers to have the Utah State Office of Education develop a higher level Nutrition, Dietetics and Food Science (NDFS) endorsement to add to the other specialized endorsements for CTE FCS educators. Incentives in the form of university advanced level or graduate credit, or licensure points, could be added to encourage the teachers to apply for these endorsements.

Immediate professional development target areas need to address Standard 1: Kitchen Safety and Sanitation. In particular, the food-borne illness prevention and contamination objective had the highest mean weighted discrepancy score between its importance and the teachers’ perception of their ability to teach its concepts. Research could be done to investigate the possibility of the USOE partnering with Utah State University Extension faculty to develop a web-based series of lectures and lab demonstrations to help the teachers understand the science behind the Standard 1 objectives. If it is web-based, the teachers would be able to access it without waiting for the Nutrition and FACS Summer Conferences.

Further, Standard 1 research could be done to discover what exactly makes Standard 1 more problematic than the other standards. The recommendation from the agricultural mechanics laboratory management article (Saucier et al., 2014) for pertinent, ongoing inservice training on one objective (competency) at a time would work well dealing with Standard 1 topics.
The creation of shorter labs and lesson plans should also be a priority, as this was specifically mentioned as an implementation barrier by many of the teachers, even those in the pilot study group who created the new curriculum. These time issues need to be examined and resources adjusted accordingly.

The Nutrition and FACS Summer Conferences were ranked as the most useful resource by 46% of the teachers who took the survey, with 40% ranking it as the second most useful. If this is the case, the very best professional development activities should take place in this venue, and they should be recorded to allow non-attending teachers to access the information throughout the year.

Some teachers requested ways to collaborate with other teachers. In the multi-case study of a two-pronged approach to professional development done by Sturko and Gregson in 2009, the teachers had a teaching strategies class in a formal setting, and a researcher-facilitated teacher study group that met every two weeks (Sturko & Gregson, 2009). The conclusion of the study was that the two methods complemented each other. The first brought new training techniques to the table, the second encouraged collaboration between the teachers.

With technology the USOE could replicate this format to enhance professional development training throughout the year and form online collaborative study groups. Monthly webinars featuring teaching strategies, and an online chat forum held weekly with a facilitator, would be one way of replicating the study without necessitating travel. One study, *Structuring Professional Development with an Online Community*, done by the National Occupational Competency Testing Institute (Hodes, Foster, Pritz, & Kelley,
would be worth reviewing in order to avoid some of the common problems associated with structuring online professional development.

Future research could also be done among the Administration of the high schools to evaluate whether the teachers’ perceived competence is the same as the Administration’s perception of the competence of the teachers, their curriculum and their performance.

Future research areas involving students could address how the STEM-enhanced curriculum as impacted student outcomes. Is student enrollment dropping as the Food and Nutrition 1 class becomes more STEM education-oriented and less cooking-oriented? Are the FCS end-of-year test scores rising? Have other STEM education end-of-year scores risen in response to STEM concepts in the FCS courses? Are the CTE students among the group of US students taking the PISA examinations? If not, would CTE students have a better scoring on the “real-world application” questions? A Borich Needs Assessment could be done evaluating student self-efficacy in STEM education because of the STEM in the Food and Nutrition 1 class. If the teachers feel themselves “Competent,” but not “Very Competent,” what level of STEM concepts are the students absorbing in Food and Nutrition 1?

A collaboration between Food and Nutrition 1 teachers and high school chemistry teachers could research if there is a way to teach the entire Chemistry Core Curriculum using edible food experiments. This would be especially efficacious in an international setting because dangerous chemicals would not have been used, a problem with chemistry teaching in Third World areas where disposal of chemicals is not regulated.
However, it may be more of a problem to use food for experiments in areas where food is scarce, than chemical disposal. Some research has been done in the area of edible chemistry experiments (Mitchell, 2014), but no literature was found using only edible food experiments to teach high school chemistry.

The problem of the teachers being unaware of the UEN File Cabinet resources, which annually contains the summer conference proceedings as well as other new and shared resources, needs to be addressed. Research should be done to discover the best method to get the knowledge of the resources to the teachers. Most of those unaware of the new resources regretted not knowing about them. The work put into the development of good, substantive labs and lesson plans is wasted if the market never hears about them.

Although the survey instrument did not return highly significant differences in the importance vs. perceived ability scales of the teachers, it did show teachers felt the curriculum was very important to be taught, and that they felt competent, but not very competent overall, to teach the new curriculum. At a Level Two licensure the teachers are required to have 200 points in a five-year period of time to renew their licensure. They cannot get points from classes they have already taken in preservice education, so the continuing education classes or professional development offered should be at a higher level of STEM education content than may currently be available. This would not only allow the teachers to get licensure points, but deepen their understanding, which should heighten their feelings of self-efficacy, which Bandura asserts will result in more effective teaching of STEM education concepts in the classroom (Smith et al., 2015, p. 186).
To come full circle to the two major findings of the national STEM crisis mentioned in the introductory of the Statement of the Problem (see Chapter I): The most effective method of educating students in STEM concepts is contextualized learning situations. CTE courses, such as Food and Nutrition 1, naturally contextualize STEM concepts. If teachers use their professional development time to deepen their own STEM education, they will be able to bring the natural cross-disciplinary STEM ties to light in the minds of their Food and Nutrition 1 students.
REFERENCES


APPENDICES
Appendix A

Letter of Information
Family and Consumer Science Teacher Needs Assessment of a STEM-enhanced Food and Nutrition Sciences Curriculum

Purpose
You are invited to participate in a research study conducted by Rebecca Lawver, a professor in the School of Applied Sciences, Technology and Education, and Cathy Merrill, a graduate student in ASTE Family and Consumer Science Education and Extension, at Utah State University. The purpose of this research is to find out more about teacher priorities and satisfaction levels with the new STEM-enhanced Foods & Nutrition 1 (aka Food and Nutrition Sciences) curriculum implemented in the 2015-2016 school year. You have been asked to participate in this study because you are 18 or older and were a teacher of this course during the 2015-2016 school year.

This form includes detailed information on the research to help you decide whether to participate in this study. Please read it carefully and ask any questions you have before you agree to participate.

Procedures
Your participation will involve taking a 15- to 20-minute online survey to give us your feedback on the new STEM-enhanced Foods & Nutrition 1 curriculum implemented in the 2015-2016 school year. There are Four Sections for you to complete. Section I asks you to indicate both your perceived level of importance of the Foods and Nutrition Sciences Curriculum objectives as well as your perceived ability to teach the objectives. Section II asks you to indicate your perceived level of importance and your perceived ability to teach the enhanced curriculum new resources. Section III asks you to rank the importance of specific STEM-enhanced curriculum resources. Finally, Section IV asks you basic demographic and personal feedback questions. There are approximately 240 potential participants in this study.

Risks
This is a minimal risk research study. That means that the risks of participating are no more likely or serious than those you encounter in everyday activities. The foreseeable risks or discomforts include a slight possibility of loss of confidentiality. In order to minimize this risk, the survey will be sent out with an anonymous link to all participants. No personally identifiable information will be requested.

Benefits
There may not be any direct benefit to you from your participation. The benefits from the data gathered with this survey will be filling a gap in current academic literature resulting in a better understanding of professional development needs for Food and Nutrition Sciences teachers, which will translate to the development of continuing education or
workshops and recommendations for preservice learning.

**Confidentiality**
The researchers will make every effort to ensure that the information you provide as part of this study remains confidential. Your identity will not be revealed in any publications, presentations, or reports resulting from this research study.

We will collect and store your information through Qualtrics. The survey will be sent out using an anonymous link so that no email addresses or other personally identifiable information will be connected to the responses.

It is unlikely, but possible, that others (Utah State University, or state or federal officials) may require us to share the information you give us from the study to ensure that the research was conducted safely and appropriately. We will only share your information if law or policy requires us to do so.

The research team works to ensure confidentiality to the degree permitted by technology. It is possible, although unlikely, that unauthorized individuals could gain access to your responses because you are responding online. However your participation in this online survey involves risks similar to a person’s everyday use of the internet.

**Voluntary Participation & Withdrawal**
Your participation in this research is completely voluntary. If you agree to participate now and change your mind later, you may withdraw at any time by not agreeing to take the survey or leaving it incomplete. There will be no consequence or loss of benefits if you withdraw.

The researchers may choose to terminate your participation in this research study if the survey is incomplete at the time of data collection.

**IRB Review**
The Institutional Review Board (IRB) for the protection of human research participants at Utah State University has reviewed and approved this study. If you have questions about the research study itself, please contact the Principal Investigator at 435-797-1254 or rebecca.lawver@usu.edu. If you have questions about your rights or would simply like to speak with someone other than the research team about questions or concerns, please contact the IRB Director at (435) 797-0567 or irb@usu.edu.

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Student Investigator  
(801) 592-7323  
cathy.merrill@aggiemail.usu.edu
Informed Consent

Q1. By clicking “agree” below, you indicate that you are over 18 years of age and that you agree to participate in this study. You also indicate that you understand the risks and benefits of participation, and that you know what you will be asked to do. You also agree that you have asked any questions you might have, and are clear on how to stop your participation in the study if you choose to do so.

_____ Agree—I will participate in the survey

_____ Disagree—I do NOT wish to participate in the survey

*If you have checked “Disagree,” you are finished with the survey. We thank you for your time.*

Q2. In order to be included in this study, you must have taught Foods & Nutrition 1 (now known as “Food and Nutrition Sciences”) in the 2015-2016 school year (one or both semesters).

_____ I taught Foods & Nutrition 1 in the 2015-2016 school year

_____ I did NOT teach Foods & Nutrition 1 in the 2015-2016 school year

*If you have checked “I did NOT teach Foods & Nutrition 1 in the 2015-2016 school year,” you are finished with the survey. We thank you for your time.*
Appendix B

Questionnaire
QUESTIONNAIRE

Thank you for agreeing to participate in this research, it is completely voluntary. Once the data has been collected, identifiers will be removed and stored separately to ensure confidentiality. There are Four Sections for you to complete. Section I asks you to indicate your perceived level of importance of the Foods and Nutrition Sciences Curriculum objectives as well as your perceived competence or ability to teach the objectives. Section II asks you to indicate your perceived level of importance and your perceived ability to teach the enhanced curriculum resources. Section III asks you to rank the importance of the STEM-enhanced curriculum resources. Finally, Section IV asks you demographic questions.

SECTION I

Instructions: Please identify the level of importance and your perceived competence for teaching the objectives in the Foods and Nutrition Sciences Revised Curriculum

(1) Please identify the level of importance of each objective by circling your answer:

Scale: 1 = Not Important; 2 = Of Little Importance; 3 = Somewhat Important; 4 = Important; 5 = Very Important

(2) Please rate your perceived ability to teach the objectives by circling your answer:

Scale: 1 = Not Competent; 2 = Little Competence; 3 = Somewhat Competent; 4 = Competent; 5 = Very Competent

<table>
<thead>
<tr>
<th>Importance</th>
<th>Food and Nutrition Science Standards and Objectives</th>
<th>Perceived Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q3. Standard 1: Kitchen safety procedures and sanitation techniques</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Safety rules and guidelines</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>First aid procedures</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Health and hygiene for food handling</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Sanitation rules and guidelines</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Identification and prevention of food-borne illnesses and contamination</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
### Q4. Standard 2: Kitchen equipment and management

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>Identify types, use and care of kitchen equipment</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Abbreviations, food measurement terminology, proper measurement techniques</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Integrate mathematic concepts through equivalents, recipe adjustments and conversion</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Basic food-preparation terminology</td>
</tr>
</tbody>
</table>

### Q5. Standard 3: Carbohydrates and fiber, sources, functions, preparation

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>Identify carbohydrates, sources, functions and importance of whole grains in the body</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Identify fiber, sources and functions</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Quick breads, rice, grains and pasta</td>
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</tbody>
</table>

### Q6. Standard 4: Proteins and lipids (fats and oils), sources, functions, preparation

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>Complete, incomplete and complementary proteins—sources, and functions</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Eggs and egg products—selection and preparation guidelines</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Milk and milk products—selection and preparation guidelines</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>Lipids—sources, functions, related health concerns</td>
</tr>
</tbody>
</table>
Q7. Standard 5: Vitamins, Minerals, and Water: Sources and Functions

<table>
<thead>
<tr>
<th></th>
<th>Vitamins—food sources, functions, and deficiencies</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Minerals—food sources, functions, and deficiencies</td>
<td></td>
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<tr>
<td>1 2 3 4 5</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Water—functions in the body</td>
<td></td>
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<tr>
<td>1 2 3 4 5</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Fruits and Vegetables—selection and preparation</td>
<td></td>
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<tr>
<td>1 2 3 4 5</td>
<td></td>
<td>1 2 3 4 5</td>
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</tbody>
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<thead>
<tr>
<th></th>
<th>Six dietary guidelines and key recommendations</th>
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<tr>
<td>1 2 3 4 5</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Demonstrate knowledge of MyPlate</td>
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<tr>
<td>1 2 3 4 5</td>
<td></td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td></td>
<td>Demonstrate knowledge of healthy eating patterns</td>
<td></td>
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<tr>
<td>1 2 3 4 5</td>
<td></td>
<td>1 2 3 4 5</td>
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</tbody>
</table>

Q9. SECTION II

For the following section please consider that there were a number of new resources added to the Utah Education Network (UEN) File Cabinet to assist in the new STEM-Enhanced curriculum. Please rank the importance of the new resources and your perceived ability to teach the concepts. If you did not use the resource, please indicate DN.

1) Please identify the level of importance of each objective by circling your answer:

*Scale: 1 = Not Important; 2 = Of Little Importance; 3 = Somewhat Important; 4 = Important; 5 = Very Important*

(2) Please rate your perceived ability to teach the objectives by circling your answer:

*Scale: 1 = Not Competent; 2 = Little Competence; 3 = Somewhat Competent; 4 = Competent; 5 = Very Competent*
Q 10. If you indicated DN (Did Not Use) a particular resource as indicated on the previous page. Please tell us why below.

Q 11. SECTION III

For the following section. Please rank the STEM Enhanced Resources from 1 to 5; 1 = Most Important Resource; 5 = Least Important Resource

<table>
<thead>
<tr>
<th>Importance</th>
<th>STEM Enhanced Curriculum Resources</th>
<th>Perceived Ability</th>
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<tbody>
<tr>
<td>New Labs</td>
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<td></td>
</tr>
<tr>
<td>1 2 3 4 5 DN</td>
<td>How Clean is Clean</td>
<td>1 2 3 4 5 DN</td>
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<tr>
<td>1 2 3 4 5 DN</td>
<td>What does it Matter</td>
<td>1 2 3 4 5 DN</td>
</tr>
<tr>
<td>1 2 3 4 5 DN</td>
<td>Better Butter</td>
<td>1 2 3 4 5 DN</td>
</tr>
<tr>
<td>1 2 3 4 5 DN</td>
<td>Leavening Agents</td>
<td>1 2 3 4 5 DN</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Institute of Food Technologists (IFT) Website Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 DN</td>
</tr>
<tr>
<td>1 2 3 4 5 DN</td>
</tr>
</tbody>
</table>

Q 12. SECTION IV

Please answer the following questions by checking the box.

<table>
<thead>
<tr>
<th>What is the highest level of formal education you have received?</th>
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<tbody>
<tr>
<td>BA or BS</td>
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<tr>
<td>MA or MS</td>
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<tr>
<td>Ph. D.</td>
</tr>
<tr>
<td>Other—please specify</td>
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</table>
Q13. What type of Teaching License do you have?

<table>
<thead>
<tr>
<th>Provisional / Alternative Licensure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
</tr>
<tr>
<td>Level 2</td>
</tr>
<tr>
<td>Level 3</td>
</tr>
<tr>
<td>Student Teacher/Intern</td>
</tr>
</tbody>
</table>

Q14. How many years have you taught Family and Consumer Sciences, including the 2015-2016 school year.

Q15. What was your undergraduate major?

Q16. If you have a Family and Consumer Sciences Education degree, please check where your degree was earned.

- ______ Utah State University
- ______ Brigham Young University
- ______ Other institution
- ______ Do not have a Family and Consumer Sciences Education degree

Q17. If you have a post-baccalaureate degree, please indicate the field of study:
Q18. Please indicate the highest level of classes taken in the following STEM-related courses. Place a check mark in the box.

Freshman = Introductory, 100 or 1000 level classes  
Sophomore = 200 or 2000 level classes  
Junior = 300 or 3000 level classes  
Senior = 400 or 4000 level classes  
Graduate = 500 or 5000 or higher level classes

<table>
<thead>
<tr>
<th>Coursework</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
<th>Graduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
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<tr>
<td>Biochemistry</td>
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<tr>
<td>Chemistry</td>
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<tr>
<td>Chemical Engineering</td>
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<tr>
<td>Engineering</td>
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<tr>
<td>Food Science</td>
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<tr>
<td>Mathematics</td>
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<tr>
<td>Nutrition/Dietetics</td>
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<tr>
<td>Physics</td>
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</tr>
<tr>
<td>Statistics</td>
<td></td>
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</tbody>
</table>

Q19. What would you say is your personal level of enthusiasm for science, technology, engineering or mathematics?
Q20. What do you see as the benefits, if any, of including science, technology, engineering and math (STEM) in Family and Consumer Science classes?

Q21. What is your age?

Q22. What is your gender?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
</tr>
</tbody>
</table>

Q23. In your opinion, what have been the main barriers to the implementation of the new STEM-enhanced curriculum?

Q24. What could the Utah State Office of Education provide to teachers to assist with removal of these barriers?
Q25. What courses would you recommend for current college/university students who want to teach the enhanced Foods and Nutrition course or Family and Consumer Science?

Thank you for completing this questionnaire.
Appendix C

Invitation Emails
Dear Educator

The STEM-enhanced curriculum developed last year for Foods & Nutrition 1 (aka Food and Nutrition Sciences) as part of a Department of Workforce Services joint grant with Utah State University needs to be evaluated. Because you taught this course last year, we would appreciate your feedback on: (1) what you perceive as the level of importance for each of the objectives; (2) what you perceive as your ability to teach each objective; (3) your ranking of the importance and utility of some of the specific STEM-enhanced labs and resources; and, (4) some basic background, demographics and implementation questions.

The information gathered from this evaluation will be used to target profession development areas and resources needed for successful implementation of the new curriculum.

This survey is completely voluntary and lack of participation will in no way affect your employment or benefits. The link to the survey is anonymous and no personally identifiable information will be requested or connected to the survey.

Inclusion criteria: You must be over 18 to complete the survey and you must have taught the Foods & Nutrition 1 class during the Fall 2015 and/or Spring 2016 school year.

Please click on the anonymous link below to participate, or to request non-participation, in the survey:
https://usu.co1.qualtrics.com/SE/?SID=SV_1Fyh9EionfioUhT

Thank you,

Cathy Merrill
USU Graduate Student Researcher
Family and Consumer Science Education & Extension
Cell phone: (801) 592-7323
Email: cathy.merrill@aggiemail.usu.edu

Rebecca G. Lawver, Ph.D.
Principal Investigator
School of Applied Sciences, Technology and Education
Utah State University
Office: (435) 797-1254
Email: rebecca.lawver@usu.edu
“DID WE MISS YOU?” LISTSERV EMAIL

ATTENTION: FCS Teachers who taught Foods & Nutrition 1 last year

Yesterday an email was sent to all FCS teachers who are currently registered to teach Foods & Nutrition 1 (aka: Food and Nutrition Sciences), inviting them to participate in an anonymous survey.

The purpose of the survey is to gain feedback from the teachers who taught the new STEM-enhanced Foods & Nutrition 1 curriculum during the 2015-2016 school year.

If you taught this revamped course last year, but did NOT receive an invitation to participate in the survey, please contact us. Your feedback is very important in determining professional development needs for this course, and also for revising other foods courses.

If you did NOT receive the invitation email and the anonymous link for the survey, please contact:

Cathy Merrill, cathy.merrill@aggiemail.usu.edu, or call 801-592-7323.

Thank you!

Cathy Merrill
USU Graduate Student Researcher
Family and Consumer Science Education & Extension
Cell phone: (801) 592-7323
Email: cathy.merrill@aggiemail.usu.edu

Rebecca G. Lawver, Ph.D.
Principal Investigator
School of Applied Sciences, Technology and Education
Utah State University
Office: (435) 797-1254
Email: rebecca.lawver@usu.edu
REMINDER EMAIL

Several weeks ago you were given an anonymous link to a survey for evaluating the new STEM-enhanced Foods & Nutrition 1 curriculum that was introduced last year. Your response will help us understand what you consider important and what you feel comfortable teaching in this new course. That information will then help us define areas you might appreciate for professional development opportunities.

If you have not yet filled out this survey, please do so now. It should only take 15 minutes. Participation is completely voluntary, but your feedback is critical in evaluating needs for this new curriculum!

Copy and paste, or click on the anonymous link:

https://usu.co1.qualtrics.com/SE/?SID=SV_1Fyh9EionfioUhT

Thank you for completing this important survey! If you have questions, please contact me at cathy.merrill@aggiemail.usu.edu, or (801) 592-7323, for information.

Sincerely,

Cathy Merrill
USU Graduate Student Researcher
Family and Consumer Science Education & Extension
Cell phone: (801) 592-7323
Email: cathy.merrill@aggiemail.usu.edu

Rebecca G. Lawver, Ph.D.
Principal Investigator
School of Applied Sciences, Technology and Education
Utah State University
Office: (435) 797-1254
Email: rebecca.lawver@usu.edu
FINAL EMAIL SENT ON SEPTEMBER 12, 2016

Subject: FACS Foods & Nutrition 1 Teacher Final Reminder for Survey Needs Assessment

The Foods & Nutrition 1 Teacher Needs Assessment survey sent out August 11, 2016, is drawing to a close. The survey link is completely anonymous, so there is no record of who has taken the survey. If you have not taken the survey on the F&N 1 new STEM-enhanced curriculum, please consider doing so now: the survey will only remain open for one more week. The August 11 survey is not the same as the survey sent out during summer conference.

If you have not yet filled out this survey, please do so now. It should only take 15 minutes. Participation is completely voluntary, but your feedback is critical in evaluating needs and creating resources for this new curriculum!

Copy and paste, or click on the anonymous link:

https://usu.co1.qualtrics.com/SE/?SID=SV_1Fyh9EionfioUhT

Thank you for completing this important survey! If you have questions, please contact me at cathy.merrill@aggiemail.usu.edu, or (801) 592-7323, for information.

Sincerely,

Cathy Merrill
USU Graduate Student Researcher
Family and Consumer Science Education & Extension
Cell phone: (801) 592-7323
Email: cathy.merrill@aggiemail.usu.edu

Rebecca G. Lawver, Ph.D.
Principal Investigator
School of Applied Sciences, Technology and Education
Utah State University
Office: (435) 797-1254
Email: rebecca.lawver@usu.edu
Appendix D

Food and Nutrition 1 Curriculum
Food and Nutrition I 6/2015

Levels: 9-12
Units of Credit: .50
CIP Code: 20.0108
Core Code: 34-01-00-00-150
Prerequisite: None
Skill Test #340

COURSE DESCRIPTION
This course is designed to focus on the science of food and nutrition. Experiences will include food safety and sanitation, culinary technology, food preparation and dietary analysis to develop a healthy life style with pathways to career readiness. Laboratory based experiences strengthen comprehension of concepts and standards outlined in Sciences, Technology, Engineering and Math (STEM) education. FCCLA may be an integral part of this course. *(Standards 1-6 will be covered on Skill Certification Test #340.)*

CORE STANDARDS, OBJECTIVES, AND INDICATORS

PERFORMANCE OBJECTIVE 1

STANDARD 1
Students will consistently demonstrate kitchen safety procedures and sanitation techniques.

Objective 1: Apply established safety rules and guidelines to maintain a safe working environment.

a. Identify safety practices for using electric appliances.
   - With electrical appliances, use dry hands, stand on dry floor and keep away from water.
   - Plug cord into electrical appliance before plugging into power source.

b. Explain how to extinguish a grease fire.
   - To extinguish a grease fire, use a lid on the pan, baking soda/salt or fire extinguisher.
   - Avoid water or flour.

c. Identify proper storage of cleaning chemicals.
   - Cleaning supplies should be stored away from foods. Keep cleaning supplies in original containers.

b. Explain prevention of: burns, cuts, fires, falls, electrical safety, and lifting techniques.
   - Dull knives are more dangerous and less efficient than sharp knives.
   - Keep clothing away from direct heat.
   - Avoid plastic on or near the range.
   - Turn handles away from the front of the range.
   - Clean up spills immediately to avoid falls.
   - Lift lids on hot foods away from you.
   - Use hot pads or oven mitts for handling hot baking pans.
   - Store heavy items on lower shelves.
   - Use a step stool for reaching high objects.

Objective 2: Identify proper first-aid procedures for cuts, burns and electrical shock. *(STEM (Biology/Science))

a. Identify ways to prevent poisoning and chemical contamination. *(Mixing chlorine with any product containing ammonia will create toxic and deadly fumes.)*
• Keep cleaning supplies away from food.
• Mixing chlorine with any product containing ammonia will create toxic deadly fumes.
b. Identify basic first-aid for cuts and burns.
• First aid for severely bleeding cut: apply direct pressure over wound.
• First aid for a first degree burn: place burned area under cold running water.
c. Identify proper first-aid procedures for electrical shock.
• To avoid electrical shock: avoid any water and electrical contact, use dry hands to disconnect appliances before cleaning and disconnect the main power source before approaching injured person.

Objective 3: Identify health and hygiene requirements for food handling. *STEM (Science)
a. Identity proper hand washing and when a double hand wash is required.
• Wash hands with soap and warm water for a minimum of twenty seconds.
• Wash hands before/after handling raw meat, poultry or eggs.
b. Describe personal hygiene practices.
• Wash hands after using restroom, sneezing, coughing, changing diapers, etc.
c. Identify appropriate clothing and hair restraints.
• Appropriate clothing includes clean clothing and apron. Cover or tie back hair with appropriate hair restraints before working with food.

Objective 4: Identify and apply sanitation rules and guidelines. *STEM (Science)
a. Identify proper dishwashing techniques.
• Describe the three-sink method of cleaning and sanitizing pots and pans and how to correctly dry dishes.
• Describe the correct procedure for cleaning and sanitizing using a dish machine.
• Dish washing order (by hand): rinse and scrape first, glassware before silverware, plates and bowls, pots and pans last.
b. Discuss cleaning and sanitizing of work surfaces.
• Keep all work surfaces clean.
• Disinfect work surfaces to prevent cross-contamination.
• When tasting foods, always use a clean spoon and use only once.
• To reduce pest/insects, avoid crumbs or spills, keep staples in airtight containers and dispose of garbage properly.
c. Discuss cleaning chemicals and how to use them safely on food contact surfaces.
• Always use cleaners and sanitizers according to manufactures directions. Clean the surface. Rinse the surface. Sanitize the surface, then allow the surface to air dry.
d. Discuss appropriate use of utensils and gloves to avoid bare-hand contact with ready-to-eat foods.
• Wear gloves if you have a cut or open sores on hands.
e. Describe the correct procedures for storing dishes and utensils.
• Utensils and equipment should be stored in ways that prevent contamination.
• Store utensils and equipment that touches food at least six inches off the floor.
• Store glasses and cups upside down on a clean, sanitized surface, and store utensils with handles up.
f. Describe the correct procedures to handle trash and garbage.
• Garbage can contaminate food and equipment if it isn’t handled safely. Remove garbage from prep areas as quickly as possible.
• Do not clean garbage containers near food prep or food storage areas. Clean the inside and outside of garbage cans often.
• Close the lids on outdoor containers.

Objective 5: Identify methods that prevent food-borne illnesses and contamination. *STEM (Biology/Science)
a. Define the characteristics of a food-borne illness.
• Food-borne illness results from eating contaminated foods containing poisonous toxins.
Fever, headache and digestive troubles are symptoms of food-borne illness.

Food will often look and smell normal. They may not always have off-odors or off-flavors.

When in doubt, throw it out.

List sources of microbes. A microbe is anything too small to be visible to the naked eye. Three types of microbes found in food are bacteria, viruses and fungi (yeast and mold). Foods like milk/dairy, meat, fish, eggs, poultry, shellfish/crustaceans, baked potatoes, tofu, sprouts, cooked rice, beans and vegetables, sliced melons or tomatoes and lettuce are susceptible to bacterial growth.

b. Identify types of food-borne illness, their symptoms and common sources of contamination:

- **Botulism**
  - Associated with *improperly canned foods*, specifically low-acid foods.
- **E-coli**
  - Bacteria spread by air from soil, ground and fecal matter to food sources. Usually found in undercooked ground beef, unpasteurized milk, fruit juices, fresh fruits and vegetables. E-coli will be killed by cooking or heating to a high enough temperature.
- **Hepatitis A**
  - Virus from *fecal matter* transferred by human contact, usually through *improper hand washing*.
- **Salmonella**
  - Bacteria often found in *raw poultry and eggs*.
- **Staphylococci**
  - Bacteria spread through *human mucous* contact to food sources.
- **Norovirus**
  - Associated with raw produce, contaminated water, and foods that are not reheated after contact with an *infected handler*.
- **Clostridium Perfringens**
  - Associated with meats, poultry, gravy, dried or precooked foods, *time/temperature abused foods*.
- **Campylobacter SPP**
  - Usually found in raw and undercooked poultry, *unpasteurized milk*, and *contaminated water*.

c. Identify population groups that are most vulnerable to food-borne illness.

- Population groups most vulnerable to food borne illness include young children, older adults, pregnant women, and people with immune systems weakened by disease or medical treatment- "YOPI"s [Young, Old, Pregnant, and Immune-Compromised].

d. Identify how to prevent food-borne illness contamination through burns, cuts or other wounds.

- Wash hands before putting on gloves and when changing to a new pair of gloves.
- Only use single-use gloves when handling food. Gloves should fit your hand.
- Change gloves when they get dirty or torn, before beginning a new task, or after handling raw meat, seafood, and poultry.
- Wear bandages over wounds and use a water-proof finger-cover over bandages and under gloves.

e. Define cross contamination and explain prevention techniques.

- A large majority of food-borne illnesses can be prevented by practicing proper hand washing.
- Throw away any food with an off odor and do not taste or use.
- Do not buy or use bulging cans.
- Frequently clean and sanitize work surfaces.
- Ways to avoid cross contamination:
  - Never place cooked food on a plate which has previously held raw meat, poultry or seafood.
  - Always wash hands, cutting boards, etc. with hot soapy water after they come in
contact with raw meat, poultry or seafood.

f. Identify proper temperatures:

- Temperature Danger Zone: 41-135 degrees
  - Describe the relationship between cooking time and temperature in killing microorganisms.
  - Foods should not be in the Temperature Danger Zone for more than two hours.
  - Foods held in the danger zone for longer than 4 hours should be thrown out. In the
    industry, restaurants get 4 hours since food is delivered in a refrigerated truck and
    moved directly to the refrigerator in the restaurant. Home use it is 2 hours.

- Discuss proper date and time marking for foods.
- List appropriate temperatures for refrigerators, freezers and steam tables.
- Heating, reheating and serving foods: 165 degrees
- Cold storage of foods: 40 degrees or below
  - Discuss steps used to cool food rapidly
  - Keep freezer temperature at 0 degrees Fahrenheit to keep foods frozen solid.
  - Keep hot foods hot and cold foods cold.

- Internal food temperatures: (Always use a thermometer to check actual temperature.)
  - Seafood, beef, veal, lamb, pork: at least 145 degrees
  - Ground meats (pork, beef, veal, lamb) : 155 degrees
  - All poultry (whole or ground): 165 degrees

- Explain how to correctly thaw foods.
  - In the refrigerator for 2-3 days. This is the safest method.
  - In a sink of cold, running water. Or a sink full of cold water, changing the water every 30
    minutes. Use food immediately.
  - In the microwave, if using the food immediately.
  - Never defrost frozen foods at room temperature.

h. Define Temperature Controls for Safety (TCS)

- Foods that require time or temperature controls for safety (TCS).
  - Identify potential hazardous foods and the dangers of leaving them at room temperature.
  - Any type of food can be contaminated, but some types allow more microbe/pathogen growth.
  - The best way to control pathogen growth in these items is to control time and temperature.
  - Foods like milk/dairy, meat, fish, eggs, poultry, shellfish/crustaceans, baked potatoes, tofu,
    sprouts, cooked rice, beans and vegetables, sliced melons or tomatoes and lettuce are
    susceptible to bacterial growth.

PERFORMANCE OBJECTIVE 2
Consistently demonstrate preventative practices related to kitchen safety and sanitation
procedures.

PERFORMANCE OBJECTIVE 3
Students will complete food and kitchen safety training comparable to that required for the
ServSafe Food Handlers Certificate with the option to acquire a Food Handers Permit from your
county Health Department through the Utah Restaurant Association.

STANDARD 2
Students will apply the skills of kitchen equipment and management.
Objective 1: Identify types, use and care of selected kitchen equipment. *STEM (Technology)
a. Identify various types of kitchen equipment.
  - bread knife • chef’s knife • colander/strainer
  - cutting board • ladle • meat thermometer
  - oven thermometer • pancake turner • paring knife
  - pastry blender • rolling pin • rubber scraper
• slotted spoon • straight edge spatula • tongs
• vegetable peeler • wire whisk • wooden spoon
b. Select appropriate equipment for specific product preparation.
• Appropriate equipment for specific preparation include:
  o using pastry blender for cutting fat into flour.
  o straight edge spatula for leveling off or spreading frosting.
  o wooden spoon for cooking on top of the stove.
  o wire whisk used for blending liquids.
c. Demonstrate the proper use and care of equipment.
d. Demonstrate basic knife skills, including safety and proper handling.
• Use caution with sharp objects such as knives and blender blades.
e. Employ standard safety procedures when using equipment.
f. Identify the basic principles of cooking in a microwave.
• Microwaves are attracted to fat, sugar and water molecules.
• Microwaves cause molecules to vibrate. Vibration creates friction, which produces the heat that cooks the food.
• Appropriate and safe cooking containers include: microwave safe plastic, glass and paper; not metal. Shallow, round containers cook more evenly than square containers.
• Standing time is the time food continues to cook after the microwave has stopped.
• Quantity/volume of food in the microwave increases cooking and standing time.
• Stir and rotate foods for even cooking.
• Covering foods holds in the moisture and helps foods to cook more evenly and prevent splattering. Cover with plastic wrap, paper towel, wax paper or lid.
• Microwave cooking does not brown foods or give a crisp crust.
• To prevent burns, use pot holders and direct steam away from body.

Objective 2: Identify abbreviations, food measurement terminology and demonstrate proper measuring techniques. *STEM (Math)
a. Identify abbreviations.
• Tablespoon = T. Tbs. or Tbsp. • Teaspoon = t. or tsp.
• Gallon = gal. • Quart = qt.
• Pint = pt. • Cup = c.
• Pound = lb. or # • Ounce = oz.
• Hour = hr. • Minute = min.
b. Identify measuring techniques and tools.
• Use dry measuring cups for dry ingredients and level with a straight edge spatula.
• Use liquid measuring cups for liquid ingredients. Measure at eye level on a flat, level surface.
• Brown sugar is packed and leveled in dry measuring cups.
• Shortening is pressed into dry measuring cups and leveled; or use water displacement method.
• Use most effective tools for measuring. For example: use ¼ cup rather than 4 Tbsp.
• Use measuring spoons for ingredients less than ¼ cup.
• Do not measure directly over the mixing bowl.

Objective 3: Integrate mathematic concepts through equivalents, recipe adjustments and conversions. *STEM (Math)
a. Compute equivalents.
• 3 t. = 1 T. • 4 T. = ¼ c. • 16 T. = 1 c.
• 4 qt. = 1 gal. • 16 c. = 1 gal. • 8 fl. oz. = 1 c.
• c. = 1 pt. • 1 stick butter = ½ c. • 16 oz. = 1 lb.
b. Double and cut recipe size in half.
• When cutting a recipe in half, or doubling a recipe, the cooking temperature will remain the same.
• The amount of ingredients, length of cooking time and size of pan will be affected.
• Use appropriate math principles for increasing/decreasing fractions.
c. Analyze, prepare and complete a recipe.

**Objective 4**: Explain basic food-preparation terminology.
a. Define cooking terms: chop, cream, cut in, dice, dredge, flour, fold in, grate, knead, mince, peel, sauté, simmer, steam and whip.
• Chop: to cut into small pieces
• Cream: to work sugar and fat together until the mixture is soft and fluffy
• Cut-in: to cut fat into flour with a pastry blender or two knives
• Dice: to cut into very small cubes
• Dredge: to coat food heavily with flour, breadcrumbs or cornmeal
• Flour: to sprinkle or coat with a powdered substance, often with crumbs of seasonings
• Fold-in: to mix ingredients by gently turning one part over another
• Grate: to finely divide food in various sizes by rubbing it on surface with sharp projections
• Knead: to work dough to further mix the ingredients and develop the gluten
• Mince: to cut or chop food as finely as possible
• Peel: to remove or strip off the skin or rind of some fruits and vegetables
• Sauté: to brown or cook foods with a small amount of fat using low to medium heat
• Simmer: to cook just below the boiling point
• Steam: to cook by the vapor produced when water is heated to the boiling point
• Whip: to beat rapidly to introduce air bubbles into food

**PERFORMANCE OBJECTIVE 4**
Consistently demonstrate proper measuring and preparation techniques while preparing a recipe.

**STANDARD 3**
Students will identify the sources and functions of carbohydrates and fiber and apply appropriate food preparation techniques.

**Objective 1**: Identify carbohydrates, their sources and functions and the importance of whole grains in the body. *STEM (Math)*
a. Define simple carbohydrates (sugars), complex carbohydrates (starches) and fiber.
• Simple carbohydrates are also called sugars.
• Complex carbohydrates are also called starches.
• Fiber is a form of a complex carbohydrate.
b. Identify and calculate the caloric content of carbohydrates (4 calories per gram) and the functions and food sources for simple and complex carbohydrates.
• The primary function of carbohydrates is to provide energy.
• Carbohydrates provide 4 calories per gram.
• Good sources of complex carbohydrates include: whole grains, cereal products, dried beans, rice and pasta.
• Carbohydrates include: sucrose (table sugar), fructose (fruit sugar), lactose (milk sugar), maltose (malt sugar) and glucose (blood sugar).
• The parts of the wheat kernel and the nutrients provided are:
  o Endosperm: starch, protein
  o Germ: unsaturated fatty acids, “B” Vitamins, Vitamin E, iron, zinc, other trace minerals
  o Bran: fiber, vitamins, minerals
c. Describe how complex carbohydrates break down into simple sugars in the digestion process.
Objective 2: Identify fiber, its sources and functions. *STEM (Biology)
a. Identify the functions and food sources of fiber.
   • Fiber, also known as roughage or cellulose, attracts water to our intestines and moves food through the intestines faster.
   • Fiber helps to keep bowel movements soft in form and reduces problems related to constipation.

b. Identify cellulose/non-digestible fiber.
   • Foods high in fiber: fruits and vegetables (especially the skins or peels), whole grains, legumes, bran cereals, dry beans, nuts, split peas and lentils.

c. Discuss the importance of liquids in the role of bowel function.
   • Drink plenty of liquids, otherwise fiber can slow down or even block normal bowel function.

d. Discuss why the National Cancer Institute recommends 20-35 grams of daily fiber.
   • Fiber may reduce the risks of diverticulosis, colon and rectal cancer.

Resources:
http://www.cancer.gov/cancertopics/pdq/supportivecare/gastrointestinalcomplications/HealthProfessional/page0
http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Whole-Grains-and-Fiber_UCM_303249_Article.jsp#mainContent

e. Identify foods high in natural fiber and how to increase the bulk in low-fiber foods.
   • Foods high in fiber: fruits and vegetables (especially the skins or peels), whole grains, legumes, bran cereals, dry beans, nuts, split peas and lentils.

Objective 3: Apply food selection and preparation guidelines related to quick breads, rice, grains and pasta. *STEM (Math/Science)
a. Identify examples of quick breads: muffins, pancakes, waffles, biscuits, cornbread and nut/fruit bread.
   • Quick breads do not use yeast for leavening.

b. Identify basic mixing techniques for quick breads.
   • Under-mixing cause quick breads to be crumbly, dry and have very few tunnels.
   • Over-mixing causes quick breads to be tough and to have tunnels.


c. Identify the role of each ingredient contained in quick breads: flour, liquid, leavening agents, fat, salt and sugar.
   • Ingredients and their role in quick breads:
     o Flour: provides structure and is the main ingredient.
     o Liquid: provides moisture.
     o Leavening agents: makes the quick bread rise. Examples of leavening agents include: baking powder, baking soda, eggs and steam.
     o Fat: provides tenderness, richness and some flavor.
     o Salt: provides flavor.
     o Sugar: provide flavor and browning.


d. Identify types of rice (brown, instant, long grain and short grain), cooking methods for rice and the ratio of uncooked to cooked rice.
   • Types of rice include: brown, instant, long grain and short grain.
     o Brown rice is the whole grain form of rice.
     o Instant rice is precooked and then dehydrated.
     o Long grain rice stays dry and fluffy.
     o Short grain rice sticks together and is also known as “sticky rice”.

   • Rice Cooking Method:
     o Bring water to a boil.
     o Add rice, cover the pan and reduce heat to a simmer.
     o Do not remove the lid while rice is cooking.
     o One cup of uncooked rice makes three cups of cooked rice. (Ratio is 1:3).


e. Identify cooking methods for pasta and the ratio of uncooked to cooked pasta.
   • Pasta dishes are usually low cost entrees.
   • Store dry pasta in a tightly covered container at room temperature. Fresh or cooked pasta should be stored in a closed container in the refrigerator.
Pasta Cooking Method:
- Bring water to a boil.
- Slowly add pasta so the boiling does not stop.
- Cook uncovered until pasta is al dente (firm to the tooth), stirring occasionally.
- One cup of uncooked pasta makes two cups of cooked pasta. (Ratio is 1:2).

PERFORMANCE OBJECTIVE 5
Actively participate in the preparation of a complex carbohydrate food from scratch. Compare the nutritional content and cost of a comparable convenience food vs. the complex carbohydrate food from scratch.

STANDARD 4
Students will identify the sources and functions of proteins and lipids (fats and oils) and apply appropriate food preparation techniques.

Objective 1: Identify proteins (complete, incomplete and complementary), their sources and functions in the body. *STEM (Math/Science)
- The primary function of protein is to build and repair body tissues.
- Protein provides 4 calories per gram.
- Keep meat and poultry portions small and lean.
- Include at least 8 oz. of cooked seafood per week.
- Amino acids are the building blocks of protein.
- There are 22 amino acids. 9 are considered essential. The body cannot manufacture essential amino acids so they must be obtained from food.
- Complete proteins contain all 9 of the essential amino acids in the right ratio for our body to use.
- Incomplete proteins contain some, but not all, of the amino acids.
- Animal foods source such as meat, chicken, fish and milk products contain complete protein.
- Soy foods such as tofu, tempeh, soy nuts and edamame also contain complete protein.
- Quinoa is considered a complete protein, but is not as high in protein as animal sources or soy, so is not included as a protein food in MyPlate.
- Incomplete proteins are from other plant sources: grains, dried beans, nuts and seeds.
- Incomplete proteins can be combined to create a complementary protein. For example: beans with rice; peanut butter with whole wheat bread.

Objective 2: Apply food selection and preparation guidelines related to egg products. *STEM (Science)
- Identify functions of eggs: binder, thickener, coating, leavening agent and emulsifier.
  - Functions of eggs:
    - Binder (Meat loaf)
    - Thickener (Pudding)
    - Coating (Breading on Chicken)
    - Leavening agent (Angel Food Cake)
    - Emulsifier (Mayonnaise)
- Identify egg cooking temperatures and techniques/methods.
  - Methods of cooking eggs: hard cooked, soft cooked, scrambled, fried, and poached.
  - Eggs are toughened by heat or by long exposure to heat.
- Identify appropriate storage of eggs.
  - Store eggs in the original container in the refrigerator. When properly stored in the refrigerator, eggs may be stored for several weeks.
Objective 3: Apply food selections and preparation guidelines related to milk and milk products.

*STEM (Science/Biology)

a. Identify serving sizes and amounts for milk and dairy products.
   • 3 cups from the milk group is recommended for teens and adults.
   • Eat calcium rich foods in the Dairy Group. Switch to fat free or low fat milk.

b. Discuss methods of cooking with milk. Define pasteurization, homogenization and fortified milk.
   • Milk products scorch easily and need to be cooked at a low temperature with constant stirring.
   • Heating milk in the microwave prevents scorching.
   • Pasteurized milk has been heat treated to remove harmful bacteria.
   • Homogenized milk has had the fat particles broken down and evenly distributed so the fat will not separate from the milk.
   • Milk is fortified with vitamins A and D.

c. Discuss raw (unpasteurized) milk and milk replacements and how they compare nutritionally.
   • Most of the nutritional benefits of drinking raw milk are available from pasteurized milk without the risk of disease that comes with drinking raw milk.
   • Raw milk made into other products like soft cheese, ice cream, and yogurt, can still cause dangerous illnesses. When consuming these products, make sure they are made from pasteurized milk. Raw, unpasteurized milk can carry dangerous bacteria such as Salmonella, E. coli, Campylobacter, and Listeria, which are responsible for causing numerous foodborne illnesses.
   • Milk replacements such as almond milk, soy milk, or rice milk are comparable with milk in regards to nutritional value and are a viable substitute for people with special dietary needs.

d. Identify methods of lowering fat in recipes by using lower fat content milk or milk products.
   • Reduce fat in recipes by using a lower fat content milk. For example: substitute yogurt for mayonnaise or sour cream, substitute fat-free (skim) or low-fat (1%) milk for whole milk.

Objective 4: Identify lipids (fats and oils), their sources, functions and related health concerns.

*STEM (Math/Science/Biology)

a. Identify the functions of fats:
   • Carrier for vitamins A, D, E, and K.
   • Reserve supply of energy.
   • Adds flavor in food.
   • Protects internal organs from shock and injury.
   • Insulates the body from shock and temperature changes.
   • Promotes healthy skin.
   • Satisfies hunger and helps you feel full longer.

b. Explain the role of cholesterol, including HDL and LDL factors. (High levels of LDL cholesterol is one factor related to heart disease and obesity.)
   • Cholesterol is essential for many body processes. Cholesterol produces hormones and bile acids. It is found in animal tissues, but is never present in plants.
   • The body has High Density Lipoprotein-(HDL) cholesterol and Low Density Lipoprotein-(LDL).
   • HDL cholesterol is considered “good” cholesterol because it transports excess cholesterol found in the blood stream back to the liver. LDL’s take cholesterol from the liver to wherever it is needed in the body. LDL cholesterol is considered “bad” cholesterol because if too much LDL cholesterol is circulating in the blood stream, it can build up in the arties and increase the chance of heart disease or stroke.
   • High levels of LDL cholesterol is one factor related to heart disease and obesity.

c. Identify the differences between saturated, monounsaturated, polunsaturated and trans-fatty acids. Discuss the effect of each type of lipid on HDL and LDL levels.
   • Most solid fats are high in saturated fats and are solid at room temperature.
   • Saturated Fats:
     o Raise the LDL and HDL levels of cholesterol in the blood.
Examples of saturated fats include: meat, poultry skin, whole milk, tropical oils, butter, shortening and lard.

- **Polyunsaturated Fats:**
  - Lower both the LDL and HDL cholesterol levels in the blood.
  - Examples of polyunsaturated fats include: corn oil, soybean oil and safflower oil.

- **Monounsaturated Fats:**
  - Lower LDL and raise HDL levels of cholesterol in the blood.
  - Examples of monounsaturated fats include: olive oil, olives, avocados, peanuts and canola oil.

d. Identify and calculate the caloric content of lipids (9 calories per gram) and methods of lowering lipid content of prepared foods.

- Fats provide 9 calories per gram. It is the most concentrated source of energy.
- Choose lean meats and lower fat dairy products.
- Replace solid fats with oils.
- Oils are not a food group, but they help deliver essential nutrients.

**PERFORMANCE OBJECTIVE 6**
Actively participate in the preparation of a complete and/or complimentary protein food from scratch. Compare the nutritional content and cost of a comparable convenience food vs. the complete and/or complementary food from scratch.

**PERFORMANCE OBJECTIVE 7**
Actively participate in the preparation of a low-fat food. Compare the nutritional content and cost of a comparable high-fat food vs. the low-fat food.

**STANDARD 5**
Students will identify the sources and functions of select vitamins, minerals and water and apply appropriate food preparation techniques to foods high in these nutrients.

**Objective 1:** Identify select vitamins, their food sources, functions and deficiencies in the body.

*STEM (Math/Science/Biology)*

a. Identify select water-soluble vitamins (Vitamin C, Folate):

- Identify sources, functions and deficiency of Vitamin C.
  - Vitamin C: Helps to form collagen which holds the cells together and aids in healing. Prevents scurvy.
  - Identify sources, functions and deficiency of folate including the role of folate in preventing neural tube birth disorders like spina bifida.
  - Folate (folacin/folic acid) is one of the B Vitamins. Folate helps prevent neural tube birth disorders, such as spina bifida. Neural tube damage occurs during the first weeks of pregnancy before a woman may realize she is pregnant. Meeting the folate requirement before becoming pregnant is essential for prevention.

b. Identify fat-soluble vitamins (Vitamins A, D, E & K):

- Identify sources, functions and deficiencies of vitamins A, D, E, & K.
  - Vitamin A: Enhances hair, skin and helps prevent night blindness. Sources: Red, orange and dark green vegetables.
  - Vitamin D: Manufactured by the body with exposure to sunlight. Works with the body to build and maintain healthy bones and teeth; usually added to milk products. It is also called the “Sunshine Vitamin”.
  - Vitamin E: Protects membranes of white and red blood cells.
  - Vitamin K: Helps blood to clot.
- Describe how to identify amounts of Vitamin D in foods using food labels.

**Objective 2:** Identify select minerals, their food sources, functions and deficiencies in the body.

*STEM (Math/Science/Biology)*
a. Identify sources, functions and deficiency of the macro mineral calcium, including the role of calcium in preventing osteoporosis.
- Most minerals help build strong bones and teeth. Others are used to make substances that the body needs.
- Minerals are usually needed in tiny amounts, but are critical to health.
- Macro minerals are needed in great quantities in the body.
- Calcium deficiency causes osteoporosis which causes bones to gradually lose their minerals. This causes bones to become weak and frail. Good sources of calcium are found in dairy products.

b. Identify sources, functions and deficiency of the trace mineral iron, including the role of iron in preventing anemia. Describe how to identify amounts of iron in foods using food labels.
- Trace/micro minerals are needed in smaller quantities, but are just as essential as macro minerals. Iron deficiency causes anemia, or low red blood cell formation. Animal products provide excellent sources of iron.

c. Identify sources, functions and deficiencies of the electrolytes sodium and potassium, including their role in fluid balance. Describe how to identify amounts of sodium and potassium in foods using food labels.
- Electrolytes help maintain the fluid balance in the body, help maintain the heartbeat and help muscle and nerve action.
- Electrolytes easily become imbalanced in cases of dehydration, illness and diarrhea.
- Electrolytes like potassium can be found in bananas and potatoes.
- For sodium there is so much in the food supply that it’s more of a concern to have too much. Label reading is a good way to identify which foods have high amounts.
- If an athlete is trying to replace sodium, then some saltier foods are ok and also foods like bread and milk contain some sodium.

Objective 3: Identify the functions of water in the body. *STEM (Math/Science/Biology)

a. Identify the functions of water:
- Carries water soluble vitamins.
- Carries waste through the body.
- Regulates body temperature through perspiration.
- Prevents dehydration. Dehydration occurs from lack of water.

b. Discuss why water is the most important of all the essential nutrients.
- Water is the most important of all the essential nutrients.
- The body cannot survive long without water.
- Drink water instead of sugary drinks.

c. Identify symptoms of dehydration and how to prevent it based on current daily recommendations.
- Thirst is an indicator of dehydration.
- Urine should be a pale yellow color. Darker urine is another indication of dehydration.
- Water prevents dehydration. Drink water and other fluids frequently, don’t wait to be thirsty.
- 64 fl. oz. of water are recommended daily.

Objective 4: Apply food selection and preparation guidelines related to fruits and vegetables. *STEM (Biology/Science)
a. Identify the nutrients provided by fruits and vegetables. (Vitamins, Minerals, Fiber, Water.)
- Vegetables provide the following nutrients: Vitamin A, Vitamin C, potassium, folic acid, Vitamin D, calcium, magnesium, fiber and water.
- Vegetables contain no cholesterol and are low in calories, fat and sodium.
- Vary your vegetables.
b. Identify how to preserve nutrients in the storage process of fruits and vegetables.
- Air, heat and water destroy nutrients in vegetables.
- Wash vegetables to remove pesticides and dirt that might remain on the skin.
c. Identify preparation methods to preserve the most nutrients for vegetables and/or fruits:
- Eating them raw • Cook in larger rather than smaller pieces when possible.
- Microwave • Use small amount of water and cook only until fork tender.
- Steam • Save the cooking liquid to use in soups or gravies for added
- Bake/Roast nutrients.
- Stir Fry
- Simmer
- Sauté
d. Identify how to select fresh, frozen, or canned fruits and vegetables.
- Select fresh fruits and vegetables that are firm, free from decay, crisp, smooth, dense (heavy for size), free from bruises and have good color.
- Seasonal fruits and vegetables are lower in cost, plentiful and have better quality.
- Buy only what you will be able to store and use. They will last about 1 week in the refrigerator.
- Fruits ripen and spoil faster at room temperature.
- Choose whole or cut-up fruits more often than fruit juice.
e. Discuss farm-to-table process.
- Food doesn’t start at the supermarket or restaurant.
- The five farm to table steps include:
- Farm (use of good agricultural practices)
- Processing (monitor at critical control points)
- Transportation (use clean vehicles and maintain the cold chain)
- Retail (follow the food code guidelines)
- Table (always follow the four C’s of safety- clean, cook, control cross contamination, chill).
f. Discuss how to prevent oxidation of fresh fruits.
- When most fresh fruit is cut, the surface will turn brown. This is called oxidation and is caused by an enzyme in the fruit.
- Prevent oxidation of fresh fruits by dipping or covering fruit with liquid containing ascorbic acid. Another way to prevent oxidation is to wait to cut the fruit until ready to eat.

PERFORMANCE OBJECTIVE 8
Actively participate in the preparation of a canned/frozen and/or fresh produce food. Compare the nutritional content and cost of a comparable canned/frozen vs. fresh produce food.

STANDARD 6
Students will explore the current Dietary Guidelines and ChooseMyPlate.gov.
Objective 1: Identify the six Dietary Guidelines and the key recommendations for each. The guidelines are listed below: *STEM (Math/Science/Biology)*

a. Eat nutrient dense foods.
- Provides vitamins, minerals and other beneficial substances with relatively few calories.
b. Balance calories to manage weight.
- Monitor food and beverage intake, physical activity, and body weight.
- Reduce portion sizes.
• When eating out, make better choices.
• Limit screen time.
c. Reduce sodium, fats and added sugars, refined grains and alcohol.
d. Increase vegetables, fruits, whole grains, milk, seafood (8 oz. of seafood per week) and use
   oils in place of solid fats.
• Choose seafood products in place of some meat/poultry. (At least 8 oz. per week for
   teens/adults.)
e. Build healthy eating patterns that meet nutritional needs over time at an appropriate calorie
   level.
f. Include physical exercise as part of healthy eating patterns. (Children and teens should be
   physically active for at least 60 minutes every day.)
• Average American diet has more fat, sodium, sugar and calories than recommended.
• Average American diets are lower in fiber and whole grains than recommended.
• Salt and sodium are usually added to processed foods and beverages and diet drinks.
• High consumption of salt and sodium are contributing factors to high blood pressure.

(Dietary Guidelines are revised every 5 years; Pending revision in 2015.)

Objective 2: Demonstrate knowledge of MyPlate. (See ChooseMyPlate.gov.)
a. Identify the characteristics of MyPlate:
   • Grains Group (Make half of your grains whole grains.)
     o Choose 100% whole grain cereals, breads, crackers, rice and pasta.
     o Check the ingredients list on food packages to find whole grain foods.
     o Make at least half of your grains whole grains.
   • Protein Group (Keep meat and poultry portions small and lean.)
     o Choose a variety of foods including seafood, beans and peas, nuts, lean meats, poultry
       and eggs.
     o Keep meat and poultry portions small and lean.
     o Try grilling, broiling, poaching or roasting. These methods do not add extra fat.
   • Vegetable Group (Eat more red, orange and dark green vegetables.)
     o Choose fresh, frozen, canned, or dried fruits and vegetables.
     o Eat more red, orange, and dark green vegetables, such as tomatoes, sweet potatoes,
       and broccoli in main and side dishes.
   • Fruit Group (Make half your plate fruits and vegetables.)
     o Use fruit as snacks, salads or desserts.
     o Choose whole or cut-up fruits more often than fruit juice.
     o Make half your plate fruits and vegetables.
   • Dairy Group (Switch to low-fat or fat-free dairy products. Get your calcium rich foods.)
     o Low-fat or fat-free dairy products have the same amount of calcium and other essential
       nutrients as whole milk, but less fat and calories.
     o Switch to low-fat or fat-free dairy products. Get your calcium rich foods.

Objective 3: Demonstrate knowledge of healthy eating patterns including MyPlate and Dietary
Guidelines. (See ChooseMyPlate.gov) *STEM (Math/Science/Biology)
a. Explain how all food groups are important to good health.
   • Each food group provides some, but not all of the nutrients you need.
   • No one single food or food group can provide all nutrients.
   • Eating a variety ensures you get all nutrients
b. Identify the characteristics of healthy eating patterns:
   • Reading and understanding food labels
   • Portion control
   • Functions and caloric value of the 6 nutrients
c. Explain how people have different caloric needs depending on age, gender and activity level.
d. Evaluate and analyze a personal dietary intake for one or more days according to the dietary
PERFORMANCE OBJECTIVE 9
Evaluate and analyze a personal dietary intake for one or more days according to the dietary guidelines and MyPlate.