

A competency model for Culinology® graduates: Evaluation of the Research Chefs Association's Bachelor of Science in Culinology® core competencies

by

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ABSTRACT

Culinology® is the blending of culinary arts and food technology (RCA, 2012). As of 2012, there are 13 RCA-approved Culinology® degree programs, but there has been no research conducted on the effectiveness of the Culinology® competencies in preparing graduates for employment in the food product development industry. The purpose of this study was to determine whether the RCA's Bachelor of Science in Culinology® core competencies prepared graduates for successful employment in the food product development industry.

A sequential explanatory design was used for this research. In the first stage, a survey was used to measure the graduates' and employers' perceptions of the importance and frequency of use for each competency. In the second stage, interviews with purposefully selected graduates and employers were conducted to gain more insight on the results of the first stage. The results indicated that a gap existed between what the employers and graduates perceived as the most important competency, and graduates are not fully prepared for employment in the food product development industry.

Employers rated the Culinary Arts competency much higher than the graduates. The primary reason is that graduates are hired for their culinary arts competence, but are often placed in positions that did not utilize those culinary skills due to the hierarchy of the company's product development team, the graduate's educational and prior work experience, and the perceptions of the graduates regarding the Culinology® degree. There is also ambiguity regarding the Culinology® graduate's skillset by the industry; the existence of two seemingly separate set of competencies required by the industry (practicing culinologist

versus Culinology® graduate); and the absence of an assessment process for Culinology® degree programs.

The researcher recommended initiating a paradigm shift in Culinology® education, and focusing on a learner-centered paradigm. This included implementing a new competency model for Culinology® graduates with a differential emphasis on each competency as well as more practical application of theory. The RCA will also need to implement several measures to increase the visibility of the Culinology® degree programs and graduates, and clearly define the role of the Culinology® graduate in the food product development industry.

CHAPTER 1. INTRODUCTION

Background

Culinology® is a trademarked term originated by the Research Chefs Association (RCA). The RCA is “the leading professional community for food research and development. Its members are the pioneers of the discipline of Culinology®, the blending of culinary arts and the science of food” (RCA, 2010). The RCA believes that “culinologists can incorporate their knowledge of taste and texture with a scientific knowledge of food production to make nutritious, “ready-made” products that more closely resemble their “from-scratch originals” (Blanck, 2007, p. 4). The essence of Culinology® is found in the rigorous knowledge, aesthetic, and experimental sensory expressions that scholars and practitioners develop, as well as the emotional excitement, love, fun, and theatre experienced while engaging with the study of the culinary field (Hegarty, 2005). Culinology® got its start in academia in 2000 through the efforts of Mr. Cousminer, then President of the RCA, and Mr. Cheng, then Culinary Arts Program Coordinator at Metropolitan Community College. The nation’s first Culinology® degree program was launched at the University of Nebraska-Lincoln in 2001 (Cheng, Ogbeide, & Hamouz, 2011). To date, thirteen institutions have RCA-approved Culinology® degree programs, as shown in Table 1 (RCA, 2011). However, there is a paucity of literature on the effectiveness of the RCA’s Bachelor of Science in Culinology® Core Competencies in preparing graduates for employment as culinologists in this bold, new discipline.

Since the inception of the first Culinology® degree program in 2001 and resulting growth and maturity from 2001 - 2006, there is a clear need to transition to a curriculum based on assessment of learning outcomes. To assist the RCA-approved Culinology®

programs in making the transition to a learning-outcomes-based curriculum, a taskforce comprised of educators from the various Culinology® programs began to work on defining the competencies for graduates of Culinology® degree programs in 2006 (Cheng et al., 2011). This process was based on several factors, including the experience of the instructors in educational principles, the resources available, and the needs of the students at that particular institution.

Table 1

RCA-approved Culinology® programs

Year of RCA Approval	Institutions	Location
2001	University of Nebraska-Lincoln / Metropolitan Community College	Lincoln / Omaha, NE
2002	Clemson University	Clemson, SC
2002	University of Cincinnati / Cincinnati State Technical and Community College	Cincinnati, OH
2003	Dominican University / Kendall College	River Forest / Chicago, IL
2004	California State Polytechnic University, Pomona / Orange Coast College	Pomona / Costa Mesa, CA
2005	University of Massachusetts-Amherst	Amherst, MA
2005	Southwest Minnesota State University	Marshall, MN
2006	California State University, Fresno	Fresno, CA
2007	Rutgers University / Mercer County Community College	New Brunswick / West Windsor, NJ
2010	Louisiana State University / Nicholls State University	Baton Rouge / Thibodaux, Louisiana
2010	Mississippi State University / Mississippi University for Women	Mississippi State / Columbus, Mississippi
2010	Purdue University / Ivey Tech Community College	West Lafayette / Indianapolis, Indiana
2011	Taylor's University	Kuala Lumpur, Malaysia

Note: From the RCA's list of RCA-approved Culinology® programs (RCA, 2011)

For a transition to a curriculum based on assessment of learning outcomes, the Institute of Food Technologists (IFT) required that: (a) a certain set of core competencies be met within the curriculum; (b) specific learning outcomes be written both for individual courses and for the curriculum as a whole; (c) adequate assessment tools be used for measuring student learning, both for individual classes and for the curriculum as a whole; and (d) there be some thoughtful process of curricular reform based on the results of the assessment data (Hartel & Gardner, 2003). As there are many similarities between the process that the IFT used and the one used by the RCA in determining its minimum standards for Culinary[®] degree programs, the RCA taskforce followed the same process in identifying the core competencies for the Bachelor's Degree in Culinary[®]. The one exception was that the RCA did not have assessment data available on graduates of Culinary[®] programs, partly due to the small number of graduates available and a paucity of literature on Culinary[®]. It is assumed that assessment data from current Culinary[®] programs was available at that time, but were not used during the process of identifying the core competencies.

In 2007, the Bachelor of Science in Culinary[®] Core Competencies were disseminated to all RCA-approved Culinary[®] degree programs at that time. Each of these degree programs had been vetted by the RCA Higher Education Subcommittee to ensure that they met the requirements of the RCA. Cumulatively, approximately 350 students were enrolled in these RCA-approved Culinary[®] degree programs nationwide in 2010, with approximately 100 graduates since 2002 (T. Kline, personal communication, March 2, 2010).

The RCA has 433 student members as of May 31, 2011, representing 19.15% of the RCA membership. Student members represented the third largest membership category for

the RCA, after chef members and affiliate members. Student members also represented one of only two membership categories in the RCA that continued to experience growth, with the other membership category being the Food Science and Technology category (T. Kline, personal communication, June 24, 2011).

The growing number of student members in the RCA is an indicator of increased interest in Culinology®, which could potentially lead to a growing number of students enrolling in Culinology® degree programs in the future. In 2007, Chikthimmah and Floros (2007, p. 39) stated that “Food science and agricultural science in the U.S. are . . . projected to experience shortage of qualified labor.” It was estimated that about 2,700 job openings annually from 2005 - 2010 will be unfilled due to lack of qualified graduates in food science and/or agricultural science in the United States. Similarly, “applicants for food science degree courses in the United Kingdom have more than halved in the past decade. More than half of the employers surveyed reported a shortage of qualified food science personnel, and recruitment times to fill food science vacancies spanned two to three years” (Chikthimmah & Floros, 2007, p. 39). However, a 2011 report in *Food Technology* showed a reversal of the declining food science enrollment trend, with an increase of almost 25% in undergraduate enrollment between 2006 and 2010 (Kuhn, 2011). Floros said that the reasons for enrollment increases could be attributed to improved recruitment of high school students by IFT and university food science departments, as well as the increased interest that people are showing in food (Kuhn, 2011). This enrollment increase is also evidenced by the increased number of students majoring in Culinology®, and culinary science. In Fall semester 2010, Southwest Minnesota State University (SMSU) reported 77 Culinology® majors, and Iowa State University (ISU) reported 46 culinary science majors (Kuhn, 2011). The Culinology®

program at SMSU was introduced in Fall 2006, and the culinary science major at ISU was introduced in Summer 2008.

Competencies in Education

Research on competencies in hospitality management has generated a multitude of studies since Tas's (1988) seminal work on identifying the competencies needed by a manager trainee, as determined by the general managers of 75 top U.S. hotels. Since then, a significant body of knowledge has been generated over the past 20 years, with the majority of the studies focusing on either the hotel industry itself, or the overall hospitality industry. Millar, Mao, and Moreo (2010) reported that very few studies focused solely on the food service industry. Many professional organizations have defined the competencies that are required for successful performance on the job. The competencies may involve knowledge, skills, ability, attitude, behavior, or judgment in relation to an established set of criteria for a position (Mariampolski, Spear, & Vaden, 1980). A competency is a skill, ability, or attitude that is required for successful performance in a specific position (Mayo & Thomas-Haybert, 2005). Tas (1988) defined competency as performance of duties based on one's ability to accomplish specific job-related tasks and assume the role of the position. A working definition of competency in education is defined as "a general statement detailing the desired knowledge and skills of students graduating from our course or program" (Hartel & Foegeding, 2004, p. 69). As stated by Mayo and Thomas-Haybert (2005), competency-based education is a process that calls for observable objectives, individual feedback, use of different learning styles, and a variety of assessment measures. The literature is rich on competencies assessment of hospitality graduates' ability to meet the needs of the hospitality industry (Horng & Lu, 2006; Kay & Russette, 2000; Lin, 2002; Perdue, Ninemeier, &

Woods, 2002; Tas, LeBrecque, & Clayton, 1996), but no comparable research exists for Culinology® graduates. The literature review listed the competencies of the practicing research chef (Birdir, 1998), and is validated by McMeen (2003), resulting in the formation of 43 core competencies for the practicing culinologist. Bissett (2009) surveyed RCA members in six different membership categories to rate their knowledge levels for each identified core competency. McMeen (2003) affirmed that the identified competencies from the Birdir and Pearson (2000) study that were used in the formation of the original minimum standards for Culinology® curriculums are still relevant and applicable to the field of Culinology® today. Bissett (2009) concluded that RCA members from the Culinology® category understood both culinary arts and food science competencies, but not at the same level of RCA members who self-identified as chef members or as food science and technology members. It is important to note here that membership categories within the RCA are self-identified by the members, and the Culinology® membership category was only created in 2006. There is no assumption made that graduates of Culinology® degree programs would self-select Culinology® as their membership category, although that would seem to be the most logical choice. Rodgers (2009) suggested that “graduates (of Culinology® programs) will be able to contribute to future advances of Molecular Gastronomy and interpret reports published in the mainstream food science journals” (p. 76).

There is a paucity of literature on the competencies associated with the work of a research chef or culinologist. As stated by Zopiatis (2010, p. 461), “the Chefs’ profession receives little attention by academic scholars worldwide.” This research has added to the body of knowledge on Culinology® and incorporated two new dimensions of research in Culinology® competencies assessment—the employer’s and the graduate’s.

Statement of the Problem

As interest in Culinology® continues to climb and the number of graduates continues to increase yearly, the lack of empirical data on Culinology® graduates in the industry as well as the effectiveness of the RCA's Bachelor of Science in Culinology® Core Competencies provided an opportunity for research into this area. It is important that Culinology® graduates be able to function effectively as culinologists when they enter the food product development industry. As the RCA believes, to develop successful products tomorrow's product development expert must know both the culinary arts and the science of food product development. "Companies are seeking employees who can offer that competitive edge through experience and proven competencies in both culinary arts and food science" (RCA, 2010, para. 3). A report published by the Minnesota State Colleges and University (2010) stated that companies such as the Schwan Food Company and Agricultural Utilization Research Institute want to hire food scientists and technologists who understood the culinary arts. This affirmed the importance of the link between educational development and a culinologist's competencies. The development of the Culinology® core competencies thus far has not been validated by any post-graduate assessments. The competencies were developed using a theoretical framework based on the logic model, drawing from the culinary arts and food science disciplines. However, there has been little investigation into the effectiveness of the Culinology® core competencies in preparing graduates for employment as culinologists in this bold, new discipline. While three studies have been conducted thus far on the competencies of practicing culinologists, none have focused on the Culinology® graduate.

Purpose of the Study

This study evaluated the effectiveness of the RCA's Bachelor of Science in Culinology® core competencies in preparing graduates of Culinology® programs for entry-level positions in food product development. The theoretical development of the Culinology® curriculum is well established. A gap existed, however, in the applied body of knowledge regarding validation of Culinology® as a viable and integral academic discipline. As Culinology® education continues to evolve and mature, it is critical that the early adopters of the Culinology® curriculum as prescribed by the RCA remain on the forefront of this new and innovative discipline. The food product development industry continues to address new challenges daily, stemming from federal legislation dealing with food safety and the consumers' desire for more healthy, authentic, and locally sourced foods. "Consumers are very interested in the new ethnic ingredients that are finding their way into dishes they love so much," quoted Chef Thomas Griffiths, CMC, CHE, Campbell Soup Company's senior executive chef (as cited in foodprocessing.com, 2012, para. 9). Additionally, the current trend toward health and wellness has prompted food manufacturers to change their processes and offer a wider variety of foods that are smaller in portions, foods with specific dietary restrictions incorporated during formulation, as well as foods that offer a feeling of satiety but are also low in fat or light. Sodium reduction in the food supply has continued to lead food product development efforts (IFT, 2010).

As culinologists are supposed to lead innovation in the companies they work for, it is imperative that they are able to stay abreast of current and upcoming trends in the restaurant industry and to translate those into consumer-ready foods (Spinelli, Jr., 2003). According to the 2011 R&D survey in Food Processing magazine, new product development is – for the

third year in a row – the most important activity for research and development among food and beverage processors (Feder, 2011). On average, the typical new food product takes between nine and 18 months to go from “ideation” to commercialization. Because of this significant investment in the product before it even begins its life cycle in the consumer market, the culinologist has to be certain that his/her creations are relevant and viable. This requires that the training received by culinologists during their academic studies incorporated skills and competencies valued by the industry.

The outcomes of this research served as recommendations to Culinology® educators and the RCA to improve the current Culinology® curriculum. The study is considerably valuable to the RCA and all the Culinology® educators, as it can also be used to develop a program assessment tool that may further refine the approval and quality assurance process currently used by the RCA. This study provided academic program administrators and educators with a basis for curriculum development, expansion, and program growth. This study is valuable to current Culinology® students, as it served as an advisory reference in understanding the knowledge or competencies the food product development industry is seeking in graduates. Finally, the outcome of this study is of considerable importance to the food product development industry, as it ensures that graduates from Culinology® programs will possess the requisite skills needed for successful product development in a competitive marketplace. Additionally, the originality of this research itself contributed to the Culinology® body of knowledge.

Research Questions and Hypotheses

This study expanded the body of literature on Culinology® by measuring the effectiveness of the RCA’s Bachelor of Science in Culinology® core competencies, as

determined by the employers and Culinology® graduates themselves. Four research questions were developed to measure this effectiveness, and are answered in Chapter Four.

RQ1. How successful are the competencies possessed by the Culinology® graduate in meeting the needs of the employers, as assessed by the employers?

RQ2. How effective are the core competencies of the RCA Bachelor of Science in Culinology® in preparing graduates for employment in the food product development industry, as self-assessed by the graduates?

RQ3. What is the relationship between the employers' assessment and the graduates' self-assessment?

RQ4. What are the implications for curricular reform in Culinology® education?

Research question one (RQ1) is answered by analyzing the responses from the employers in both the quantitative and qualitative stages of the research. Research Question Two (RQ2) is answered by testing three hypotheses:

1. There is no significant difference between the graduates' perception of importance and frequency of use for each of the identified core competencies.
2. There is no significant difference between the graduates' years of experience in current position and their perception of importance for each of the identified core competencies.
3. There is no significant difference between the graduates' perception of importance for each of the identified core competencies and the institution they graduated.

Research Question Three (RQ3) is answered by testing the hypothesis that there is no significant difference between the employers' and the graduates' perception of importance

for each of the identified core competencies. Research Question Four (RQ4) is answered by analyzing the overall responses from both the graduates and employers.

Description and Scope of the Research

The purpose of this research was to determine whether the core competencies of the RCA's Bachelor of Science in Culinology® prepared graduates to meet the needs of the food product development industry. The objectives were: (a) examine whether these competencies met the needs of the current employers of Culinology® graduates, (b) evaluate the graduates' self-assessment of these competencies in relation to their preparedness for employment in their current position, and (c) explore the correlation between the employers' and the graduates' self-assessment and its implications for curricular reform in Culinology® education.

The theoretical framework for this study is the competency model. According to Lucia and Lepsinger (1999), a competency model is a descriptive tool that identifies the skills, knowledge, personal characteristics, and behaviors needed to perform a role in the organization effectively and help the business meet its strategic objectives. In short, it is an integrated set of competencies required for excellent performance. Competency models focused on how objectives are met and how the work is accomplished, in contrast to job analysis, which is much more work- and task-focused (Shippmann et al., 2000). There are many different methods of developing competency models, as outlined by Lucia and Lepsinger (1999). The *Customized Generic Model Method* was used for this research. This model used empirical studies on Culinology® competencies to aid in the selection of a generic model, and surveyed graduates of Culinology® programs and their employers to evaluate the competencies required to perform effectively in the food product development

industry.

Specifically, this research surveyed two different subsets of Culinology® practitioners: (a) those who graduated from a Culinology® degree program, as opposed to practitioners who were trained in the culinary arts, food science, a combination of both, or a related field, and (b) the employers of Culinology® graduates. Due to the relatively short existence of Culinology® degree programs and limited number of graduates, the population of study was small. Because the entire population of Culinology® graduates was surveyed, the results are generalizable and applicable to the entire population of Culinology® graduates, both current and future. The decision to use the Internet as a means of surveying the population allowed greater cost savings associated with eliminating the printing and mailing of survey instruments (Cobanaglu, Warae, & Moreo, 2001). Studies have shown that for special populations that regularly use the Internet, this method has been found to be a useful means of conducting research (as cited by Kaplowitz, Hadlock, & Levine, 2004). The population of study for this research consisted of graduates from RCA-approved Culinology® programs, and tended to be younger, between the ages of 22 and 30 years old, and part of Generation Y. This generation of students are “dependent upon technology” and has been called a “digital native” generation (Black, 2010). Digital natives are characterized as fluent in acquiring and using technological tools and seem to use these tools as an extension of their brains (Black, 2010). For these reasons, the use of Internet surveys as a means to reach the population of study was appropriate.

For this research, the sequential explanatory design was used. The collection and analysis of quantitative data from the first stage was followed by the collection and analysis of qualitative data in the second stage. In the first stage, a questionnaire consisting of three

parts was developed to assess the effectiveness of the Culinology® graduates' performance in the food product development industry, as determined by the graduates' employers and the graduates themselves. Part I consisted of demographic questions related to the survey participants. Part II consisted of questions intended to measure the graduates' and employers' perception of the importance and frequency of use for each of the identified core competencies. Part III consisted of open-ended questions intended to solicit additional insights into the competencies that are necessary for a Culinology® graduate to be successful. Following the analysis of the quantitative data from the first stage, additional questions were developed and purposefully selected graduates and employers were interviewed for the second stage of the research. The second stage of the research focused on seeking additional information regarding the difference observed between employers and graduates of Culinology® degree programs, as well as to gain additional insight regarding the graduates' perception of each of the Culinology® degree core competencies.

Assumptions of the Study

The following assumptions were made concerning this research:

- The sample represented all graduates of RCA-approved Culinology® programs and their employers in the United States.
- The small sample size is representative of the majority of future Culinology® graduates and their employers.
- The vocabulary of core competencies for Culinology® programs, as used in the instrument itself, is understood by respondents and that no definition is needed in the instrument itself.

- The survey instrument is sufficiently inclusive to be meaningful in making curriculum recommendations.
- Between 2001 and 2006, institutions that were approved by the RCA to offer a Culinology® degree followed the requirements as set forth in the minimum standards. Those standards did not delineate the core competencies as required by the RCA today. Rather, they included a list of specific courses that the institutions have to offer in the Culinology® degree program. It is assumed that the competencies for those sets of courses in the minimum standards are the same as the core competencies that were identified.

Limitations

The research subjects in this study were the graduates of Culinology® programs in the United States, and their corresponding employers. Due to the relatively short existence of Culinology® programs to date, the available pool of research subjects consisted of 101 graduates, with their corresponding employers. Although the position of culinologist can be held by individuals who obtained the equivalent of a Culinology® degree by attaining a separate food science degree and a culinary arts degree, they were not included in the sampling frame. Also excluded from this study are graduates of baccalaureate food science programs currently employed as culinologists. Similarly, graduates of culinary arts programs who are currently employed as culinologists were also excluded. Likewise, if a survey respondent who represented the employer of Culinology® graduates also has non-Culinology® graduates working for the company, those employers were asked to limit their responses in relation to the employee who has the Culinology® degree only. The survey

instrument used scales of measurement that are self-reported rather than observed; thus, a possible variance in this study may occur.

A final limitation involved the potential for bias in the study. The researcher is currently the program administrator for one of the RCA-approved Culinology® degree programs and has held the position of Co-Chair of the RCA Higher Education Subcommittee from 2000 - 2010. Any bias as a result of these appointments were removed by asking peer Culinology® educators to review the study and instrument. These Culinology® educators were also involved in the course of the study and research design.

Definition of Terms

For the purpose of ensuring uniformity and understanding the context of this study, selected terms were defined as follows. Definitions were developed by the researcher unless otherwise noted.

Competencies: A competency is a skill, ability, or attitude that is required for successful performance in a specific position (Mayo & Thomas-Haybert, 2005).

Culinary arts curriculum: a prescribed set of competencies that are approved by the American Culinary Federation.

Culinology®: the blending of culinary arts and the science of food (RCA, 2010).

Culinology® degree program: a RCA-approved Culinology® program.

Culinology® graduate: a graduate from an RCA-approved Culinology® program.

Culinologist: someone who is able to fill the roles of both a chef and a food scientist (Blanck, 2007); also referred to in literature as a Research Chef.

Food product development industry: a segment of the food industry that focuses primarily on food product development for manufacturing, chain restaurants, or ingredient suppliers.

Food science curriculum: a food science curriculum that meets the IFT Undergraduate Education Standards for Degrees in Food Science.

Minimum standards: a set of education standards with defined objectives, and administrative, physical, and curricular standards.

Summary

Culinology® educators are concerned about the quality of students' learning. The RCA is concerned about the validity of the Bachelor of Science in Culinology® core competencies. The food product development industry is concerned about maintaining quality while remaining competitive in the global marketplace. At the same time, they are also faced with a shortage of qualified individuals who understand the scientific underpinnings of food product development and are skilled in the culinary arts as well. According to foodprocessing-technology.com (2008, para. 19), “. . . areas like new product development are uniquely rewarding because of the high degree of creative input they require.” Therefore, it is crucial for Culinology® educators and employers to have an alignment in the competencies that are needed for a culinologist as they prepare to enter the food product development industry. Since Culinology® is a trademarked term by the RCA (Blanck, 2007), they also have a vested interest in validating their Bachelor of Science in Culinology® competencies.

The creation of this new academic discipline in 2000 was not done arbitrarily. Rather, the researcher played an integral part during the creation and its subsequent implementations. The RCA was also closely involved, and its members represented the food product development industry. The RCA community has embraced the curricular framework for this new discipline, as evidenced by the growing number of student members in the

association. Additionally, the RCA Certification Commission has also adopted a variation of the competencies for its own certification testing. This study served as the only research ever conducted on Culinology® degree program graduates to date and its outcomes provided opportunities for future research in competencies required for Culinology® graduates.

CHAPTER 2. REVIEW OF LITERATURE

The purpose of this research was to determine whether the core competencies of the RCA's Bachelor of Science in Culinology® prepared graduates to meet the needs of the food product development industry. The objectives of this research were to (a) examine whether these competencies meet the needs of the current employers of Culinology® graduates; (b) evaluate the graduates' self-assessment of these competencies in relation to their preparedness for employment in their current position; and (c) explore the correlation between the employers' and the graduates' self-assessment and its implications for curricular reform in Culinology® education. Literature from parallel studies in culinary arts and food science was used for this research because of the paucity of literature available in the field of Culinology®. The reasons for the literature review were to (a) provide a basis for understanding the use of competencies in education, (b) obtain a better understanding of what other researchers have done in parallel studies in order to develop a framework for evaluating the competencies of the Bachelor of Science in Culinology®, and (c) discover what competencies are required in the food product development industry. The review of literature concluded with a section on (d) applying a competency model with identified skills, knowledge, personal characteristics, and behaviors needed for success in food product development.

Competencies and Competency-based Education

The foundation for competency-based learning and competency-based learning objectives is believed to have originated with Ralph W. Tyler and the Tyler Rationale (Brough, 2008). The Tyler Rationale is a process used for curriculum development that identifies fundamental questions that must be answered during the development process

(Tyler, 1949, p. 1). Tyler suggested four steps were involved in a rationale for viewing, analyzing and interpreting the curriculum and instructional program of an educational institution. These were:

1. What educational purposes should the school seek to attain?
2. What educational experiences can be provided that are likely to attain these purposes?
3. How can these educational experiences be effectively organized?
4. How can we determine whether these purposes are being attained? (Tyler, 1949, p. 51)

Tyler (1949) believed educational objectives should be written first and all other decisions should follow after that. He reasoned it was necessary to identify clearly what is to be taught before actually proceeding with designing the curriculum. Tyler said, "Objectives become the criteria by which materials are selected, content is outlined, instructional procedures are developed and tests and examinations are prepared" (1949, p. 52). Tyler posited that the objectives are to be drawn from three sources: studies of the learner, studies of society, and suggestions from subject-matter specialists. The Tyler Rationale can be equated to the familiar four-step process by which a curriculum is developed: stating objectives, selecting the course content, organizing the course content, and evaluating. However, to critics of the Tyler Rationale, his method is not the universal model of curriculum development (Kliebard, 1970; Carswell & Roubinek, 1977). Even so, it seemed to have become more revered as a result (Cho & Trent, 2005).

For over a century, the accreditation system in the United States has been used as the primary vehicle for defining and assuring quality in higher education (Schray, 2006).

Accreditation from a regional accrediting body required documentation verifying the institution has met several predefined standards. For instance, the Higher Learning Commission, a commission of the North Central Association of Colleges and Schools, a regional accrediting body, required assessment of student learning outcomes to be clearly stated for each educational program and effective assessment be made possible (Higher Learning Commission, 2003). Huba and Freed (2000) defined assessment as “the process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding of what students know, understand, and can do with their knowledge as a result of their educational experiences; the process culminates when assessment results are used to improve subsequent learning” (p. 8). Assessment is an on-going process that is continually open to modifications over time. It is a goal-oriented process, and the statement of intended outcomes is the first step in any assessment plan (Hartel & Gardner, 2003). An outcome is a very specific statement describing exactly what a student will be able to do in some measurable way (Hartel & Foegeding, 2004). Using Bloom’s taxonomy as a guide for measurable verbs is recommended when writing measurable outcomes. Hartel and Foegeding (2004) stated that good learning outcomes contain three primary characteristics: a verb that identifies what action the student should be able to perform, the conditions under which the student should demonstrate mastery, and some element of how that mastery may be evaluated. Together, these learning outcomes defined the objectives of the course or program. As Lafferty eloquently stated, “educational objectives are the specific component parts of competency statements. A competency statement is a compilation of objectives” (as cited by Tas, 1983, p. 13).

Competencies

The word “competency” has been used extensively in early (pre 1966) law and psychological literature (Shippmann et al., 2000). Bowden and Masters stated it was originally used in the field of education to describe trainee teacher behaviors, and became widely known through the work of Boyatzis (as cited by Hoffmann, 1999). A competency is a skill, ability or attitude required for successful performance in a specific position (Mayo & Thomas-Haybert, 2005). Tas (1988) defined competency as performance of duties based on one’s ability to accomplish specific job related tasks and assumed role of the position. Parry (1996) offered this definition of a competency: “. . . a cluster of related knowledge, skills, and attitudes that affects a major part of one’s job (a role or responsibility), that correlates with performance on the job, that can be measured against well-accepted standards, and that can be improved via training and development”. A review of the literature showed that the definition of the word “competency” can vary depending on the context in which it is used (Campion et al., 2011; Horng & Lu, 2006; Kay & Russette, 2000; Lin, 2002; Lucia & Lepsinger, 1999; Millar et al., 2010; Perdue et al., 2002; Tas, 1988; Tas et al., 1996). Thus, it is evident there was not one single universal definition of the term “competency” (Hoffmann, 1999). However, the definition of “competency” in literature is often cited with the combination of the terms “knowledge,” “skills,” and “abilities,” and includes observable performance, the standard or quality of the outcome of the person’s performance, and the underlying attributes of a person (Campion et al., 2011; Hoffmann, 1999; Millar et al., 2010). Gale and Pol (1975) defined competency as “the quality of being functionally adequate in performing the tasks and assuming the role of a specified position, with the requisite knowledge, ability, capability, skill, judgment, attitudes, and values” (p. 20). In education,

competency is a general statement detailing the desired knowledge and skills of students graduating from a program (Hartel & Foegeding, 2004). Mayo and Thomas-Haybert (2005) stated that competency-based education is a process calling for observable objectives, individual feedback, use of different learning styles, and a variety of assessment measures.

The process of identifying and describing competencies required input from many parties (Parry, 1996). Identifying and describing competencies required us to consider the organizational context, linking competency models to organizational goals and objectives, starting at the top, using rigorous job analysis methods to develop competencies, and considering future-oriented job requirements (Campion et al., 2011). Parry (1996) described 12 guidelines that can help identify and describe competencies that are important:

1. *Focus on generic competencies* – keeping the competencies broad and generic will gain greater acceptance by more jobholders.
2. *Avoid the obvious* – avoid listing competencies that should be met by every entry-level employee. Examples: literacy skills at the high school graduate level.
3. *Behavior must be observable and measurable* – competency statements should provide a clear indication of what to look for as evidence of the presence or absence of the competency.
4. *Illustrate with behavioral examples* – pinpoint the behaviors that demonstrate what the competency statement is looking for.
5. *Use familiar language* – using the organization’s unique language enhances communication and ownership of the competency model by the organizational members.

6. *Keep it short* – list only about a dozen competencies. If more are selected, the list may contain specific skills and not just generic competencies.
7. *Keep competencies mutually exclusive* – careful definition of competencies prevents confusion of the competencies' purpose.
8. *Focus on future needs* – job analysis focuses on the knowledge, attitudes and skills needed to do the jobs as they currently exist, but competencies are used to assess and train people for tomorrow.
9. *Work backward, from results to behavior to competencies* – identify the desired outcome before identifying the competency that is required.
10. *Define levels of excellence* – Once a competency has been defined, give illustrations of behavior that is expected of a novice, a master and an expert.
11. *Avoid personality traits* – personality traits cannot (and possibly should not) be improved through training, therefore the list of competencies should not include personality traits.
12. *Cluster similar competencies* – grouping similar competencies under broad headings facilitates the acceptance and understanding of the competencies.

Competencies usually contain three parts: (a) a descriptive label or title; (b) a definition, usually describing how the competency appears on the job in detailed behavioral terms; and (c) a detailed description of the levels of proficiency on the competency (Campion et al., 2011; Mirabile, 1997; Parry, 1996). In general, the greater the level of detail contained in the competency model, the less you can generalize the possible applications (Campion et al., 2011; Mirabile, 1997). Champion et al. (2011) recommended utilizing rigorous job analysis methods to develop competencies:

These job analysis methods can include the use of multiple data collection methods such as observations, subject matter expert interviews, and structured brainstorming methods in focus groups to identify potential competency information; the use of clear construct definitions in the competencies and linkages to theory and literature; the use of survey methodology to empirically identify the critical competencies and to differentiate the job grades where specific competencies emerge as most important; the use of sampling techniques; the use of appropriate statistical analysis; the assessment of reliability and other psychometric quality checks; the validation of models against important organizational criteria; and the validation of models across sources of information or job groups. (p. 234-235)

Core Competency

Prahalad and Harmel (1990) invented the term “core competence” to describe the strategic strength of an organization and what makes the organization competitive within its environment. Core competence is the support system that provided sustenance and stability (Prahalad & Hamel, 1990). In higher education, core competencies provided general statements about the desired outcomes in each subject area (Hartel, 2002). The RCA (2011) identified 10 core competencies for Culinary® degree programs:

1. Food chemistry analysis and functions of ingredients
2. Food safety and quality
3. Food processing and manufacturing
4. Culinary arts
5. Baking, pastry and confectionary arts
6. Nutrition

7. Business of product development
8. Food policy analysis and regulations
9. Sensory evaluation
10. Research methodologies and experimental design

Each of these core competencies contained objectives as well as learning outcomes. A well-designed set of competencies can benefit students as well as educators. Together, these competencies combine to form a competency model, which was discussed in greater detail at the end of this chapter. As stated by Champion et al. (2011), competency models are often highly tailored to the organization. The organizational context in this study is the Research Chefs Association and Culinology®. The resulting competency model described specific competencies that are identified as essential to the culinologist, thus linking the competency model to organizational goals and objectives.

Competency-based Education

Competencies are the foundation of competency-based education (CBE) (Millar et al., 2010). CBE was defined by Palardy and Eisele (1972) as an educational process where the recipient must be able to demonstrate attainment of specified criteria. These criteria can be stated so that they include the cognitive, affective and psychomotor domains. Schneider (1973) found that competency-based education has several different names or titles: criterion-referenced, proficiency-based, consequence-based, output-oriented, performance-based, and competency-based. CBE also has connections to curriculum theory (Millar et al., 2010). Walker (1982) stated that Bobbitt's curriculum theory rationalized procedures for curriculum construction. In other words, Bobbitt proposed the ideal curriculum could be determined by studying the best performances of the most educated people and proceeding to

adopt these as standards for all people (Walker, 1982). Thus, as Millar et al. (2010) affirmed, developing competencies requires understanding the experiences that the student is encountering in the classroom. One suggestion is to ask industry professionals what competencies they believe students should possess, and then incorporate those competencies into their courses. Competencies can be determined by analyzing star performers, evaluating the performance of many exemplary employees, or surveying experts (Cheng et al., 2011).

Competencies in Culinary Arts Education

Culinary arts education has experienced an unprecedented growth in the last decade. The National Center for Education Statistics reported over 500 postsecondary institutions offering culinary training at the Associate's and Bachelor's degree level in 2012. The increased interest in culinary arts education stemmed from several factors: the "Top Chef" syndrome where aspiring chefs dream of being on the Food Network; new culinary students think it is glamorous to work in a professional kitchen; and career-changers hope for a better life (Holden, 2010). In addition, the prospect of readily available jobs in the restaurant industry fueled the drive to enroll in culinary arts programs. The foodservice industry is a \$632 billion industry and employed an estimated 12.9 million people (National Restaurant Association, 2012). The National Restaurant Association stated, "Driven by the continued national economic recovery and consumers' pent-up demand for the food, service and social outlet that restaurants provide, the U.S. restaurant industry is projected to expand in 2012" (National Restaurant Association, 2012, p. 2).

Mandabach (1998) and Mandabach, Revalas, and Cole (2002) believed culinary education curriculum has its roots in the vocational education movement of the late 19th and early 20th centuries and traditionally focused on achieving student mastery of core technical

culinary competencies (as cited by Muller, VanLeeuwen, Mandabach, & Harrington, 2009). Today, vocational education is more commonly known as career and technical education. Even so, the focus remained the same – mastery of core technical competencies. In the United States, the most recognizable authority on culinary arts competencies is the American Culinary Federation (ACF). The ACF was founded in 1929 and is a professional organization for chefs and cooks. The ACF was instrumental in elevating the executive chef profession from service status to professional category in 1976 in the U.S. Department of Labor’s Dictionary of Official Titles (American Culinary Federation, 2011). The executive chef is the most skilled cook in the kitchen, in view of the high capability to use creativity and knowledge of food to develop and prepare recipes (Bureau of Labor Statistics, 2011). Another one of the ACF’s major accomplishments was the establishment of a postsecondary accrediting body, the American Culinary Federation Educational Institute (ACFEI) Accrediting Commission in 1986. The ACFEI Accrediting Commission is known as the American Culinary Federation Educational Foundation Accrediting Commission (ACFEFAC) today. The ACFEF Accrediting Commission is made up of ACF certified chefs who obtained professional certification through the association’s rigorous testing process. ACF certification proved to an employer that the individual’s skills and culinary expertise has reached a set benchmark.

The ACFEFAC is recognized by the Council on Higher Education Accreditation, and has developed an extensive set of culinary arts competencies, called ACF Required Knowledge and Competencies (see Appendix A for complete list of ACF Required Knowledge and Competencies). The topic areas are summarized below:

1. Basic Baking – 24 competencies

2. Beverage Management – 9 competencies
3. Business and Math Skills – 9 competencies
4. Dining Room Service – 10 competencies
5. Food Preparation – 17 competencies
6. Garde Manger – 9 competencies
7. Human Relations Management – 16 competencies
8. Introduction to the Hospitality Industry – 9 competencies
9. Menu Planning – 10 competencies
10. Nutrition – 11 competencies
11. Purchasing and Receiving – 16 competencies
12. Sanitation and Safety – 18 competencies

The ACFEFAC Required Knowledge and Competencies followed the framework of competency-based education. Each student graduating from an ACFEFAC accredited program has to demonstrate mastery of all the required competencies as listed by the ACFEFAC before the graduate can be certified as a Certified Culinarian. However, of the 500 plus post-secondary institutions offering a program in culinary arts, only 205 are accredited by the ACFEFAC as of June 24, 2011. This could be due to a variety of factors, ranging from budgetary to curricular. Hertzman and Stefanelli (n.d.) stated that these culinary schools are extremely diverse and vary by factors such as type (public, private, or proprietary), degrees offered, student count, faculty count, faculty characteristics, facility size, curricula, student selectivity, student services, and price. Evaluation of quality in higher education in itself is controversial due to the difficulties in defining quality, and the issue is

compounded further by the variety of culinary arts programs currently available (Hertzman & Ackerman, 2010).

Competencies in Food Science Education

The food science education programs in the United States originated mostly from the dairy science programs that were common at agricultural colleges (Potter & Hotchkiss, 1999). The initial development of food science as a field of study paralleled the development of the food processing industry (Murano, 2003). Solving the spoilage problems in the early days of the canning industry (circa 1900) led to the involvement of academics in the development of food science as a discipline. Murano (2003) stated:

Students wishing to study food science at the undergraduate level generally take courses in food chemistry, food engineering and processing, food microbiology, nutrition, and food marketing, as well as courses in the supporting disciplines, general sciences, and commodity areas according to interest. Topics covered include engineering aspects of food processing, packaging, and storage; measurement of physical properties including food texture; food industry unit operations; evaluation of changes in nutrient content of foods during processing and storage; protein and enzyme technology; food product development; functional properties of food components; quality assurance; and current research (p. 11).

The transformation of food science education has been ongoing since 1977, when the first revision was made to the Institute of Food Technologists' (IFT) minimum standards that specified the courses necessary for an undergraduate food science program (Hartel, 2002). The minimum standards were first established by the IFT in 1966, and were modified slightly to account for background courses in 1977. The change was mostly formalizing the

minimum standards and requiring food science departments to document that the curriculum met these minimum standards. In 1992, the minimum standards were revised again to include courses in communication skills, statistics, computer and critical thinking skills. However, the format of the minimum standards remained the same, and each food science program had to document that the curriculum contained all of the required courses (Hartel, 2002). The core of the required food science and technology courses consisted of a minimum of 24 semester hours, and included Food Chemistry, Food Analysis, Food Microbiology, Food Processing, Food Engineering, and a senior-level capstone course. In addition, IFT also specified the following courses as required: two courses in general chemistry, organic chemistry, biochemistry, general biology, general microbiology, nutrition, two courses in calculus, statistics, general physics, and two courses in writing and speaking (Potter & Hotchkiss, 1999). Thus, the 1992 minimum standards for a food science program to be approved by the IFT were fairly prescriptive in terms of curriculum design.

The shift to competency-based education in food science began around 1996, when Iwaoka, Britten, and Dong (1996) posited the need for transforming food science education from an instruction paradigm to a learning paradigm. In the learning paradigm, students control the learning, as opposed to the instruction paradigm, where teachers control the learning. In essence, food science educators needed to focus on a manner of teaching that encouraged students to learn how to think better. Similar to competency-based education, it moved education from focusing on what educators believed students need to know to what students need to know and be able to do in different situations, thus encouraging the development of critical thinking skills in students. Bloom (1956) included critical thinking skills as part of the cognitive domain. It involved logical thinking and reasoning including

skills such as comparison, classification, sequencing, cause/effect, patterning, webbing, analogies, deductive and inductive reasoning, forecasting, planning, hypothesizing, and critiquing (Bloom, 1956). Beyer (1985) defined critical thinking as the process of determining the authenticity, accuracy and worth of information or knowledge claims. In 2002, Swanson wrote “. . . it is the role of educators to meet the dynamic, rapidly changing needs of individuals by fostering a continued quest for learning, discovering, and challenging accepted doctrines and the status quo” (as cited by Mermelstein, 2002, p. 48). Hartel has argued that food science education will be most enhanced by incorporating a variety of teaching and learning techniques (as cited by Iwaoka et al., 1996). The aim of food science education is to provide students with the skills needed in future chosen career (Hartel, 2002).

In 2001, the IFT Education Standards, a new set of guidelines developed for the approval of food science programs, was implemented for all IFT approved food science programs. This was a major shift away from content-based learning towards outcome-based learning. The new Education Standards provided a set of content subjects along with core competencies detailing what students should be able to do with the information in the content subject (Hartel, 2002). There were no specific courses mandated in the new Education Standards (see Appendix B for a complete list of the IFT Education Standards). Rather than requiring programs to follow a prescribed list of courses in the food science curriculum, programs can now decide where each competency is developed in the curriculum (Hartel, 2002). Additionally, programs must also have an assessment process to evaluate whether students and/or graduates in the programs are meeting specific learning outcomes. A third requirement was the implementation of a continual evaluation and improvement process,

based on the assessment data. Just as Huba and Freed (2000) stated, the process culminates when assessment results are used to improve subsequent learning.

The 2001 IFT Education Standards has five areas of core competencies:

1. Food chemistry and analysis – 7 competencies
2. Food safety and microbiology – 6 competencies
3. Food processing and engineering – 10 competencies
4. Applied food science – 7 competencies
5. Success skills – 14 competencies

Beyond requiring that each competency was covered in the curriculum, all IFT-approved programs also need to document the establishment of learning outcomes and implementation of different methods of assessment for each course.

Competencies in Culinology® Education

The concept of Culinology® was introduced by the Research Chefs Association in 1996 (RCA, 2010). The RCA is “the leading professional community for food research and development. Its members are the pioneers of the discipline of Culinology®, the blending of culinary arts and the science of food” (<http://www.culinology.org>). The RCA believed that “culinologists can incorporate their knowledge of taste and texture with a scientific knowledge of food production to make nutritious, “ready-made” products that more closely resemble their “from-scratch originals” (Blanck, 2007, p. 4). Danny Bruns, corporate chef for Kerry Americas, quoted, “Education is really the big push, getting students to understand both sides of the business. Culinology®, combining the two paths, is really the next big wave in food creation” (as cited by Tittl, 2008, p. 269). The RCA’s Bachelor of Science in

Culinology® Core Competencies supported the organizational goals and objectives of the RCA.

Culinology® as an academic discipline was started in 2000 when Mr. Cousminer, then President of the RCA, approached Mr. Cheng, then Culinary Arts Program Coordinator at Metropolitan Community College (Metro), with the idea of a new academic discipline that blended culinary arts and food science. As a result of this initial conversation, the Institute for the Culinary Arts program at Metro in Omaha, Nebraska, in collaboration with the Department of Nutritional Science and Dietetics at the University of Nebraska-Lincoln (UNL), launched the nation's first Culinology® degree program in 2002, the only degree of its kind in the world (Cheng et al., 2011).

The development of the framework for a Culinology® curriculum in 2000 was achieved by analyzing the courses that were required for a culinary arts degree and a food science degree. A benchmark study by Birdir (1998) was used to guide the formation of the curriculum. The initial curriculum underwent several revisions before Cousminer, along with the RCA Board of Directors, approved it. The challenges faced during the development of the curriculum were related to decisions on which courses from within a Culinary Arts curriculum were considered essential, and which ones were not, in the context of a culinologist's responsibilities. Similarly, the same decisions had to be made about the food science content. As an example, to ensure that all the necessary courses were included within the framework of 128 semester credit hours, courses such as Purchasing, Legal Aspects, Cost Management, Food Engineering, and Physics were omitted from the required core Culinology® courses. The proposed curriculum was reviewed by the RCA Board of Directors, and adopted by the RCA in 2001 as the minimum standards that specified the

courses needed to make up an undergraduate Culinology® program. These standards included recommendations for facilities, faculty, and budget.

Since the inception of the first Culinology® degree program in 2001 and resulting growth and maturity from 2001 - 2006, there was a clear need to transition to a curriculum based on assessment of learning outcomes. To assist the RCA-approved Culinology® programs in making the transition to a learning outcomes-based curriculum, an expert taskforce comprised of educators from Culinology® programs worked on defining the competencies for graduates of Culinology® degree programs in 2006. This process was based on several factors, including the experience of the instructors in educational principles, the resources available, and the needs of the students at that particular institution. A study conducted by Joyce McMeen in 2003 on the *Validation of the identified competencies of a culinologist* for her Master's thesis was also used to guide the development of the RCA's Bachelor of Science in Culinology® Core Competencies. As there were many similarities between the process that the IFT used during their transformation from Minimum Standards to their current Education Standards, the RCA taskforce followed the same process in identifying the core competencies for the Bachelor Degree in Culinology®. The exception was that the RCA did not have assessment data available on graduates of Culinology® programs, partly due to the small number of graduates available and a paucity of literature on Culinology® at that time. It is assumed that assessment data from current Culinology® programs was available at that time, but were not used during the process of identifying the core competencies.

In 2007, the Bachelor of Science in Culinology® Core Competencies (see Appendix C for a complete listing of the RCA Bachelor of Science in Culinology® Core

Competencies) were disseminated to all RCA-approved Culinology® degree programs at that time. Each of these degree programs had been vetted by the RCA Higher Education Subcommittee to ensure that the programs meet the requirements of the RCA. The ten RCA Culinology® Core Competency areas are:

1. Food chemistry analysis and functions of ingredients – 5 topic areas
2. Food safety and quality – 4 topic areas
3. Food processing and manufacturing – 6 topic areas
4. Culinary arts – 12 topic areas
5. Baking, pastry and confectionary arts – 5 topic areas
6. Nutrition – 4 topic areas
7. Business of product development – 4 topic areas
8. Food policy analysis and regulations – 8 topic areas
9. Sensory Evaluation – 1 topic area
10. Research methodologies and experimental design – 3 topic areas

These identified core competencies are unique and encompass both the culinary arts and food science domain. As Cheng et al. (2011, p. 18) states:

Every great chef understands the importance and value of using the finest ingredients . . . understanding the fundamental cooking methods, cuisines styles, and ingredients brings an authenticity factor to food that is critical in today's product development environment.

Competencies of the Research Chef in the Food Product Development Industry

Product development is a vital part of the food industry. It drives innovation, advances technology, and encourages growth (McKim, 2008). The 2011 R&D Survey in

Food Processing magazine reported that new product development is – for the third year in a row – the most important activity for research and development among food and beverage processors (Feder, 2011). Stephen Kalil, former RCA President, believed that “in order to develop successful products, tomorrow’s product development expert must know both the culinary arts and the science of food product development” (Feder, 2009, para. 12).

Mermelstein (2003) emphasized that the importance of culinary arts in new product development is being increasingly recognized by the food industry. According to Phil Nelson, Head of Purdue University’s Department of Food Science, today’s food science students need to understand the language and terminology of the chefs, understand the process a chef goes through to develop a “Gold Standard” recipe, and have a knowledge of flavors and the chemistry that created those conditions (as cited by Mermelstein, 2003).

Research chefs, also called product development chefs, create new foods for restaurant chains, coffee shops, and food manufacturing companies. These chefs blend culinary training with food science knowledge (Crosby, 2002). However, the role of research chefs in product development has not always been obvious—it is complicated, varied, and highly challenging. In general, the research chef is charged with enhancing the profitable growth of their company by providing culinary expertise and solutions to expand the customer’s menu and the end use of their company’s products (McGrath, 2008). The skills that the research chef brings to the organization placed them in a position to interpret consumer culinary expectations and needs with a focus on consumer or customer culinary satisfaction. In other words, the research chefs have to maintain the authenticity of the product, also known as the “Gold Standard” (Thomas, 2008). The role of the research chef is an integrated one and by using a multidisciplinary team approach, the research chef is

involved from “ideation” to commercialization and evaluation of the food product. Bringing a culinary viewpoint into product development can have a tremendous impact on the company’s financial results (Spinelli, Jr., 2003).

Until 1998, there had been no analysis conducted on the competencies of the research chef. Dr. Kemal Birdir laid the foundation for research chefs competencies in 1998 when he surveyed 22 research chefs for his doctoral dissertation over three rounds, and discovered that it was possible to cluster the research chef into two main groups – research-focused research chef, and management-focused research chef. Birdir’s (1998) study started at the top by surveying 12 research chefs chosen as leaders/experts in the field by the RCA. Campion et al. (2011) stated, “top leadership buy-in is critical for obtaining sufficient budgetary support as well as ensuring that the resulting models are used” (p. 233).

Birdir’s (1998) study used a modified version of the Delphi technique. This modification consisted of using a panel of experts to develop the pilot questionnaire rather than developing the questions from the literature. The first round was the pilot instrument, which consisted of the following three questions:

1. What skills and knowledge areas are required of successful research chefs?
2. What responsibilities (task areas) distinguish a research chef from other chefs?
3. What factors distinguish a respected leader among research chefs from those who are less successful?

The pilot instrument was sent to the 12 research chefs chosen as the leader/experts in the field. Ten chefs responded to the pilot instrument, resulting in a total of 320 knowledge, skill, ability, and behavioral statements identified. These statements were combined, organized and clarified to develop 29 knowledge competencies, 30 skill and ability

competencies, and 21 behavioral competencies, which then became the first instrument. In the second round, participants were asked to rate the competencies on a five point Likert scale, from (1) not important to (5) extremely important. Results were tabulated using means, standard deviations, and most frequent rating for each individual competency statement. The results from the second round led to restatements of some competencies. Any additional competencies suggested by the participants were also combined, clarified and added to the second instrument. The second instrument consisted of 46 knowledge competencies, 38 skill and ability competencies, and 23 behavioral competencies. The data was analyzed using means, standard deviations and most frequent rating. From the third round of surveys, Birdir (1998) identified 23 competencies for the research-focused research chef, 25 competencies for the management-focused research chef, and 35 competencies that were common to both research-focused and management-focused research chef.

From the list of 23 identified competencies for the research-focused research chef, Birdir (1998) identified one through twelve as the most important. These competencies had means of four and above, on a 5-point Likert-type scale. The 23 competencies for the research-focused research chef were:

1. Knowledge of recipe development and formula ratios
2. Ability to work with product development team
3. Knowledge of culinary fundamentals and production systems
4. Knowledge of ingredients functionality
5. Knowledge of traditional sauces/stocks
6. Understanding the complete process of research through production of a product which can be produced in large volumes

7. Knowledge of all commercial kitchen functions and pressures
8. Ability to leverage trends into new products
9. Understanding of food testing
10. Ability to work effectively with other company departments to develop large scale products
11. Knowledge of regional cuisines - including preparation, spicing, and presentation
12. Understanding of changes in ingredients resulting from the research process
13. Knowledge of sensory analysis
14. Ability to keep high concentration
15. Knowledge of research methodologies – experimental design
16. Knowledge of oils and spice extractives
17. Knowledge of gum/starch stabilization systems
18. Knowledge of other research and research activities through networking skills
19. Knowledge of food additives
20. Knowledge of food chemicals and their usage levels
21. Knowledge of applicable food chemistry and microbiology
22. Knowledge of product changes necessary for multicultural distribution
23. Knowledge of the physics of heat exchange

From the 25 competencies identified for the management-focused research chef, Birdir (1998) identified one through eight as the most important competencies (with means of four and over on a 5-point Likert-type scale). The 25 competencies for the management-focused research chef were:

1. Ability to work with customer/client groups

2. Knowledge of end user skills (e.g. cooks in national chains)
3. Skilled at food presentation
4. Management skills (delegating and organizing, personnel development)
5. Knowledge of food service operations
6. Skilled at basic computer systems
7. Skilled at presentation of research and plans
8. Skilled at writing accurate reports
9. Leadership skills (ability)
10. Skilled at public speaking
11. Ability to think analytically
12. Ability and willingness to travel
13. Knowledge of operations (back and front of house)
14. Knowledge of large scale production systems
15. Knowledge of food safety and OSHA safety systems and laws
16. Knowledge of quality assurance systems
17. Ability to have or create a vision (not necessarily a solution)
18. Knowledge of strategic planning
19. Knowledge of current economic climate
20. Understanding of the nature of production/distribution system delays and hurdles
21. Knowledge of government food regulations
22. Skilled at execution of consumer research projects
23. Knowledge of business marketing
24. Knowledge of cost accounting

25. Knowledge of finance systems

In addition, Birdir (1998) also identified 19 basic competencies (with means of four and over on a 5-point Likert-type scale) common to both research- and management-focused research chefs:

- Interpret flavors
- Practice proper food sanitation
- Distinguish levels of quality in food products
- General communication skills (verbal, written, listening)
- Ability to make decisions
- Ability to conceptualize new products, processes systems - Creative
- Ability to keep ego in check
- Ability to see the “Big Picture”
- Ability to work in multi-task environments
- Ability to prioritize projects
- Identify and relate projected / future food trends
- Skilled in various culinary uses and applications of products
- Explain current food trends
- Ability to balance personal and professional lives
- Ability to take criticism
- Ability to control emotion during communication with people
- Employ weight and measurement conversions
- Skilled at time management

- Skilled at motivating a team

Essentially, the research-focused research chef is one whose role is primarily in product development, creating new recipes, and food testing; whereas, the management-focused research chef is one who is primarily representing the company on product presentations and sales meetings (Birdir & Pearson, 2000). For the purpose of this research, only the competencies that were identified as important to the research-focused research chef were discussed and compared in the literature review.

A follow-up to the Birdir (1998) study was conducted by Joyce McMeen for her Master's thesis in 2003. Birdir's study was conducted in 1998 and surveyed the existing membership of the RCA at that time, which consisted of one category, research chefs. In comparison, McMeen's study was conducted in 2003, and there were four membership classifications in existence by that time - Chef, Affiliate, Associate, and Student. Affiliate was the membership category used for food scientists and technologists, educators, media communications professional, publisher, nutritionist, and researchers. Only the Chef and Affiliate membership categories were surveyed in McMeen's (2003) study. Both membership types were chosen because they contained the primary population of interest, individuals who worked in food product development. The Associate membership category was strictly restricted to vendors and sales support personnel, whereas the Student membership category was designated for students. McMeen's (2003) study also categorized the most important competency by membership type, Chef and Affiliates. The most important knowledge competency from McMeen's (2003) study, and also common to both groups, Chef and Affiliate, was *knowledge of flavors*, followed by *knowledge of culinary fundamentals and production*. Hall defined flavor as "the sensation produced by a material

taken in the mouth, perceived principally by the senses of taste and smell, and also by the general pain, tactile, and temperature receptors in the mouth” (as cited by deMan, 1999, p. 263). Knowledge of flavors is at the very heart of cooking (McMeen, 2003). A great cook knows how to taste, to discern what is needed, and to make adjustments to their cooking. Knowing how to cook alone does not make one an expert on flavors. It is the combination of mastering the competencies of culinary fundamentals along with the ability to use your senses (taste, mouthfeel, and smell) and skills in cooking that truly characterizes flavor.

Even with the difference in membership makeup, McMeen’s (2003) study affirmed the identified competencies from the Birdir (1998) study that were used in the formation of the original minimum standards for Culinology® curriculum were still relevant and applicable to the field of Culinology® today. The most important knowledge, skills, and abilities competencies common between both Birdir’s (1998) and McMeen’s (2003) studies, and common between both Chef and Affiliate groups in McMeen’s (2003) study were:

- Knowledge of flavors
- Ability to work with a product development team
- General communication skills (verbal, written, and listening)
- Ability to conceptualize new products, processes and systems (creativity)
- Ability to make decisions
- Ability to work in multi-task environments

McMeen’s study served as the foundation for the development of the present day RCA Bachelor of Science in Culinology® Core Competencies (see Appendix C for a complete listing). In 2007, using both Birdir’s and McMeen’s studies, a joint taskforce of the RCA Certification Commission (RCACC) and RCA Education Committee developed 43

competency statements for the purpose of enhancing degree programs, continuing education efforts, and other educational measures supported by the RCA. The taskforce membership represented chefs, food product developers, food scientists, and academicians. The taskforce recommended the competencies be categorized into seven competency areas, representing culinary arts and food science knowledge competencies. Table 2 shows the 43 competency statements grouped into seven competency areas representing culinary arts and food science.

Table 2

RCA-defined Core Knowledge Competencies

Competency Areas	Competency Statements
Applications Areas	<ol style="list-style-type: none"> 1. Application of Nutrition Knowledge (including labels, recipes, healthy eating recommendations) 2. Knowledge of Allergens 3. Knowledge of Carbohydrates (including vegetables, fruits, cereals, grains) 4. Knowledge of Commercial Flavorings (including process flavors, compound flavors, HVPs, yeast extracts) 5. Knowledge of Current Nutrition Trends 6. Knowledge of Dairy Products 7. Knowledge of Flavor Building in the Kitchen (including fond, stock, cooking method, seasoning, etc.) 8. Knowledge of General Nutrition (including essential nutrients, food pyramid, micro and macro nutrients) 9. Knowledge of Proteins (including meat, poultry, eggs, seafood, plant proteins) 10. Knowledge of Top, Mid, and Base Notes, and Construction of Flavor Systems
Business	<ol style="list-style-type: none"> 11. Knowledge of Competitive Products and Competitive Product Analysis 12. Knowledge of Current and Projected Food Trends (temperature conversion, metric conversion, weight calculations, etc.)
Chemistry, Science, and Ingredient Functionality	<ol style="list-style-type: none"> 13. Knowledge of Fats and Oils (including processing, quality, functionality, nutrition) 14. Knowledge of Functional Ingredients (including acidulants, buffers, pH adjusting ingredients, enzymes) 15. Knowledge of New Technologies (including fat substitutes, carbohydrate reduction technologies, etc.)

Competency Areas	Competency Statements
Culinary Arts and Hospitality Management	16. Knowledge of Commercial Equipment 17. Knowledge of Commercial Kitchen Responsibilities and Pressures 18. Knowledge of Culinary Fundamentals and Production Systems 19. Knowledge of Culinary Uses and Applications of Products 20. Knowledge of End-user Skills (including cooks in national chains) 21. Knowledge of Kitchen Tools and Equipment (including how to use and apply) 22. Knowledge of Principles of Cooking (including heat transfer, cooking methods, breading/batters, etc.) 23. Knowledge of Regional & World Cuisines (including preparation, spicing & presentation, and cultural topics) 24. Knowledge of Traditional Stocks and Sauces
Microbiology, Food Safety, Quality Assurance & Regulations	25. Knowledge of Food Chemistry and Microbiology (including process lethality validation, contaminants -biological) 26. Knowledge of Food Safety and OSHA Systems and Laws 27. Knowledge of Food Sanitation (including prevention of food borne illnesses, HACCP, etc.) 28. Knowledge of Government Food Regulations (including FDA, USDA, NLEA, CFR, etc.) 29. Knowledge of Product Shelf Life (including preservation methods, packaging technologies, effects of temp.) 30. Knowledge of Quality Assurance Systems (including process control, lot traceability and recall, etc.) 31. Knowledge of Quality Issues and Troubleshooting (mold/yeast/microbial issues, effects of abuse)
Processing, Manufacturing & Engineering	32. Ability to "Convert" from Lab to Plant (effects of scale up on finished product) 33. Knowledge of Heat Exchange/Heat Transfer (how it works/effect on the product) 34. Knowledge of Large-scale Production Systems (including technologies affecting products, large scale production) 35. Knowledge of Recipe Development and Formula Ratios (including percent vs. per batch, yield, etc.) 36. Knowledge of Weight & Measurement Conversions

Competency Areas	Competency Statements
Food Product Development	37. Knowledge of Appropriate Documentation (including lab book, specs, process documentation, etc.) 38. Knowledge of Equipment & Selection (as part of product/process development) 39. Knowledge of Formula Development 40. Knowledge of Ingredient Sourcing (including how choices affect purchasing (e.g. seasonality, cost, etc.) 41. Knowledge of Product Presentation (including planning and physical details) 42. Understanding Follow-through (including production start-up and customer support) 43. Understanding of the Product Development Process

Note. Research Chefs Association. (2012). Core Knowledge Competencies. Retrieved August 1, 2012, from <http://www.culinology.org/core-knowledge-competencies>.

This signified the first time the RCA had officially declared what competencies were needed by research chefs. In 2010, the RCACC released a more comprehensive learning outcomes document for RCA members interested in taking the Certified Research Chef (CRC) and Certified Culinary Scientist (CCS) (see Appendix D for full listing). To the researcher's knowledge, no study had been conducted to validate these learning outcomes against practicing culinologists.

In 2009, Rachel Bissett conducted an assessment of the Research Chefs Association's core competencies for practicing culinologists for her Master's thesis (Bissett, 2009). The RCA-defined core knowledge competencies as shown in Table 2 were surveyed with the existing RCA membership. It was found that the 43 competency statements were deemed to be too "broad." In Bissett's (2009) study, context was found to be important when reading the competency statements. As an example, knowledge of proteins could mean "center of the plate" for a chef, but it could refer to the chemistry of the macromolecule for a food scientist. Other findings from Bissett's (2009) study related to the competency statements were:

- Ambiguity regarding the use of the competencies. Were the competencies

developed just for certification and educational purposes, or also to be used as a tool for self-evaluation?

- There was a general consensus that an analysis of the RCA's core knowledge competencies for culinologists would be beneficial to the food industry as a whole. It could help employers identify areas of strengths and weaknesses in the employees, and develop professional development opportunities. In addition, it could be extremely beneficial to the individual in identifying one's own strengths and weaknesses.
- The RCA is a young association still working to establish a clear identity. Thus, over time, clarification of the outcomes will define which competencies are important to the membership.

Bissett's study (2009) surveyed RCA members in six different membership categories to rate *self-perceived knowledge of competency* and *importance to job success* for each of the 43 competency statements. The six RCA membership categories were Affiliate, Associate, Chef, Culinology®, Food Science and Technology (FST), and Student. Exploratory factor analysis and theoretical fit was used to determine the validity and reliability of the survey research tool. Significance was set ($p = 0.05$) and each of the 43 competency statements was grouped into a "factor." For questions associated with *self-perceived knowledge of competency*, eight factors were identified, whereas for questions associated with *importance to job success*, nine factors were identified. These 'factors' were given a descriptive name following review by industry professionals with experience in food and culinary industry and education. For this section of the literature review, the discussion centered on the nine factors identified for *importance to job success*. Bissett (2009) identified three new factors,

Technology and Equipment, Nutrition and Flavor Building that were important to job success.

Table 3 shows the original RCA-defined core knowledge competencies and competency statements (as previously shown in Table 2) compared to Bissett's (2009) nine factors that surfaced after the exploratory factor analysis. From the original seven RCA-defined core knowledge competencies and 43 competency statements, Bissett (2009) categorized 37 competency statements into nine competency areas. Two competency statements, "Heat Exchange/Heat Transfer" and "End User Skills" were not loaded into any of the nine competency areas from the factor analysis, and the researchers in Bissett's study were unsure why certain competency statements were statistically not loaded into any factor. Four other competency statements, "Competitive Products and Competitive Product Analysis", "Product Shelf Life", "Weight and Measurement Conversions", and "Dairy Products" were missing from Bissett's (2009) categorization. It is unclear from the literature review why those four competency statements were omitted, either intentionally or unintentionally, as all four competency statements could be categorized into an existing competency area. Bissett (2009) stated that many of the competency statements remained in similar categories after the statistical factor analysis was performed, and suggested that "since the factor analysis provided a statistically validated categorization of the Culinology® competencies, the RCA has the opportunity to consider realigning the competency statements into the factors identified in the analysis" (Bissett et al., 2010a, p. 13). As of 2012, the RCA has not conducted any revisions to the RCA-identified core knowledge competencies as a result of Bissett's (2009) study.

Table 3

Comparison Of RCA-defined Core Knowledge Competencies To Bissett's (2009) Exploratory Factor Analysis Results

RCA-defined core knowledge competencies ^a	Competency statements	Bissett's (2009) Factors	Competency statements
Business	1. Competitive Products and Competitive Product Analysis 2. Current and Projected Food Trends	Business and Sales	1. Understanding Follow-through 2. Current and Projected Food Trends 3. Product Presentation
Chemistry, science, and ingredient functionality	3. Fats and Oils 4. Functional Ingredients 5. New Technologies	Food Science	4. Proteins 5. Fats and Oils 6. Functional Ingredients
Culinary arts and hospitality management	6. Commercial Equipment 7. Commercial Kitchen Responsibilities and Pressures 8. Culinary Fundamentals and Production Systems 9. Culinary Uses and Applications of Products 10. End-User Skills 11. Kitchen Tools and Equipment 12. Principles of Cooking 13. Regional & World Cuisines 14. Traditional Stocks and Sauces	Culinary arts	7. Kitchen Tools and Equipment 8. Principles of Cooking 9. Culinary Fundamentals and Production Systems 10. Commercial Kitchen Responsibilities and Pressures 11. Culinary Uses and Applications of Products 12. Traditional Stocks and Sauces 13. Regional & World Cuisines 14. Flavor Building in the Kitchen

RCA-defined core knowledge competencies ^a	Competency statements	Bissett's (2009) Factors	Competency statements
Microbiology, food safety, quality assurance, and regulation	15. Food Chemistry and Microbiology 16. Food Safety and OSHA Systems and Laws 17. Food Sanitation 18. Government Food Regulations 19. Product Shelf Life 20. Quality Assurance Systems 21. Quality Issues and Troubleshooting	Food Safety and Quality	15. Food Safety and OSHA Systems and Laws 16. Food Chemistry and Microbiology 17. Quality Assurance Systems 18. Food Sanitation
Processing, manufacturing, and engineering	22. Ability to "Convert" from Lab to Plant 23. Heat Exchange/Heat Transfer 24. Large-scale Production Systems 25. Recipe Development and Formula Ratios 26. Weight & Measurement Conversions	Manufacturing	19. Large-scale Production Systems 20. Quality Issues and Troubleshooting 21. Commercial Equipment 22. Ability to "Convert" from Lab to Plant 23. Government Food Regulations
Food product development	27. Appropriate Documentation 28. Equipment & Selection 29. Formula Development 30. Ingredient Sourcing 31. Product Presentation 32. Understanding Follow-through 33. Understanding the Product Development Process	Product and formula development	24. Understanding the Product Development Process 25. Formula Development 26. Recipe Development and Formula Ratios 27. Appropriate Documentation 28. Ingredient Sourcing

RCA-defined core knowledge competencies ^a	Competency statements	Bissett's (2009) Factors	Competency statements
Application areas ^b	34. Application of Nutrition Knowledge		
	35. Allergens		
	36. Carbohydrates		
	37. Commercial Flavorings		
	38. Current Nutrition Trends		
	39. Dairy Products		
	40. Flavor Building in the Kitchen		
	41. General Nutrition		
	42. Proteins		
	43. Top, Mid, and Base Notes, and Construction of Flavor Systems		
		Technology and Equipment ^c	29. Equipment and Selection
		Nutrition ^d	30. New Technologies
			31. Application of Nutrition Knowledge
			32. General Nutrition
			33. Carbohydrates
			34. Current Nutrition Trends
			35. Allergens
		Flavor Building ^e	36. Commercial Flavorings
			37. Top, Mid, and Base Notes

Note. ^a Reprinted from “A Quantitative Assessment of the Research Chefs Association Core Competencies for the Practicing Culinologist” by R. L. Bissett, M. S. H. Cheng, and R. G. Brannan, 2010, *Journal of Food Science Education*, 9(1), p. 12. Copyright 2010 by the Institute of Food Technologists. Adapted with permission.

^b The competency statements of *Application Areas* were moved into various factors identified from the exploratory factor analysis.

^{c, d, e} New factors identified by Bissett (2009).

A gap analysis was conducted by Bissett (2009) to determine areas where the level of competency was not in congruence with its important to success. Her study paid special attention to the gaps generated solely by Chef, Culinology® and FST members, since these are the membership categories that were directly related to food product development. Bissett (2009) summarized the results for *importance to job success* showed that Chef members rated the *culinary arts competency* as the most important, whereas Culinology® and FST members rated *product and formula development competency* as most important. The lowest ratings for all three membership categories (Chefs, Culinology®, and FST) were *technology and equipment*.

The topics for culinary arts as categorized by Bisset et al. (2010a) were:

- Kitchen tools and equipment
- Principles of cooking
- Culinary fundamentals and production systems
- Commercial kitchen responsibilities and pressures
- Culinary uses and applications of products
- Traditional stocks and sauces
- Regional & world cuisines
- Flavor building in the kitchen

The topics for product and formula development as categorized by Bisset et al. (2010a) were:

- Understanding the product development process
- Formula development

- Recipe development and formula ratios
- Appropriate documentation
- Ingredient sourcing

The literature review of the three studies about research chefs competencies has shown that all the competencies for the research-focused research chef as identified by Birdir (1998) were still important, as affirmed by McMeen's (2003) and Bisset's (2009) studies. Birdir (1998) identified the research-focused research chef as “. . . a person who primarily engages in new product development, in creation of new recipes, and in food testing. This chef also possesses a strong background in food ingredients, sauces, stocks, and various cuisines” (Birdir & Pearson, 2000, p. 208). The top knowledge competency identified as most important from McMeen's (2003) study was *knowledge of flavors*. “Flavor is exceedingly important to the food industry,” said Gary Reineccius, head of the Department of Food Science and Nutrition at the University of Minnesota, and author of *Flavor Chemistry and Technology* (as cited by Breining, 2012, para. 5). It is what largely determined people's food choice. The most important skill and ability competency from McMeen's (2003) study was *ability to work with a product development team*. Similarly, the *culinary arts* and *product and formula development* competencies were identified as most important to the Chefs, Culinology®, and FST members in Bissett's (2009) study. All three studies conducted on research chefs' competencies identified *culinary arts* and *product development* as competencies that are important for a research chef.

Not surprisingly, there was very little commonality between the management-focused research chef's competencies and McMeen's (2003) or Bissett's (2009) studies, as the role of the management-focused research chef was to represent the company on sales meetings and

product presentations (Birdir & Pearson, 2000).

In summary, all three studies surveyed members from the RCA, but at different points in time. The Birdir study ($n = 22$) was conducted in 1998, the McMeen study ($n = 245$) was conducted in 2003, and the Bissett study ($n = 192$) was conducted in 2009. In the same time period, membership classifications in the RCA went from singular (1998) to four (2003) and finally to six (2009). The overall theme of the studies pointed to the importance of *culinary arts* and *product development* as core competencies. However, development of new food products required an understanding and appreciation for the scientific and technological principles of foods and food processing. Knowledge of chemistry and functional properties of food constituents and ingredients and the ability to apply this knowledge to create commercially successful convenient food products is critical (Toledo & Brody, 2008). Thus, food science competencies and culinary arts competencies are truly the foundation of the Culinology® discipline. The results of the three existing studies on research chef competencies and the current RCA's Bachelor of Science in Culinology® Core Competencies served as the foundation for the development of a competency model for Culinology® graduates.

Developing a Competency Model for Culinology® Graduates

David McClelland, a former Harvard psychologist, wrote an influential article entitled “Testing for Competence Rather than for Intelligence” in 1973 (Shippmann et al., 2000). In the article, McClelland presented five major themes: (1) grades in school did not predict occupational success, (2) intelligence tests and aptitude tests did not predict occupational success or other important life outcomes, (3) tests and academic performance only predicted job performance because of an underlying relationship with social status, (4) such tests were

unfair to minorities, and (5) "competencies" would be better able to predict important behaviors than would more traditional tests. McClelland was then asked by the U.S. Foreign Service to find new research methods capable of predicting human performance and reducing the bias of traditional intelligence and aptitude testing (Mirabile, 1997). Thus, the concept of competency model was born.

According to Lucia and Lepsinger (1999), a competency model is a descriptive tool that identified the skills, knowledge, personal characteristics, and behaviors needed to perform effectively a role in the organization and help the business meet its strategic objectives. In short, it is an integrated set of competencies required for excellent performance. Competency models focused on how objectives are met and how the work is accomplished, in contrast to job analysis, which is much more work- and task-focused (Shippmann et al., 2000). Mansfield (1996) defined a competency model as a “detailed, behaviorally, specific description of the skills and traits that employees need to be effective in a job” (p. 7). Similarly, Dubois (1993) defined it as “. . . competencies that are required for satisfactory or exemplary job performance within the context of a person’s job roles, responsibilities and relationship in an organization and its internal and external environment” (p. 9). Competency models tended to focus on behavior rather than on personality traits because personality traits are usually difficult to measure correctly (Chung-Herrera, Enz, & Lankau, 2003; Mirabile, 1997). Shippmann et al. (2000) stated that a group of seven to nine total competencies are usually required for a particular job, depending on the work and organizational environment (as cited by Ennis, 2008, p. 5). Conversely, Campion et al. (2011) posited that while there is no ideal number of competencies, and many factors such as the purpose of the model, the scope of the model, the organization’s preferences, and the

organization's experience with competencies and competency models can all impact the target number of competencies, the recommended number of competencies is around 12.

There are numerous advantages to using competency models, such as recruitment and selection of managers and employees, assessment programs, development of job descriptions, development of training programs, succession planning, empowering employees to make managerial decisions, and curriculum development (Campion et al., 2011; Canning, 1990; Ennis, 2008; Lucia & Lepsinger, 1999; McHale, 1995; McLagan, 1980; Mirabile, 1997; Stewart & Hamlin, 1992). Competency models should provide a definition for each core competency and its objectives, together with measurable or observable performance indicators for evaluating individuals (Campion et al., 2011; Markus, Cooper-Thomas, & Allpress, 2005). The value of competency models is that a whole-person assessment can be developed to examine the competencies an individual possesses and may still need to acquire, as required by one's chosen profession or industry (Ennis, 2008).

Campion et al. (2011) suggested augmenting competency models with visuals to enhance memorableness as well as improving communication by presenting information in multiple modes. When using visual portrayals of competency models, Campion et al. (2011) recommended simplicity as well as focusing on the core idea of the model by not including every detail of the model. An example of a competency model that is hierarchically arranged and visually represented is shown in Figure 1, Framework of competencies by the hospitality industry/hotel & lodging.

The Employment and Training Administration (ETA), as part of the U.S. Department of Labor, has a mission to contribute to the more efficient and effective functioning of the U.S. labor market by providing high-quality job training, employment, labor market

information, and income maintenance services primarily through state and local workforce development systems (Employment and Training Administration, 2011). The ETA has been working with business, industry, and education/training leaders to develop competency models for targeted industries and broker information on resources used to efficiently prepare the workforce (Ennis, 2008). One example of such collaboration is a comprehensive competency model framework for the Hotel and Lodging sector of the hospitality industry, as shown in Figure 1. Detailed information regarding each of the competencies for this Hospitality/Hotel and Lodging Competency Model is shown in Appendix E.

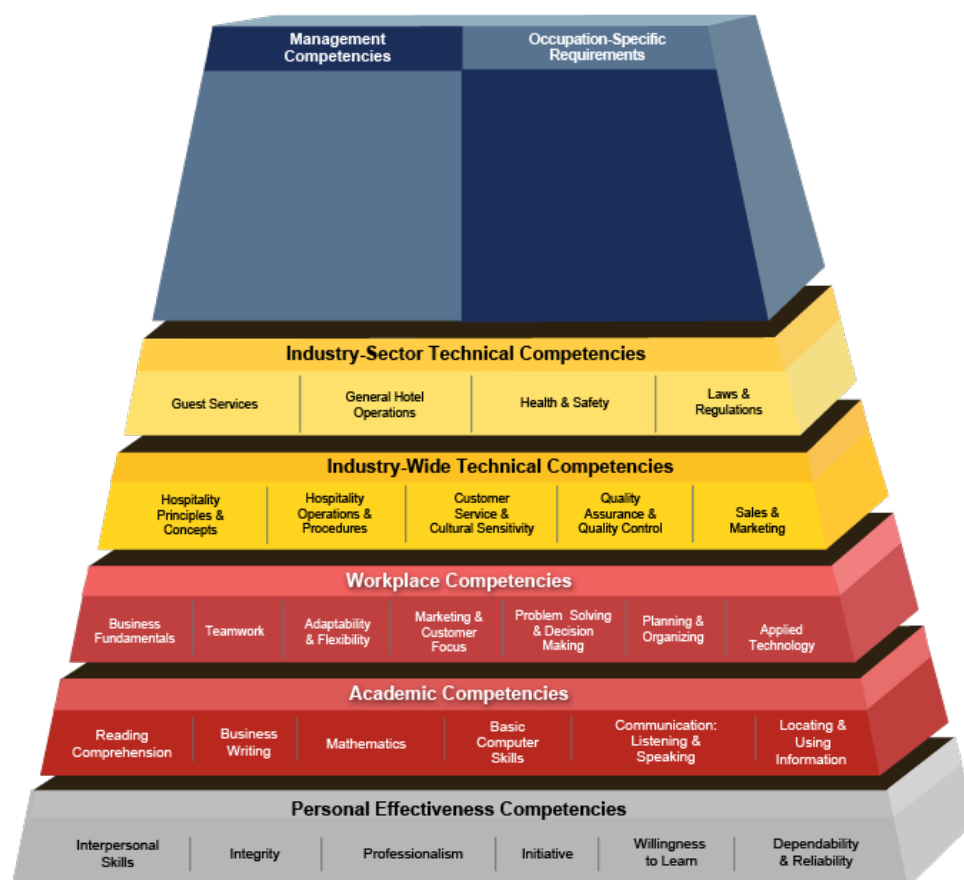


Figure 1. Framework of Competencies by the Hospitality Industry/Hotel & Lodging. Retrieved Oct 1, 2012 from <http://www.careeronestop.org/competencymodel/pyramid.aspx?hsp=Y>

However, competency models are not the sole solution for all hiring and selection decisions in human resource management. Ashworth and Saxton (1990) explained that focusing only on competencies on the job can result in a disregard for the mental and personal processes utilized in developing and exhibiting skills and utilizing knowledge (as cited by Ennis, 2008). As shown in Figure 1, the foundational competencies from tiers one through three represented personal effectiveness, academic effectiveness, and workplace competencies. Over-emphasis on the industry and technical competencies during the hiring and selection process may result in hiring an individual who does not have the requisite communication skills to work in the hospitality industry. Proper identification of the level of proficiency in a competency ensured the appropriate competencies are emphasized for the defined position. Campion et al. (2011) recommended defining progressive levels of competence development on the job in terms of highly observable behavior on the job, such as novice, master, and expert. Schawbel (2012) reported that 98% of the employers surveyed in the Student Employment Gap study viewed communication skills as important or very important when hiring entry-level positions.

Using the framework of competency modeling, one can see that competency models currently exist for culinary arts education, food science education, and Culinology® education. Lucia and Lepsinger (1999) stressed the importance of validating competency models:

For the model to be used effectively, it must be shown to have face validity (that is, the competencies described in the model must make sense to those performing the job) and it must be validated as a predictor of successful performance (that is, the competencies must be demonstrated by the top performers in the job) (p. 93).

The literature review has shown that culinary arts competencies validation is achieved through the ACF by the accreditation and certification process. In contrast, the food science competencies validation was achieved indirectly through the IFT taskforce that developed the 2001 IFT Education Standards. The task force at that time comprised of food science industry administrators / executives and faculty members (W. Iwaoka, personal communication, July 5, 2011). However, the development of the RCA's Bachelor of Science in Culinology® core competencies did not follow a similar process. It used the foundational studies of Birdir (1998) and McMeen (2003) and was completed by a taskforce consisting of Culinology® program faculty. The core competencies were then approved by the RCA Board of Directors at that time, which consisted of representatives from the food product development industry. Indirectly, there was a process that vetted the competencies as needed by Culinology® degree graduates, but just like the IFT Education Standards, there was no direct professional certification process that linked the competencies to the industry. This gap provided the opportunity for the development of a competency model for the RCA's Bachelor of Science in Culinology® core competencies that is validated.

There are many different methods of developing competency models, as outlined by Lucia & Lepsinger (1999) and Dubois (1993). The *Job Competence Assessment Method* used interviews and observations of outstanding and average performers at critical incidents to determine differentiating competencies. The *Modified Job Competence Assessment Method* asked interviewees to provide a written account of critical incidents. The *Generic Model Overlay Method* used generic off-the-shelf competency models for a specific role or function. The *Customized Generic Model Method* used a tentative list of competencies to develop a customized competency model that is specific to a job, its outputs, and the

application environment where the job exists. The *Flexible Job Competency Model Method* sought to identify the competencies required to perform effectively under different conditions of the future. The *Systems Method* drew from what exemplary performers do now but also in the future. The *Accelerated Competency Systems Method* focused on the competencies that specifically support the production of output, such as the organization's products, services, or information.

Due to the paucity of the literature on the competencies of the research chef, the researcher used the *Customized Generic Model Method*. This method relied on the researcher's identification of a universe of generic competencies that fully characterized the attributes of the job in the organization. The universal list of competencies was then researched and interpreted within the job and the larger organization context. As a result, the specific competencies that characterized the successful employee are verified or denied by the research (Dubois, 1993). These job competencies were then used to develop the final competency model. The final outcome of the *Customized Generic Model Method* is the same as all the other competency models: identification of the knowledge, skills, and characteristics needed to effectively perform a role in an organization.

Competency models can be used to guide individual professional development and assist educators and trainers in developing curricular that meet the needs of employers. Competency models are maps for guiding education and training and professional development and can serve as a viable tool to retain skilled incumbent workers to meet the job requirements and other needs of employers (Ennis, 2008).

Summary

The development of the competencies required for culinary arts education has its

roots in the vocational education movement of the late 19th and early 20th centuries and focused on achieving student mastery of core technical culinary competencies. However, Millar et al. (2010) reported that very few studies focused solely on the food service industry. Zopiatis (2010, p. 461) quoted, “the Chefs’ profession receives little attention by academic scholars worldwide.” Conversely, the history and development of the food science discipline dates back to the 1900’s, and the literature review showed the transformation of food science education from its original content-based format to its current outcomes-based format. The literature review also listed the competencies of the practicing research chef (Birdir, 1998), which was validated by McMeen (2003), resulting in the formation of 43 core competencies for the practicing culinologist. Bissett (2009) surveyed RCA members in six different membership categories to rate their knowledge levels for each of the identified core competency and concluded that RCA members from the Culinology® category understood both culinary arts and food science competencies, but not at the level of RCA members who self-identified as chef members or as FST members.

The literature review has identified the necessary competencies of the chef, the food scientist, and the research chef. The need for clearly identified job functions of a research chef has also been clearly stated. The literature is rich in competencies assessment of hospitality graduates’ ability to meet the needs of the hospitality industry (Horng & Lu, 2006; Kay & Russette, 2000; Lin, 2002; Perdue et al., 2002; Tas et al., 1996), but no comparable research existed for Culinology® graduates. Therefore, this research has added to the body of work on Culinology®, and developed a competency model for Culinology® degree graduates that is validated.

CHAPTER 3. RESEARCH DESIGN AND METHODOLOGY

The purpose of this research was to determine whether the core competencies of the Research Chefs Association's (RCA) Bachelor of Science in Culinology® prepared graduates to meet the needs of the food product development industry. The core competencies were developed using a theoretical framework based on the competency model, drawing from the culinary arts and food science disciplines, but have not been validated thus far. Lucia and Lepsinger (1999) stressed the importance of validating competency models:

For the model to be used effectively it must be shown to have face validity (that is, the competencies described in the model must make sense to those performing the job) and it must be validated as a predictor of successful performance (that is, the competencies must be demonstrated by the top performers in the job) (p. 93).

The objectives of this research were: (a) examine whether these competencies met the needs of the current employers of Culinology® graduates, (b) evaluate the graduates' self-assessment of these competencies in relation to their preparedness for employment in their current position, and (c) explore the correlation between the employers' and the graduates' self-assessment and its implications for curricular reform in Culinology® education. The theoretical framework for this study was the competency model. A competency model is a descriptive tool that identifies the skills, knowledge, personal characteristics, and behaviors needed to perform a role effectively in the organization and help the business meet its strategic objectives (Lucia & Lepsinger, 1999). In other words, it is an integrated set of competencies required for excellent performance.

Using the literature about competencies and the framework of competency modeling

as a foundation, this chapter explained the methods used in the study. The research questions guided the researcher in fulfilling the purposes of the study and the hypotheses developed were tested. Research design, population and sample, data collection, data analysis, and validation of the competency model were discussed.

Problem and Purposes Overview

As interest in Culinary® continues to rise and the number of graduates continued to increase yearly, the lack of empirical data on Culinary® graduates in the industry as well as the effectiveness of the RCA's Bachelor of Science in Culinary® core competencies provided an opportunity for research into this area. It is important that Culinary® graduates be able to function effectively as culinologists when they enter the food product development industry. As the RCA believes, to develop successful products, tomorrow's product development expert must know both the culinary arts and the science of food product development. However, there has not been any investigation into the effectiveness of the Culinary® core competencies in preparing graduates for employment as culinologists in this innovative, new discipline. There have been no studies conducted on Culinary® graduates till now.

The results of this research served as recommendations to Culinary® educators and the RCA to improve the current Culinary® curriculum. The study is valuable to the RCA and Culinary® educators because it can be used to develop a program assessment tool that serves to further refine the approval and reporting process currently used by the RCA. This study provided academic program administrators and educators with a basis for curriculum development or expansion, as well as program growth. This study is valuable to current Culinary® students, as it served as an advisory reference in understanding the knowledge

and competencies the food product development industry is seeking in graduates. Finally, the outcome of this study is of considerable importance to the food product development industry, as it ensured that graduates from Culinology® programs will possess the requisite skills needed for successful product development in a competitive marketplace.

Research Framework

Competency Model

The literature review on competencies and competency models has shown that the majority of the prior studies on competency modeling were done by organizational behavior specialists and managerial consultants. Competency models in human resource management generally focused on selection, training and development, appraisal, or succession planning (Lucia & Lepsinger, 1999; Spencer & Spencer, 1993). There are many different methods of developing competency models, as outlined by Lucia and Lepsinger (1999). The *Customized Generic Model Method* was used for this research. This model began with the identification of a universe of generic competencies that fully characterized the attributes of the culinologist in the food product development industry, as shown in Appendix C, the RCA Bachelor of Science in Culinology® Core Competencies. This list of competencies was researched and interpreted within the job and the larger organization context via surveys and interviews. As a result, the specific competencies that characterized the successful culinologist are verified or denied by the research data. These job competencies are then used to develop the final competency model. The final outcome of this competency model is identification of an integrated set of competencies that are required to perform the role of the culinologist successfully.

To develop a competency model, Lucia and Lepsinger (1999) identified four areas

that must be followed to ensure a solid foundation for the project:

1. Determine the objectives and scope of the project.
2. Clarify implementation goals and standards.
3. Create an action plan.
4. Identify individuals who meet, exceed, or fall below established performance criteria.

These four areas served as the major sections for the research design and are discussed in greater detail in this chapter. Information about participants, research design, dependent and independent variables, measures, instruments, and procedures were discussed within the four sections.

Step One: Determine the Objectives and Scope of the Project

There were four steps in this process:

1. Identify the business needs or needs the competency model will address
2. Identify the jobs, functions, or business units the model will target (the target population)
3. Determine the method for developing the competency model
4. Determine the makeup of the project team (Lucia & Lepsinger, 1999, p. 51)

The purpose of this research was to determine whether the core competencies of the RCA's Bachelor of Science in Culinology® prepared graduates to meet the needs of the food product development industry.

Research Questions and Hypotheses

This research expanded the body of literature on Culinology® by validating and measuring the effectiveness of the RCA's Bachelor of Science in Culinology® core

competencies, as determined by the employers and Culinology® graduates themselves. The research questions were:

1. How successful are the competencies possessed by the Culinology® graduate in meeting the needs of the employers, as assessed by the employers?
2. How effective are the core competencies of the RCA's Bachelor of Science in Culinology® in preparing graduates for employment in the food product development industry, as self-assessed by the graduates?
3. What is the relationship between the employers' assessment and the graduates' self-assessment?
4. What are the implications for curricular reform in Culinology® education?

The first research question, how successful are the competencies in meeting the needs of the employers, was answered by analyzing the responses of the employers obtained from the surveys and interviews. The second research question, how effective are the competencies in preparing graduates for employment, was answered by testing the following three null hypotheses:

1. There is no significant difference between the graduates' perception of importance and frequency of use for each of the identified core competencies.
2. There is no significant difference between the graduates' years of experience in current position and their perception of importance for each of the identified core competencies.

3. There is no significant difference between the graduates' perception of importance for each of the identified core competencies and the institution they graduated.

The third research question examined the relationship between the graduates' and the employers responses, and tested the following null hypothesis:

4. There is no significant difference between the employers' and the graduates' perception of importance for each of the identified core competencies.

And finally, the last research question explored the implications for curricular reform in Culinology® education by analyzing the overall responses of the graduates and employers from the surveys and interviews, and the resulting themes that arose from the analyses.

Research Design

This study used the mixed methods research design. Mixed methods research is an approach to inquiry that combined both qualitative and quantitative forms of research. A mixed methods strategy enables a researcher to broaden understanding by incorporating both qualitative and quantitative research, or build on the results from the other approach, thereby assisting the researcher in not only discovering what happened but how it happened as well (Creswell, 2009). Specifically, the sequential explanatory strategy was used to explain and interpret the quantitative results by collecting and analyzing follow-up qualitative data (Creswell, 2009). Survey research was carried out to describe the characteristics of a population (Fraenkel & Wallen, 2009). The dependent variables in this study were the measures collected from the survey instrument. The independent variables were: *institution offering the Culinology® degree program, length of time in current position, years of food*

industry experience, and *gender*. This research also explored the independent variables in the study to determine if a correlation existed.

An embedded model of design is one of several strategies used in mixed methods research and emphasized a major primary form of data collection and can include a minor secondary form of data collection (Creswell, 2009). Using an embedded model of design made sense for this research because the majority of the data collection is quantitative and were collected via surveys, with additional research carried out via interviews completed with purposefully selected students and employers.

Population and sample. This research surveyed two different subsets of Culinology® practitioners: (a) those who graduated from a Culinology® degree program, as opposed to practitioners who were trained in culinary arts, food science, a combination of both, or a related field, and (b) the employers of Culinology® graduates. The population studied consisted of Bachelor of Science graduates from all RCA-approved Culinology® programs, between 2001 and 2009. Culinology® programs that were approved by the RCA in 2010 and 2011 were not included, as they did not have any graduates yet at the time of this research. Listed in chronological order, the Culinology® programs were:

1. University of Nebraska-Lincoln, 2001
2. Clemson University, 2002
3. University of Cincinnati, 2002
4. Dominican University, 2003
5. California State Polytechnic University, Pomona, 2004
6. University of Massachusetts-Amherst, 2005
7. Southwest Minnesota State University, 2005

8. California State University, Fresno, 2006
9. Rutgers University, 2007

For this study to have reliable results, only graduates who are currently working in the food product development industry were analyzed in the results. The primary purpose of the research was to develop a competency model for Culinology® graduates; therefore, using feedback from practitioners in the food industry is critical.

Program directors / coordinators for each of the nine Culinology® programs were contacted via electronic mail and telephone to collect contact information of their graduates. Approval for this study was granted by Iowa State University's Institutional Review Board prior to data collection (Appendix F).

Due to the relatively brief existence of Culinology® degree programs and limited number of graduates, the population studied was small. One hundred and one names of graduates were collected from the program directors and coordinators. Because the entire population of Culinology® graduates was surveyed, the results are generalizable and applicable to the entire population of Culinology® graduates. Fraenkel and Wallen (2009) stated that populations as a whole are rarely studied; instead a sample is surveyed and characteristics of the population are inferred from what the sample reveals. A very rare population is defined as consisting of about one percent or less of the total population (Sudman, 1972). Sampling rare populations is often difficult and the sample frequently is costly to identify. However, for this research, a complete list of the population was obtained from seven of the nine individual Culinology® program directors / coordinators. Two programs did not provide names of graduates because they had none, or were not permitted to.

Validity and reliability. One of the challenges in developing new competency models is establishing its validity. For this research, the researcher used a previously validated competency model method, the *Customized Generic Model Method*. This method used empirical studies on Culinology® competencies and was validated by input from practitioners and academia. Development of this competency model validated the core competencies of the RCA's Bachelor of Science in Culinology®.

The primary researcher was responsible for leading this research with assistance and input from key stakeholders representing academia and the industry. Stakeholders from academia included the researcher's doctoral committee as well as Culinology® program directors and coordinators, who served as the expert panel for the pilot survey instrument. Stakeholders from the industry were members of the RCA Board of Directors, who served as visible sponsors and advocated for it within the organization.

Internal and external validity. According to Fraenkel and Wallen (2009), internal validity means that observed differences on the dependent variable are directly related to the independent variable and not due to some other unintended variable. Choosing an appropriate research design minimized the majority of the threats to internal validity. This study examined whether the core competencies of the RCA's Bachelor of Science in Culinology® prepared graduates for employment in the food product development industry. Since the questionnaire was distributed electronically, and to all RCA-approved Culinology® programs from 2001 – 2009, the conditions under which the study occurred were standardized. This helped control for location, instrumentation, and subject attitude.

External validity exists when one can generalize the results of a study to a larger population (Fraenkel & Wallen, 2009). Since the population studied is the sample, this

research has external validity as well as population generalizability.

Step Two: Clarify Implementation Goals and Standards

Lucia and Lepsinger (1999) stated that a good implementation goal included all of the following characteristics:

- Specific
- Challenging, yet realistic and attainable
- Consistent with available resources
- Consistent with the organization's policies and operating procedures
- Measurable
- Inclusive of an expected completion date (p. 55)

Thus, the goal statement for this research project was, "To develop a competency model that will validate the RCA's Bachelor of Science in Culinology® core competencies in preparing graduates for employment in the food product development industry by the end of October, 2012."

Step Three: Develop an Action Plan

An action plan is the primary tool to manage the workload, establish milestones, and communicate with key stakeholders on the progress of the project (Lucia & Lepsinger, 1999). For this research, there were five phases. Phase One (Original Instrument Construction) was the construction of initial items for the instrument. Phase Two (Expert Panel Review) was conducted to establish face and content validity by a panel of experts. Phase Three (Pilot Study Instrument) focused on revision of the instrument as a result of internal consistency reliability testing. Phase Four was data collection, and Phase Five was data analysis. The primary researcher established the timeline and ensured that all the phases

were accomplished by their due dates. The schedule developed is identified below:

- Phase One (Original Instrument Construction) – July 2011
- Phase Two (Expert Panel Review) – September 2011
- Phase Three (Pilot Study Instrument) – October 2011
- Phase Four (Data collection) – November 2011 – August 2012
- Phase Five (Data analysis) – May - October 2012

Phase One (Original Instrument Construction)

A survey instrument was used for this study. Creswell (2009) suggested three options for obtaining an instrument: (a) an original instrument designed for the research, (b) a modified instrument, or (c) an intact instrument developed by someone else. Each of the options has its own advantages and disadvantages. Developing an original instrument may be time-consuming and consists of several steps including identifying the purpose of the instrument, reviewing the literature, writing the questions, and testing the instrument (a pilot study). The advantage to this option is that the researcher would have the flexibility to structure the questions exactly as needed to generate the necessary data. Modifying an instrument involves identifying an existing instrument and making changes to the original instrument, then making changes to fit your specific study. Finally, using an intact instrument in its entirety would enable the researcher to use an instrument that already has validity and reliability but limit them to what additional data can be gathered for the research, due to the original focus of the instrument.

For the purpose of this study, an original survey instrument was created to measure the core competencies of the RCA's Bachelor of Science in Culinology®. Because of the originality of the instrument, validity and reliability needed to be tested. Three traditional

forms of validity to look for are content validity, predictive or concurrent validity (criterion-related), and construct validity (Creswell, 2009). Content validity ensured that the items measure the content they were intended to measure. Using an expert panel to review the instrument verified the content validity of the survey instrument. Predictive or concurrent validity measures whether the scores predict a criterion measure or correlates with other results. Since this research aimed to evaluate the effectiveness of the RCA's Bachelor of Science in Culinology® core competencies, criterion-related validity is not an issue.

Construct validity checks to see if the items measure the hypothetical constructs. The results from the pilot instrument test showed that the data had a normal distribution, thus confirming the construct validity of the survey instrument. Reliability refers to the consistency of scores or answers from one administration of an instrument to another and from one set of items to another (Fraenkel & Wallen, 2009). The common measure of reliability is Cronbach's alpha; the usual criterion is a Cronbach's alpha coefficient of .70, which indicates a high degree of internal consistency among the data collected (Cronbach, 1951). Cronbach's alpha coefficient for the pilot study was measured at .90, indicating a high degree of internal consistency of the items in the scale.

The survey instrument (see Appendix G for the full original instrument constructed) consisted of three parts that assessed the effectiveness of the Culinology® graduates' performance in the food product development industry, as determined by the graduates and their employers. Part I consisted of demographic questions related to the survey participants. Those characteristics included: name of institution that they graduated from, the year of graduation, current employment information, years of food industry experience, position title, number of years in current position, and gender. Part II consisted of questions intended to

measure the graduates' and employers' perception of the importance and frequency of use for each of the identified core competencies. A five-point Likert-type scale (1 = Not important, 5 = Very important) was used to measure importance and a five-point Likert-type scale (1 = Less than once a month, 5 = Almost daily) was used to measure frequency of use in this part of the instrument. Both graduates and employers rated the importance and frequency of use for each core competency in the day-to-day responsibilities of a culinologist. Additional questions included identifying any content areas within the competency that were believed to be less important, and used less frequently. Part III consisted of open-ended questions intended to solicit additional insights into the competencies that were necessary for a Culinology® graduate to be successful. These questions included listing any other competencies that the respondents believed are critical for a culinologist to have that were not already listed and an opportunity for the respondents to provide additional comments regarding the competencies.

Phase Two (Draft Instrument)

A panel of five experts were selected to review the draft instrument to determine face and content validity of the draft instrument. Validity refers to the appropriateness, meaningfulness, correctness, and usefulness of the inferences a researcher makes. The panel was made up of one member from the target population and other Culinology® program directors / coordinators and faculty. Members of the expert panel have in-depth knowledge of the competencies necessary for success in the product development industry through their combined education and work experiences.

Panel members were sent an email requesting their participation in the study. The email briefly outlined the objectives of the study and provided directions for the completion

of the draft instrument feedback form. The form is included in Appendix H.

Phase Three (Pilot Study Instrument)

The objective of the pilot study was to provide the researcher with the opportunity to:

1. Pretest the survey instrument to determine the usefulness or otherwise of each item;
2. Pretest the data collection method to determine its appropriateness for the research; and
3. Determine any possible problems, and consequently, make the necessary modifications, corrections, or adjustments.

Due to the small number of participants in the research, it was inadvisable to test the final survey instrument on a pilot group that consisted of members of the population of study because it would eliminate them for inclusion in the study. Rather, an alternative was to use graduating seniors in the Culinology® program from Southwest Minnesota State University as the pilot group. This ensured that the total number of participants available in the population of study remained as large as possible for statistical relevance.

Average scores, frequency distributions, and the Wilcoxon Signed Rank Sum Test were used to determine if there were significant differences in the measures of the pilot study. No significant differences were found and the survey instrument was circulated to a cross section of respondents who participated in the pilot study to ensure that their feedback and suggestions are included. No other changes were needed, thus it was determined that the survey instrument had strong face validity.

Phase Four (Data Collection)

For this research, a dual-stage sampling procedure was employed. In the first stage,

participants were contacted via email and invited to participate in the research. A follow-up email with an Internet link to the survey was provided to the participants in the email, along with all the necessary information on the background, objectives, methods, and timeframe of the research. Participants were given the opportunity to receive the results of the research at the end the research period if they wished.

The decision to use the Internet as a means of surveying the population allowed greater cost savings associated with eliminating the printing and mailing of survey instruments (Cobanaglu et al., 2001). Studies have shown that for special populations that regularly use the Internet, this method has been found to be a useful means of conducting research (as cited by Kaplowitz et al., 2004). Kaplowitz et al. (2004) found that in a population in which each member has Internet access, an Internet survey application achieved a comparable response rate to a surface mail questionnaire when both are preceded by an advance mail notification. The population of study for this research consisted of graduates from RCA-approved Culinology® programs, and tended to be younger, between the ages of 22 and 30 years old, and part of “Generation Y.” This generation of students is “dependent upon technology” and has been called a “digital native” generation (Black, 2010). Digital natives are characterized as fluent in acquiring and using technological tools and seemed to use these tools as an extension of their brains (Black, 2010). For these reasons, it was appropriate to use Internet surveys as a means to reach the population of study.

Step Four: Identify Individuals at Various Performance Levels

In the second stage, follow up interviews were conducted with purposely selected individuals in the food product development industry that best helped the researcher

understood the significant findings that arose out of the first stage. The sample selection, interview contents, procedures, and analysis are explained next.

Interview Sample Selection

From the Stage One sample group represented by graduates, two graduates from each of the four institutions represented in the final sample size were purposefully selected, for a total of eight participants. The selection criteria for the graduates included the institution they graduated from and their tenure in the food product development industry. The purposeful selection resulted in four participants with 0 – 12 months of experience, and four participants with 13 or more months of experience in the food product development industry. Each participant was sent an email and invited to participate. Six out of the eight graduates responded and agreed to participate in this portion of the study. These six participants represented an equal balance of work experience in the food product development industry, with three having less than twelve months of experience, and three with more than 13 months of experience. Phone interview dates and times were set with each graduate approximately one week from their initial response via email. Along with the email confirmation, each participant from the graduate sample were also provided with the full listing of the RCA's Bachelor of Science in Culinology® Core Competencies, as shown in Appendix C.

Similarly, three participants from the employers group that completed the survey in Stage One were purposefully selected and contacted via email to participate, with care taken to ensure that the employers do not represent the same corporation. Two out of the three responded, and a follow-up email with the RCA's Bachelor of Science in Culinology® Core Competencies (Appendix C) was sent to them, along with a request for a date and time to conduct the telephone interview. Approximately three weeks lapsed after the initial email

invitation before both interviews could be completed, due to the employers' busy work and travel schedules. One of the employers has previously served on the RCA Education Committee, and had prior knowledge of the core competencies, whereas the other employer was relatively new to the concept of Culinology® degree core competencies.

Interview Content

All interview questions were written as open-ended questions, in order to discourage short 'yes' or 'no' responses. Interview protocols were developed for both the graduates and employers to better guide the researcher in exploring the topic (as shown in Appendix I, Interview Protocols). The protocol was reviewed and approved by the Committee members. The interview was designed in a semi-structured format to allow the researcher to ask pre-planned questions during the interview that addressed the findings from Stage One. Based on the participants' responses, the researcher added questions to allow for more in-depth probing to garner more detailed information. The questions that were asked during the interviews were developed from the quantitative analysis of Stage One's results.

Three introductory questions were asked at the beginning of the interviews to initiate the interview conversation. Both graduates and employers were first asked for their position title, their length of employment at their current position, and if they were members of the Research Chefs Association. Then, the graduates were asked a series of research questions designed to investigate their choice of rating of importance and frequency of use for each of the competencies, whether or not their university's curriculum sufficiently prepared them in each of the competency for employment after graduation, and their perceptions of the results from Stage One indicating employers valued culinary arts highly. The employers were asked what influenced their choice of rating of importance and frequency of use for each of the

competencies, their perceptions of whether the core competencies sufficiently prepared graduates for employment, and their opinion on the findings from Stage One of the research which indicated that employers valued the culinary arts competency more than graduates. The interview questions were scripted to ensure that all relevant research questions were asked of each participant.

Interview Procedure

Before starting the interview, each participant was asked if they had received and reviewed a copy of the complete list of competencies sent in an earlier email. All participants were reminded that they were considered the expert at their work, and encouraged to provide honest and open answers. Each participant was also read a script to ensure that they understand that their participation was strictly voluntary, and their confidentiality would be maintained at all times. Informed consent was not needed again as all participants had already given their consent to participate in the study during Stage One of the research. The participants were notified that the interviews will be audio-recorded, transcribed, and the results would be sent to them for member-checking after the interviews were over. Each interview lasted approximately one hour, and the researcher took pertinent notes during the interview.

Interview Analysis

Upon completion of the interviews, the audio recordings were transcribed by the researcher into raw text. The interview responses were sent to each respective participant for member checking, so as to ensure the accuracy of the results. Once the participants verified and approved the transcripts, two transcripts (one each from the graduates and employers group) were sent to an external researcher for coding and identification of themes. Two

external researchers assisted the researcher with the identification of the themes. One researcher is an Assistant Professor of Marketing at a regional public university, and the other researcher is an Associate Professor of Hospitality Management at a public university. Both researchers were familiar with qualitative research methods and Culinology® competencies.

The researcher and one of the external researcher independently developed the codes and themes from the same two transcripts. The responses were read in detail and both researchers started to look for emerging themes from the transcripts. These themes were categorized and defined by the both researchers. The more general categories were derived from the research objectives and the more specific categories were derived from the results in Stage One and multiple readings of the raw data. After agreement was reached between the researcher and external researcher on the classification of the codes and themes, the researcher coded the remainder of the transcripts. Using the constant comparative method (Taylor & Bogdan, 1998), new themes and subthemes were identified, and in some cases, consolidated, re-arranged, and discounted. Continuous revisions and refinement of the categorization of themes took place until all themes and sub-themes were identified. Contradictory viewpoints and new insights were noted by the researcher, and appropriate quotes were selected that conveyed the core theme or essence of the category. Investigator triangulation was conducted with both external researchers to increase the validity and reliability of the data. Concepts and propositions were developed based on this set of themes (see Appendix J for the list of themes developed).

Phase Five: Data Analysis

This study used the sequential explanatory design, with the collection and analysis of

quantitative data occurring in the first stage, followed by the collection and analysis of qualitative data in the second stage that built on the results of the initial quantitative data (Creswell, 2009). Once the quantitative data collection stage was completed, a pre-analysis data screening was performed to ensure the accuracy of the data and to deal with missing and incomplete data. Frequency analysis was used to screen the data for any irregularities. The data also were checked for normality by using the Shapiro-Wilk W test. The survey questionnaire's data were analyzed statistically using Stata 11.2 (StataCorp, 2009). A relational analysis of the survey results between both groups (graduates and employers) was conducted, and any semantic or meaningful observations that surface was analyzed and explored deeper during the qualitative phase.

Descriptive statistics was used to analyze the demographic profiles of Culinology® graduates and to obtain the means and standard deviations on each of the dependent and independent variables. The nonparametric version of the t -test (at $p = 0.05$) was conducted to determine whether there was a significant difference between genders. The Kruskal-Wallis one-way analysis of variance (ANOVA) by ranks test was used to determine if there were significant differences (at $\alpha = 0.05$) for each of the competency factor sets (importance and frequency of use) according to the following demographic information: (a) age, (b) institution they graduated from, (c) length of time in current position, and (d) years of food product development experience.

Qualitative validity, an important component of qualitative research procedures that ensures the accuracy of the findings, was achieved by triangulating the data sources—comparing the graduates' and employers' responses with external sources of data, such as the RCA survey (see Appendix K for results of the RCA survey), and also via investigator

triangulation with two external researchers. Qualitative reliability was ensured by consistently documenting the procedures throughout the process. Other procedures for enhancing validity and reliability included:

- Using member checking, a process to determine the accuracy of the qualitative findings by reviewing the final report with the participants,
- Writing down the questions asked, in addition to the answers received,
- Employing researcher reflexivity by recording personal thoughts during the interviews,
- Documenting the sources of remarks whenever possible and appropriate, and
- Documenting the basis for inferences. (Fraenkel & Wallen, 2009)

Limitations

The research subjects in this study were the graduates of Culinology® programs in the United States. Due to the relatively short existence of Culinology® programs to date, the available pool of research subjects consisted of 101 graduates, with their corresponding employers. Although the position of culinologist can be held by individuals who obtained the equivalent of a Culinology® degree by attaining a separate food science degree and a culinary arts degree, they were not included in the sampling frame. Also excluded in this study were graduates of baccalaureate food science programs currently employed as culinologists. Similarly, graduates of culinary arts programs who were currently employed as culinologists were also excluded. Likewise, if a survey respondent who represented the employer of Culinology® graduates also had non-Culinology® graduates working for the company, those employers were asked to limit their responses in relation to the employee who has the Culinology® degree only.

A final limitation involved the potential for bias in the study. The researcher is currently the program administrator for one of the RCA-approved Culinology® degree programs and previously held the position of Co-Chair of the RCA Higher Education Subcommittee from 2000 - 2010. All attempts were made to remove any bias that may come as a result of these appointments by asking peer Culinology® educators to review the study and instrument. These Culinology® educators were also involved in the course of the study and research design. Another step that was taken to eliminate possible bias in this study was to record the interviews with the graduates and employers on digital media and transcribe the interviews to ensure the accuracy in the statements of the participants. This step led to more accurate data as the researcher cross-referenced and categorized and coded the data during the analysis of the interviews.

Validation of the Competency Model

For a competency model to be used effectively, Lucia and Lepsinger (1999) recommended that it must have face validity and must be validated as a predictor of successful performance. There were four steps that were undertaken to ensure this:

1. Conduct focus groups, surveys, or both to test the model
2. Analyze focus group and survey data and refine the model
3. Validate the model by comparing the results from the quantitative data analysis with the qualitative data
4. Finalize the model (p. 93)

Validation of the competency model included the development and testing of the pilot study instrument (Phase Three), data collection (Phase Four), and data analysis (Phase Five).

The final step in the validation of the competency model was the development of the actual

competency model for Culinology® degree graduates at the conclusion of this research.

Rigorous job analysis methods as outlined by Campion et al. (2011) was used to develop the competencies.

CHAPTER 4. RESULTS AND DISCUSSIONS

This chapter discussed the results of the study and is divided into two sections. Descriptive statistics of the sample population will be presented first, followed by the results and discussion of the data analysis. It was organized based on the four research questions. This study expanded the body of literature on Culinology® by validating and measuring the effectiveness of the Research Chefs Association's (RCA) Bachelor of Science in Culinology® core competencies, as determined by the employers and Culinology® graduates themselves. The first research question asked if the employers believed the competencies possessed by the Culinology® graduate met their needs. The second research question asked the Culinology® graduates if the RCA's Bachelor of Science in Culinology® core competencies prepared them for employment in the food product development industry. The third question examined if there was a relationship between the employers' assessment and the graduates' self-assessment. The final question explored the implications of the results for curricular reform in Culinology® education.

Data Collection

As discussed, two populations of interest were examined in this study. The first group consisted of graduates of RCA-approved Culinology® programs, and the second group consisted of their corresponding employers. As of 2012, there are thirteen RCA-approved Culinology® degree programs. Of the thirteen programs, nine Culinology® programs were selected for this research, based on the implementation year of their Culinology® programs. These nine programs were most likely to have graduates working in the food product development industry at the time of this study. Listed in chronological order, they are:

1. University of Nebraska-Lincoln, 2001

2. Clemson University, 2002
3. University of Cincinnati, 2002
4. Dominican University, 2003
5. California State Polytechnic University, Pomona, 2004
6. University of Massachusetts-Amherst, 2005
7. Southwest Minnesota State University, 2005
8. California State University, Fresno, 2006
9. Rutgers University, 2007

The study was conducted in two stages. Sequential explanatory strategy was used to explain and interpret the quantitative results from the first stage by collecting and analyzing the follow-up qualitative data of the second stage. For the first stage of the study, a total of 101 graduates were identified from seven of the nine programs, however, only 81 corresponding email addresses were obtained. These graduates' names were obtained with permission from the individual program directors and coordinators. One program was not able to provide the names of its graduates, and another program did not have any graduates yet when this research was conducted. The sample size of 81 graduates represented seven of the nine programs. The second stage of the study involved six graduates and two employers identified from the same sample.

For Stage One of the study, 81 graduates of RCA-approved Culinology® degree programs were contacted via email. It was hoped a similar sized group of employers would be obtained from the graduates' responses. The unit response rate for the graduates group was 58.02%, ($n = 47$), with item response rate of 44.44%, ($n = 36$). The item response rate represented surveys that were usable only, as not all of the survey respondents answered all

ten questions on the competencies.

From the responses, 61.70% ($n = 29$) provided information regarding their current employer to be used in the second stage of the study. Unfortunately, not all of the graduates' employers consented to participating in the research. The unit response rate for the second group, employers of Culinology® degree program graduates, was 48.28% ($n = 14$), with 34.48% ($n = 10$) item response rate. Tables 4 and 5 present the breakdown of both groups for the first stage of the study.

Table 4

Breakdown of Sample Data from Graduates Group

	<i>n</i>	%
Sample size	81	100.00
Unit response rate	47	58.02
Item response rate	36	44.44

Table 5

Breakdown of Sample Data from Employers Group

	<i>n</i>	%
Sample size	29	100.00
Unit response rate	14	48.28
Item response rate	10	34.48

Table 6 presents the demographic data of the sample. A majority of the usable responses were graduates of two Culinology® programs, the University of Nebraska-Lincoln ($n = 15$) and University of Cincinnati ($n = 13$). Both programs have the highest number of graduates and have been in existence since 2001 and 2002, respectively. Only four institutions were represented in the final sample of usable responses; University of Nebraska-Lincoln (UN-L), University of Cincinnati (UC), Southwest Minnesota State University (SMSU), and Clemson University (CU). Members of both genders were almost equally

represented in the sample. The average age of the graduates was 27.19 years old ($SD = 4.32$), ranging between 22 to 39 years old.

Table 6

Demographic Information of Usable Responses from the Graduates Group

		<i>n</i>	%
Gender	Female	19	52.78
	Male	17	47.22
Institution	University of Nebraska-Lincoln	15	41.67
	University of Cincinnati	13	36.11
	Southwest Minnesota State University	5	13.89
	Clemson University	3	8.33
	Dominican University	0	0.00
	California State Polytechnic University, Pomona	0	0.00
	University of Massachusetts-Amherst	0	0.00
	California State University, Fresno	0	0.00
	Rutgers University	0	0.00

Note. Dominican University was not able to provide information regarding its graduates, and Rutgers University did not have graduates yet at the time of this study.

Table 7 compares the graduates' number of years in their current position and in the food product development industry. A large majority (83.3%) of the graduates have been in their current positions for less than two years, and 61.1% of graduates have worked in the actual food product development industry for less than two years. Table 7 also showed that the total number of graduates who have worked in their current position ($n = 30$) for less than two years is more than the total number of graduates who have two years or less of food product development experience. This could be due to the changing nature of their positions within their companies, and the consolidation of job functions. None of the graduates had more than five years in their current position, although several ($n = 6$) have indicated they have more than five years of experience in the food product development industry.

Table 7

Graduates' Years of Experience in Current Position and in Food Product Development

	Current Position		Food Product Development	
	<i>n</i>	%	<i>n</i>	%
0 – 1 Year	15	41.67	14	38.90
1 – 2 Years	15	41.67	8	22.22
2 – 5 Years	6	16.66	8	22.22
More than 5 Years	0	0	6	16.66

Note. *n* = 36

The second group of respondents, employers of Culinology® graduates, was represented by 8 males and 2 females. The average age of the employers was 40.7 years, and all of them indicated they have more than five years of food product development experience. Six of the employers have been in their current positions for over five years, whereas two have been in their current positions for two to five years. Only two of the employers were relatively new to their current positions, with less than two years in that role. Due to the small sample size of the employers group, only descriptive and nonparametric statistics was used to analyze the data.

In Stage Two of the study, six graduates and two employers were interviewed. The six graduates purposefully selected represented all four institutions of the final sample group. Two were graduates of the University of Nebraska-Lincoln, two were graduates of Southwest Minnesota State University, and there were one graduate each from Clemson University and the University of Cincinnati. Fifty percent of the graduates have 0 – 12 months of experience whereas the remaining 50% of the graduates have 13 or more months of experience, but less than five years of experience in the food product development industry. The two employers chosen for follow-up analysis were also selected purposefully, and are not employers of the six graduates selected. One represented a major food manufacturer on the east coast, and the

other represented a small to medium size product development consultancy in the Midwest. One of the employers has in-depth knowledge of the RCA's BS in Culinology® degree core competencies, and also previously served as Chair of the RCA Education Committee. The other employer is not as actively involved in the RCA but does have in-depth knowledge of competencies from his involvement with non-credit product development workshops. Both have been working in the food product development industry for more than 30 years.

Data Analysis

The data were first screened to ensure the accuracy of the data and also to deal with missing and incomplete data. The data then were checked for reliability.

Cronbach's alpha was calculated at 0.83 for the graduates' responses and 0.84 for the employer's responses. Level of significance (α) was set at 0.05 for all analyses. Next, normality tests were performed to determine the appropriate statistical tests to use for analysis. Many parametric statistical tests often assume the sample is from a population with normal distribution. Since the sample size ($n = 36$) is less than 100, it is difficult to ensure the variables are normally distributed. Therefore, the use of nonparametric tests is appropriate for this research.

There are two ways to test for normality: by using graphical methods and/or numerical methods. Graphical methods visualize the distributions of random variables between an empirical distribution and a theoretical distribution (Park, 2008). Numerical methods use summary statistics such as skewness and kurtosis, or statistical tests of normality. The Kolmogorov-Smirnov D test and Shapiro-Wilk W test are most commonly used (Park, 2008). Razali and Wah (2011) concluded that the Shapiro-Wilk W test is the most powerful normality test, thus the decision was made by the researcher to utilize the

Shapiro-Wilk W test to assess the data's normality.

The results of the Shapiro-Wilk W test on the graduates group showed that six out of the ten competencies were not normally distributed, as indicated by the asterisk in Table 8. This was confirmed by a graphical method, using histogram charts, as shown in Figure 2.

Table 8

Shapiro-Wilk W test for Normality (Graduates Group)

Competency	Prob > z
Culinary Arts	0.36
Baking, Pastry and Confectionary Arts	0.93
Food Chemistry Analysis and Functions of Ingredients	0.01*
Food Safety and Quality	0.01*
Food Processing and Manufacturing	0.01*
Nutrition	0.34
Business of Product Development	0.01*
Food Policy Analysis and Regulations	0.03*
Sensory Evaluation	0.01*
Research Methodologies and Experimental Design	0.12

* $p < 0.05$

The competencies that exhibited skewness were:

- Food Chemistry Analysis and Functions of Ingredients
- Food Safety and Quality
- Food Processing and Manufacturing
- Business of Product Development
- Food Policy Analysis and Regulations
- Sensory Evaluation

The skewness of these six competencies can be attributed to any number of factors, such as the small sample size, the institutions represented in the sample size, or the respondents' current job requirements. Further analysis on the graduates' rating of importance for each of

the competencies was conducted in Stage Two of the research, and discussed in Research Question One.

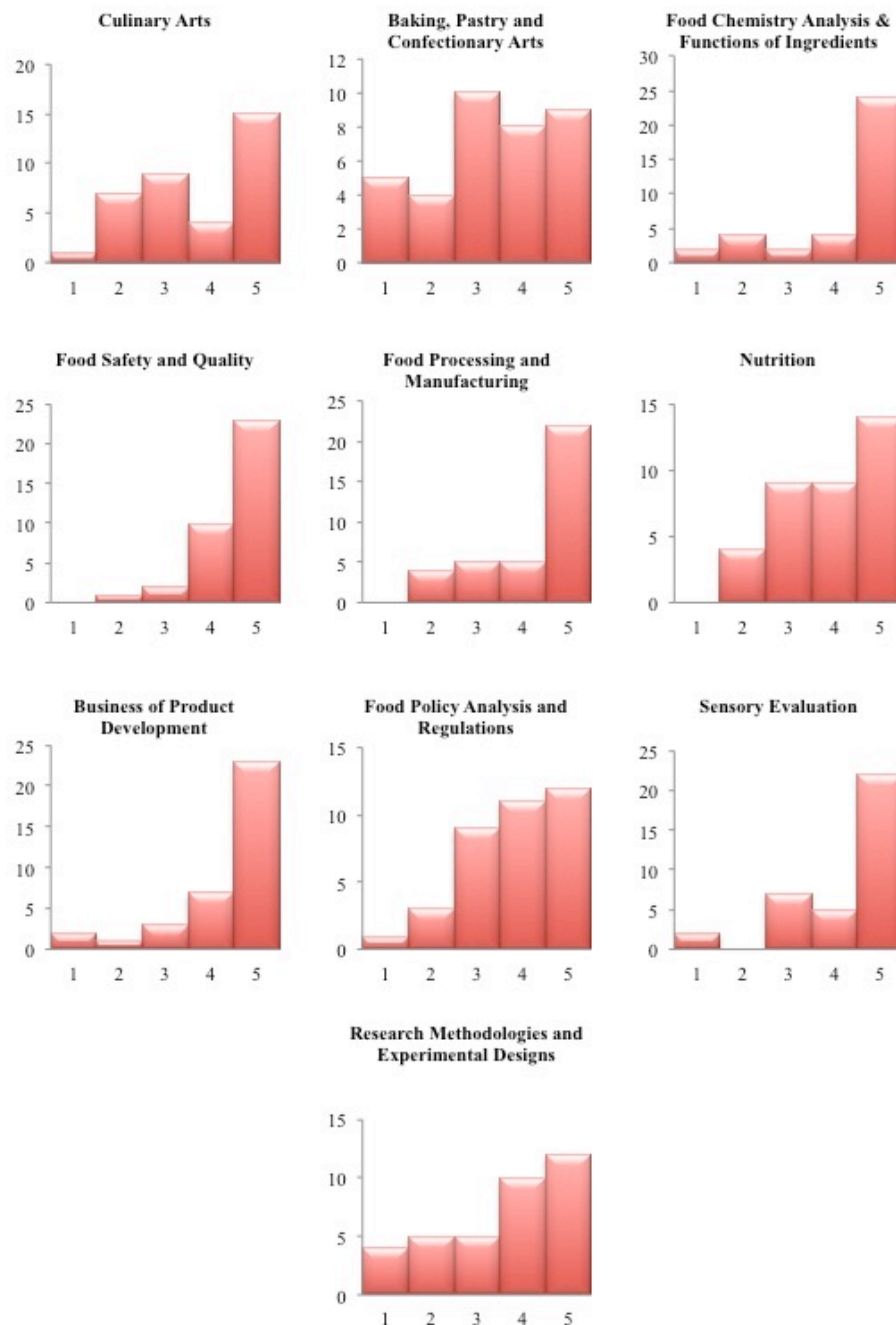


Figure 2. Histograms of graduates' rating on importance for each competency. Graphic shows each competency, based on a five-point Likert-type scale (1 = Not important, 5 = Very important).

For the employers' group, the Shapiro-Wilk W test revealed two out of the ten competencies were not normally distributed. They were the Culinary Arts and Sensory Evaluation competencies. Table 9 presents the analysis of the employers' group, and Figure 3 confirmed the graphical presentation of the two variables identified.

Table 9

Shapiro-Wilk W test for Normality (Employers Group)

Competency	Prob > z
Culinary Arts	<0.01*
Baking, Pastry and Confectionary Arts	0.58
Food Chemistry Analysis and Functions of Ingredients	0.89
Food Safety and Quality	0.31
Food Processing and Manufacturing	0.31
Nutrition	0.75
Business of Product Development	0.99
Food Policy Analysis and Regulations	0.99
Sensory Evaluation	0.02*
Research Methodologies and Experimental Design	0.61

* $p < 0.05$

Univariate analysis methods were next utilized to check the data before analysis. Frequencies, means, and the Kruskal-Wallis one-way analysis of variance by ranks tests were performed next on the graduates' and employers' data to obtain descriptive statistics. Kruskal-Wallis is a non-parametric method of the one-way analysis of variance (ANOVA) test, and does not assume a normal distribution. No significant differences were found by gender, length of time in current position, or years of food product development experience from the graduates' data. However, the Kruskal-Wallis one-way analysis of variance test on the variable *school* in the graduates' data revealed a significant difference for one of the dependent variables, Food Chemistry Analysis and Functions of Ingredients. Further analysis conducted on this significant relationship was discussed in Research Question Two.

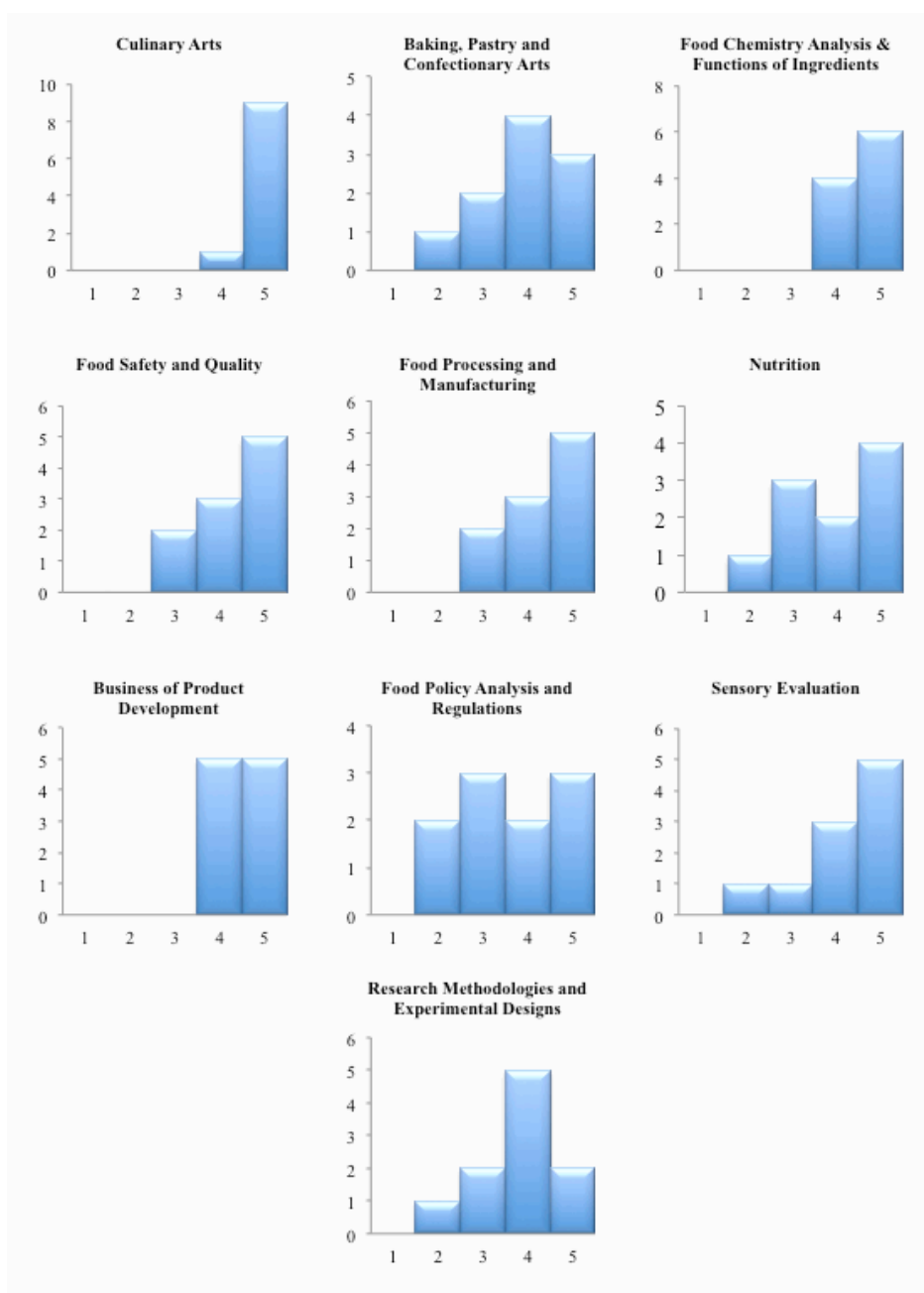


Figure 3. Histograms of employers' rating on importance for each competency. Graphic shows each competency, based on a five-point Likert-type scale (1 = Not important, 5 = Very important).

Table 10 presents the graduates' average rating of importance for each of the core competencies, ranked from high to low. The core competency with the lowest mean was Baking, Pastry, and Confectionary Arts ($M = 3.33$, $SD = 1.35$), whereas the core competency

with the highest mean was Food Safety and Quality ($M = 4.53$, $SD = 0.74$). Table 11 presents the employers' average rating of importance for each of the core competencies, ranked from high to low. The core competency with the lowest mean was Food Policy Analysis and Regulations ($M = 3.60$, $SD = 1.17$), whereas the core competency with the highest mean was Culinary Arts ($M = 4.90$, $SD = 0.32$). The difference between the ratings was analyzed and discussed in Research Question Three.

Table 10

Graduates' Mean Rating of Importance for Each Competency, From High to Low

Competency	<i>M</i>	<i>SD</i>
Food Safety and Quality	4.53	0.73
Business of Product Development	4.33	1.12
Food Processing and Manufacturing	4.25	1.08
Sensory Evaluation	4.25	1.13
Food Chemistry Analysis and Functions of Ingredients	4.22	1.29
Nutrition	3.92	1.05
Food Policy Analysis and Regulations	3.83	1.08
Culinary Arts	3.69	1.28
Research Methodologies and Experimental Design	3.58	1.38
Baking, Pastry and Confectionary Arts	3.33	1.35

Note. Based on five-point Likert-type scale (1 = Not important, 5 = Very important)

Table 11

Employers' Mean Rating of Importance for Each Competency, From High to Low

Competency	<i>M</i>	<i>SD</i>
Culinary Arts	4.90	0.32
Food Chemistry Analysis and Functions of Ingredients	4.60	0.52
Business of Product Development	4.50	0.53
Food Safety and Quality	4.30	0.82
Food Processing and Manufacturing	4.30	0.82
Sensory Evaluation	4.20	1.03
Nutrition	3.90	1.10
Baking, Pastry and Confectionary Arts	3.90	0.99
Research Methodologies and Experimental Design	3.80	0.92
Food Policy Analysis and Regulations	3.60	1.17

Note. Based on five-point Likert-type scale (1 = Not important, 5 = Very important)

Research Questions and Hypotheses

In this section, the research questions and its corresponding hypotheses were examined and tested. The results were analyzed and discussed following each research question.

Research Question One

The first research question evaluated the success of the competencies possessed by the Culinology® graduate in meeting the needs of the employers, from the employers' viewpoint. Twenty-nine employers were identified from the graduates' responses, and fourteen employers completed the survey, yielding a response rate of 48.28%. Of the fourteen responses from the employers, four were incomplete, thus leaving ten complete surveys for analysis. Table 11 presents the employers' average rating of importance for each of the ten core competencies. The competency with the highest mean for importance in the day-to-day responsibilities of a culinologist as rated by the employers was Culinary Arts ($M = 4.90$, $SD = 0.32$), and the competency with the lowest mean for importance was Food Policy Analysis and Regulations ($M = 3.60$, $SD = 1.17$).

The results were as expected, as almost all job postings for culinologists emphasized the need for culinary arts skills. This finding correlated with the report published by the Minnesota State Colleges and University (2010), foodprocessing.com (2012) and is underscored numerous times by Mermelstein (2003), Thomas (2008), Feder (2009) and Bisset et al. (2010b). The employer's responses from the second stage of the study also validated Culinary Arts as the number one competency they would like an employee to have. Employers' responses included:

1. “There is no sense in trying to make a food product without it. That’s kind of like somebody with no artistic training trying to paint. You can come up with stuff that simulates food, but it’s never going to be authentic or particularly high quality. It doesn’t mean that you can’t make a business without the culinary, but you’re not talking about a food business, you’re talking about something else,”
2. “The culinary piece is certainly a critical piece. It is not the only piece, but it is certainly fundamental to being a culinologist,” and
3. “. . . culinary foundation is based on the dozen cooking techniques and how to master the cooking techniques is absolutely critical when you go into the commercialization process. You might not be able to roast something so you might have to add a roasted flavor, or add grilled marks or something that would be done differently in the gold standard but still delivered the same flavor and appearance attributes. So I think the culinary part is really the foundation for the science part.”

In a separate survey conducted by the RCA between December 2011 and January 2012 on its membership, respondents also listed Culinary Arts as the most important knowledge competency (See Appendix K for the results of the survey, sorted by rank order). This survey was completed by the general membership of the RCA, and was not restricted to just graduates of Culinology® degree programs or employers. The focus of the RCA’s survey was to identify the core knowledge competencies for those practicing Culinology®, using a similar knowledge competency listing (see Appendix D for the complete list).

The competency with the lowest mean, Food Policy Analysis and Regulations ($M = 3.60$, $SD = 1.17$), included the following content areas:

- FDA, USDA, and ATF food regulations
- Food and beverage labeling requirements
- Food additives, nutraceuticals, and dietary supplements
- ISO 9000 requirements
- Legal aspects involved in intellectual property preservation
- Knowledge of multicultural competency such as halal and kosher requirements
- Knowledge of OSHA systems as related to factory inspections

Interestingly, the Knowledge of Food Safety & OSHA Systems and Laws competency was ranked 23rd by the RCA membership in their survey. Knowledge of Government Food Regulations, including FDA, USDA, NLEA, CFR, etc. was ranked 40. None of the other content area above was ranked by the RCA membership in their survey. It is also important to note the competencies and content areas of the Culinology® degree core competencies do not align perfectly with the competencies and content areas of the RCA's knowledge competencies for practicing culinologists (see Appendix D for complete listing of the RCA's knowledge competencies), although they do contain a large majority of the same competencies. Even though the mean for the Food Policy Analysis and Regulations competency was 3.6, it was still viewed as an important competency that is required for Culinology® graduates. On a Likert-type scale of 1 to 5, a mean of 3.6 is still above average. In Stage Two of the research, one employer commented:

... all of us working in the food industry have to be cognitive of our two overseers, the FDA and USDA and what their requirements are of food that is to be manufactured and sold for sale, particularly food that has to cross state lines. Critical regulations have to be followed both in terms of correct processing, correct labeling,

quality control and it all comes down to abiding by the law. The FDA and USDA's primary reason for this is protecting the safety and well-being of the public. It's not like there is a choice. You have to do it. So you really need to know about it and you certainly need to know what the major laws are. It's what we all live by. It's our bible.

All major food manufacturers have their own regulatory departments that are responsible for ensuring their food products meet federal standards. In many cases, the role of the culinologist in major food manufacturing companies do not include in-depth knowledge of every law on food regulations but rather, general understanding of the required rules and regulations pertaining to their work. This ensures that the culinologist creates food products that are safe for consumers. Timmer, Falcon, and Pearson (1983) stated:

Food policy encompasses the collective efforts of governments to influence the decision making environment of food producers, food consumers, and food marketing agents in order to further social objectives. Food policy analysis is the process of research and thinking designed to discover the complementarities and trade-offs among food policy objectives and to identify government initiatives in the project, program, and policy arenas that can best achieve these objectives. (p. 6)

In essence, food policy analysis is concerned with all food-related issues, including food laws and regulations. The content of the competency does not accurately reflect the title of the competency, and should be revised accordingly. It is possible that this could have result in a lower mean from the employers' perspective, if their understanding of the competency was more aligned with the definition provided by Timmer et al. (1983). Even so, a mean of 3.6

for the Food Policy Analysis and Regulations competency still denoted that it is a critical knowledge competency for the Culinology® graduate.

Each employer was asked if there were one or more content areas within each of the competencies in question they believed were less important than the others. The responses for the Culinary Arts competency revealed the following content areas as less important:

- Knowledge of beverages, including basic production of wines, presentation and service
- Knife skills within a corporate setting
- Knowledge of culinary history
- Knowledge and application of Garde Manger and butchery skills, including preparation of appetizers, forcemeats, salads and salad dressings, and fabrication of meat, poultry, and seafood.
- Menu development, including menu planning and costing

With the exception of the knife skills content area, each of the content areas above were validated again in a following question regarding its frequency of use, thus reaffirming the employers' responses. Knowledge of culinary history was mentioned four times as less important than the other areas. It is possible the employers responding to the survey think of culinary history as understanding the roots of classical cuisine, Escoffier, and perhaps the origins of food, hence its low importance. However, most culinary skills training begin with the understanding of classical cuisine cooking methods, and the creation of proper flavors and aromas through cooking (Muller et al., 2009). The importance of ensuring culinologists develop proper foundations in culinary arts by understanding culinary history is essential, and aligns with the employers' selection of culinary arts as the highest rated competency.

This was confirmed by the RCA's survey, which ranked Knowledge of Culinary Fundamentals and Production Systems as fourth most important, and Knowledge of Traditional Stocks and Sauces as 13th most important for those practicing Culinology®. Similarly, knife skills are crucial to the training of a chef as well as a culinologist. However, for a culinologist who has advanced to a managerial position within a corporate environment, knife proficiency skill set may be less important than the ability to manage employees, resources and projects (Birdir & Pearson, 2000).

The beverage content area is typically taught in the majority of culinary arts programs as an elective course, therefore it was not surprising to see it listed as less important by the employers. Garde Manger and charcuterie skills are traditionally included in the profession of a chef, and the use of classical methods of forcemeat or terrine making is unlikely to be found in the commercial food production industry. One employer indicated that none of the content areas within the Baking, Pastry, and Confectionary Arts core competency were important in the day-to-day responsibilities of the culinologist. The researcher believed this could be due to the nature of the respondent's job, which may not have included baked goods. When compared with the RCA's survey results, none of the three aforementioned content areas and competency were identified as core to the practicing culinologist.

In the Food Safety and Quality competency, one employer indicated that knowledge of the use of microorganisms in food production was less important than the others because they rarely ferment anything. In the Food Processing and Manufacturing competency, one employer indicated that knowledge of the principles of food processing and packaging technologies was less important because it was an area often specified by their customers.

Generally, that is true for most private label food manufacturers, as they produce and package the products according to their customers' specifications.

In the Nutrition competency, one employer indicated that knowledge of laws and evaluation systems was less important. With the current focus on sodium reduction in the food manufacturing industry, including federal mandates, it was surprising to see that knowledge of laws and evaluation systems was viewed as less important (IFT, 2010). The researcher believed the employers may have a different interpretation of this outcome if they understood that it included understanding the parameters of food composition and labeling laws, as well as government and health evaluation systems. This was affirmed by the results of the RCA's survey, which ranked Knowledge of Current Nutrition Trends 15, Knowledge of General Nutrition 17, and Application of Nutrition Knowledge 30.

In the Business of Product Development competency, one employer replied that trends analysis was less important than others. This outcome included the ability to read, understand, and interpret market trends and data. The researcher believed the employer may have a different interpretation of trends analysis, as almost all aspects of successful food product development included the ability to stay ahead of the competition by developing food products that targeted new and emerging trends (Spinelli, Jr., 2003; foodprocessing.com, 2012). The results of the RCA's survey also placed Knowledge of Current and Projected Food Trends as 16th most important in ranking.

In the Food Policy Analysis and Regulations competency, three employers stated that knowledge of ISO 9000 requirements as well as knowledge of OSHA systems as related to factory inspections were less important. This was again reaffirmed in a subsequent question. ISO 9000 is a family of standards related to quality management systems, and its use by a

culinologist is very limited. OSHA inspections are typically the responsibility of the Quality Assurance personnel, and culinologists are usually not involved with that area. However, the RCA's survey results indicated otherwise and ranked OSHA systems and laws as a core knowledge competency for the practicing culinologist.

No content areas within the Food Chemistry Analysis and Function of Ingredients, Sensory Evaluation, and Research Methodologies and Experimental Design core competencies were identified by the employers as less important, or used less frequently by the graduate in the workplace.

The employers were also asked if there were any other competencies they believed are critical for the culinologist to have or possess that were not already listed. The responses listed the following content areas:

1. "Team work, and understanding how culinary teams work with product development teams"
2. "Sales and presentation skills"
3. "Cost analysis, especially the cost of ingredients used in the finished product"
4. "Product commercialization"
5. "Computer skills, i.e. Word Press for website, Excel, and Power Point"

These content areas are typically covered in the undergraduate curriculum in various general education classes, and also sometimes emphasized in the major classes. It is recommended more emphasis should be given to these content areas, as a recommendation for curricular improvement. In particular, soft skills such as communication skills, having a positive attitude and teamwork skills are highly valued by employers when hiring for entry-level positions (Schawbel, 2012). Product commercialization included the theory and

applied knowledge of developing a food product, and is included in the Business of Product Development competency, although the wording of the outcome may need to be clearer. The RCA's guidelines for approved Culinology® degree programs stated that pilot plant facilities will be available to teach the stated learning outcomes; however, in institutions where these facilities are not available, evidence of joint partnerships with other institutions or organizations for access to these facilities must be provided (see Appendix L for complete information on the RCA's Guide to Developing Approved Culinology® Degree Programs). The researcher believes most RCA-approved Culinology® degree programs do not have their own pilot plants and relied on partnerships with other organizations or institutions to provide those experiential learning opportunities. In some cases, the institutions relied on the students' internship experiences to provide those experiential learning. Therefore, hands on experience with product commercialization could be a hit-or-miss, depending on the institution, faculty, and student.

Additional comments provided by the employers when asked for feedback regarding the RCA's Bachelor of Science in Culinology® core competencies are listed below:

1. "Too broad of scope, combining both disciplines offers a good balanced individual with the basic foundational base. However, foodservice/ restaurant needs are very different from the skill set needed to be successful in manufacturing."
2. "I believe that the RCA BS program is sound in teaching fundamentals, but has room for improvement in helping its graduates to have a better understanding of how to effectively scale up from kitchen gold standards to industrial scale production."

3. “Solid methodology, well rounded back ground, passion, knife skills, demonstrated knowledge of all cooking techniques.”

In relation to the first comment, “. . . foodservice/restaurant needs are very different from the skill set needed to be successful in manufacturing,” the researcher noted the focus of the Culinology® degree core competencies was to develop graduates with knowledge of culinary arts and food manufacturing, much to the chagrin of RCA members who work in the foodservice segment. The RCA’s Board of Directors recognized the need to acknowledge and work with corporate chefs in the foodservice sector during its strategic planning session in 2009 (Research Chefs Association, personal communication, June 5, 2012), but the realignment of the Culinology® degree core competencies to include a focus in that arena has yet to happen. McGrath (2008) listed restaurant/food service cooking experience of five to ten years as a required minimum qualification for the research chef.

Overall, the RCA Bachelor of Science in Culinology® degree core competencies met the needs of the employers. As commented by one of the employers in Stage Two of the research study, “. . . on all the base knowledge of all these competencies is perfect. It’s like the launch pad for really understanding product development, different manufacturing processes, and the steps products go through in a commercialization process, but having this base knowledge helps you understand all the critical control points and any type of Q/A perspectives.” Several new areas for inclusion in future revisions of the Culinology® competencies were suggested, as well as the removal of a few individual outcomes such as ISO 9000. The average of all means was 4.2, on a Likert-type scale of 1 – 5, with 5 as most important. This implied that employers believed the competencies to be relevant to the performance of their employees in their day-to-day functions as culinologists.

Research Question Two

The second research question aimed to identify how effective are the core competencies of the RCA's Bachelor of Science in Culinology® in preparing graduates for employment in the food product development industry, as self-assessed by the graduates. This research question was answered by testing three hypotheses. For each hypothesis, the results were analyzed and discussed. The research question was answered following the analyses.

Hypothesis One: There is no significant difference between the graduates' perception of importance and frequency of use for each of the identified core competencies.

To test this hypothesis, the nonparametric version of the paired *t*-test was applied to determine if the graduates' mean rating of importance differed from their frequency of use for each competency. The Wilcoxon signed rank sum test was used for this purpose. Table 12 shows all competencies were significantly different between importance and frequency of use except for three:

- Culinary Arts ($p = 0.15$)
- Food Safety and Quality ($p = 0.11$)
- Sensory Evaluation ($p = 0.08$)

Table 12

Wilcoxon Signed Rank Sum Test Comparing Graduates' Mean Rating of Importance and Frequency of Use

Competency	<i>p</i> value
Culinary Arts	0.15
Baking, Pastry and Confectionary Arts	<0.01*
Food Chemistry Analysis and Functions of Ingredients	0.01*
Food Safety and Quality	0.11
Food Processing and Manufacturing	<0.01*
Nutrition	<0.01*
Business of Product Development	0.02*
Food Policy Analysis and Regulations	<0.01*
Sensory Evaluation	0.08
Research Methodologies and Experimental Design	<0.01*

**p* < 0.05

Further exploration and analysis of this outcome was conducted in Stage Two of the research. Specifically, graduates were asked what influenced their rating of importance and frequency of use for each of the significantly different competencies. All of the graduates replied that their current position and job responsibilities influenced their choice of rating for importance and frequency of use. This is largely due to the nature of their positions and the business strategies of their employers. Graduates also commented that their workplace competencies were driven by customer needs and wants, as well as by their employers' focus on the bottom line. The graduates' employers represented three major food-manufacturing companies, a midsize custom label food manufacturer, a major food ingredient company, and a midsize consulting company. As stated by one graduate, "It does not matter what you like as a chef. It is what the customer wants." All of the graduates responded that they believe each of those skill sets and competencies were required for their jobs, but in varying degrees. One graduate commented that larger companies typically assigned some of those

competencies, such as food regulations to separate departments (Lonergan, 2008); but the size of his company required him to utilize all of those skills in his position. As validated by another graduate, “. . . a lot of the food chemistry (are) done by the PhD’s that get hired in, or it’s done by a completely different group who then filters the projects down to us.” Another graduate commented, “In a sense, food chemistry, quality, and food policy, depending on company size, it is important to have knowledge on that to know what you are speaking (about) but we have other people who are very specific to that.” Other responses included: “how applicable it was to my job,” “what I am using everyday,” “the importance of understanding and having background knowledge on the subject,” and “basically just the everyday application of them.” These responses indicated their ratings on importance were largely influenced by their job responsibilities. One graduate also commented:

. . . you may not use some of these core competencies on a daily basis (but) you should have a vast understanding of each so you can communicate with a larger spectrum of people within other groups of your company or other companies that you might have to work with. . . you have to be able to understand what somebody else is talking about even though you might not ever actually have to do it.

Having baseline knowledge of all the competencies facilitates product development across functional groups as well as shortens development time. A comment made by a graduate in relation to differential emphasis on competencies stated:

There are some competencies (that) are more important to learn on the job and some are more important to learn while at school. For example, nutrition, there is a difference between the two. Nutrition would be most important to have an

understanding while at school and to gain that knowledge. Then you utilize it at work but you don't dwell on it, you have it in the back of your head.

Building a framework of knowledge competencies to draw from aids the career progression of the culinologist. The culinologist gains the practical experience on the job, using the technical skills learned from their education. As quoted by an employer in Stage Two of the research:

I think it's been a pretty good base education. There is a lot of practical knowledge in developing products that has to be learned in time, but I think the overall general involvement and knowledge of different types of ingredients and understanding the functionality . . . (will help them) take all the knowledge they have gained and make it practical.

The graduates' perception of importance for each core competency were influenced by several factors, including:

- emphasis placed by the individual Culinology® programs
- the business strategy of the company they work for
- the graduates' own personal beliefs and skills

When asked how much were each of those skills emphasized during their undergraduate education versus how much was used, the responses varied from “highly emphasized” and “emphasized but not enough” to “over emphasis in nutrition,” “. . . did not teach . . . the practical application of most of these skill sets,” “. . . there was no class explaining any business aspect of product development, the food industry or manufacturing,” and “there was not a true understanding from the professor's standpoint which translated into a complete lack of understanding from the student's perspective.” These comments

suggested the competencies viewed as important by the graduates from their undergraduate education may not be the same as what the industry viewed as important, thus supporting the need for differential emphasis on the competencies. While the employers believed the Culinology® degree program competencies met their needs, further in-depth analysis into this particular sampling of graduates revealed otherwise. In addition, the Culinology® program's faculty roster appeared to directly influence the amount of emphasis placed on each competency. The graduates' responses alluded to a lack of teacher preparation as well as a lack of more stringent oversight by the RCA on each program. Consequently, each institution's graduates does not have the same level of proficiency for each of the competencies, thus creating a disparity in the preparedness of the Culinology® graduate. As commented by one graduate on the Food Processing and Manufacturing competency:

I find it highly important for something they missed out on but I learned through my time that it talked about the function of freezing, spray drying, things of that nature. I don't have any of that knowledge. I didn't have any of that knowledge coming out of school. The first time I went to a plant was an eye opener, I mean that's highly important and they need exposure.

This supported the researcher's belief that each Culinology® degree program was similar, yet each has unique identifying characteristics that influenced the student's career preparedness. Further refinement of the Culinology® degree core competencies, and the addition of required proficiency level for each competency will create a differential emphasis on each competency, thus alleviating some of the issues currently faced by Culinology® graduates.

Career preparation is multi-faceted issue, and is viewed differently by different institutions, faculty and program directors or coordinators. The goal of the Culinology®

degree competencies has always been to develop trained culinologists for the food product development industry. The education received by culinologists is only a portion of the career preparation process. Other factors include networking, conference attendance, co-curricular activities, and so on. According to Schawbel:

. . . students need to build relationships. All hiring is personal – and whether you meet your future hiring manager or mentor who can help make introductions that get you in the door, ‘who you know’ can make a big difference. Introduce yourself and stay connected – relations make a big difference. (MN Future Work, personal communication, June 8, 2012)

The faculty or program director/coordinator’s role in preparing future culinologists greatly impacts the students’ view of the importance of each competency. Providing networking opportunities to the students before they complete their education enhances their awareness and marketability as graduates. In addition, it also shows students the many different niches available within the food product development industry in which they can specialize. Some may choose to work for companies that focused on manufacturing ready-to-prepare ingredients, while some may choose companies that manufactured finished products for the retail food market. Ultimately, how much of a particular competency was used daily or weekly in the workplace, and to some degree, the importance placed on the competency, depended on the employer.

The results of the quantitative and qualitative analyses led towards the researcher rejecting the hypothesis that there is no difference between the graduates’ perception of importance and frequency of use for each of the identified core competencies.

Hypothesis Two: There is no significant difference between the graduates' years of experience in their current position and their perception of importance for each of the identified core competencies.

To test this hypothesis, the data was first recoded with dummy variables to separate out the graduates' years of experience in their current position. Three dummy variables, *Less1Year*, *One-TwoYear*, and *Two-FiveYear*, were generated. *Less1Year* meant the graduate has indicated working less than one year in their current position. Similarly, *One-TwoYear*, and *Two-FiveYear* referred to the graduates' time in their current positions, 1 – 2 years, and 2 – 5 years, respectively. None of the respondents from the graduates' group indicated having worked for more than five years. The data then were tabulated to verify the recoding was accurate. Next, they were checked for multicollinearity to ensure proper use of dummy variables. The variance inflation factor was calculated to be 1.0, indicating no presence of multicollinearity, but presence of orthogonality, meaning there was no correlation of that term with any others. Regression analysis with robust standard errors was conducted on each competency with each of the dummy variables as a predictor.

Table 13 shows the coefficient values for each of the regressions, with a significant difference ($p < 0.05$) marked by an asterisk. The results of the regression indicated that one predictor, *One-TwoYear*, explained 16.3% of the variation ($R^2 = 0.16$, $F(1,34) = 5.78$, $p = 0.02$) for the Research Methodologies and Experimental Design competency. The negative coefficient indicated a negative relationship between the rating on the Research Methodologies and Experimental Design competency and the number of years spent in the current position. The researcher believed this could be due to the small sample ($n = 3$), and a larger sample size may yield different results. Since there was no significant difference

observed from the *Less1Year* and *Two-FiveYear* groups for the same competency, the researcher was unable to draw a conclusion on whether the number of years spent in their current position had a linear correlation with the respondents' rating on importance for this competency. Overall, none of the other competencies were significantly different, thus, the hypothesis cannot be rejected, assuming that the observed significant difference for the Research Methodologies and Experimental Design competency was due to the small sample size. The researcher recommends collecting a larger sample in a future study to verify the conclusion.

Table 13

Regression Analysis of Graduates' Time in Current Position and Each Competency

Competency	Coefficient		
	0 – 1 Year (n = 15)	1 – 2 Years (n = 15)	2 – 5 Years (n = 6)
Culinary Arts	-0.16	0.52	-0.63
Baking, Pastry and Confectionary Arts	-0.69	0.23	-0.80
Food Chemistry Analysis and Functions of Ingredients	0.76	-0.84	0.13
Food Safety and Quality	0.12	-0.33	0.37
Food Processing and Manufacturing	0.14	0.26	-0.70
Nutrition	-0.31	-0.09	0.70
Business of Product Development	0.57	-0.69	0.20
Food Policy Analysis and Regulations	0.63	-0.74	0.20
Sensory Evaluation	0.37	-0.43	0.10
Research Methodologies and Experimental Design	0.83	-1.11*	0.50

* $p < 0.05$

Hypothesis Three: There is no significant difference between the graduates' perception of importance for each of the identified core competencies and the institution from which they graduated.

To test this hypothesis, the data were recoded with dummy variables to separate out the graduates' by the institution from which they graduated. Four dummy variables, *UNL*,

Clemson, *UC*, and *SMSU*, were generated. *UNL* represented the University of Nebraska-Lincoln, *Clemson* represented Clemson University, *UC* represented University of Cincinnati, and *SMSU* represented Southwest Minnesota State University. The data then were tabulated to verify the recoding was accurate.

Next, it was checked for multicollinearity to ensure proper use of dummy variables. Variance inflation factor was calculated to be 1.0, indicating no presence of multicollinearity but presence of orthogonality, meaning there was no correlation of that term with any others. Regression analysis with robust standard errors was conducted on each competency with each of the dummy variables as a predictor. Table 14 shows the coefficient value for each of the regressions, with the significant difference ($p < 0.05$, $p < 0.01$, $p < 0.001$) marked by asterisks.

The results of the regression indicated that graduates from Clemson University explained 10.5% ($R^2 = 0.11$, $F(1,34) = 17.23$, $p < 0.001$) of the variation for the Culinary Arts competency, 4.1% ($R^2 = 0.04$, $F(0,34) = .$, $p < .$) of the variation for the Sensory Evaluation competency, and 3.4% ($R^2 = 0.03$, $F(0,34) = .$, $p < .$) of the variation for Food Chemistry Analysis and Functions of Ingredients. In other words, graduates from Clemson University placed a lower emphasis on the importance of the Culinary Arts competency and higher emphasis on the importance of the Food Chemistry Analysis and Functions of Ingredients and Sensory Evaluation competencies. However, the missing F and p values denoted that the model did not reliably predict the rating for two competencies, Sensory Evaluation and Food Chemistry Analysis and Functions of Ingredients, and is validated by the low proportion of variance explained (R^2) as well. The sample size for Clemson

University is extremely small ($n = 3$) and it is possible a larger sample size from Clemson University may show different results.

Table 14

Regression Analysis of Graduates' Institution and Each Competency

Competency	UNL ($n = 15$)	UC ($n = 13$)	SMSU ($n = 5$)	Clemson ($n = 3$)
Culinary Arts	0.07	0.12	0.59	-1.48***
Baking, Pastry and Confectionary Arts	-0.34	0.32	0.31	-0.36
Food Chemistry Analysis and Functions of Ingredients	-1.18*	0.86*	0.21	0.85***
Food Safety and Quality	-0.33	0.26	0.32	-0.21
Food Processing and Manufacturing	-0.77*	0.69*	0.17	0.09
Nutrition	0.03	0.01	0.33	-0.64
Business of Product Development	-0.57	0.44	0.31	0.00
Food Policy Analysis and Regulations	-0.40	0.26	0.43	-0.18
Sensory Evaluation	-0.54	0.33	-0.06	0.82***
Research Methodologies and Experimental Design	-0.31	0.05	0.72	-0.27

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

From the survey, two of the Clemson University graduates stated that knife skills were not needed, “unless you (were going) to work in an actual restaurant kitchen.” Indeed, the profession of culinary arts begins with mastery of proper knife skills; however the competencies of the culinologist is multi-faceted and encompasses more than just culinary arts. Both employers and the graduate from Clemson University interviewed in Stage Two of the research affirmed the importance of the Culinary Arts competency to the culinologist. The graduate from Clemson University interviewed was a transfer student with a culinary arts degree, which may explain the reason why she believed in the importance of the Culinary Arts competency. In more than one instance, interview respondents noted that employers were interested in the culinary competence of the culinologist, yet they were hired into entry-level positions with responsibilities typical of a food technician. Over and over

again, graduates alluded to the need for better communication with employers in the food industry regarding the skills of the culinologist.

When asked about the Food Chemistry Analysis and Functions of Ingredients competency, the graduate noted that the coursework did prepare graduates very well in that competency. For the Sensory Evaluation competency, the graduate quoted, “that was great, I wish there was a second class pertaining to it when I was going to the university. The professor there was interesting and she was great, but it would have been nice to have a secondary class to reinforce all of this.” From the surveys and the interview, it appears that graduates from Clemson University placed a lower emphasis on the Culinary Arts competency, but higher emphasis on the Sensory Evaluation and Food Chemistry Analysis and Functions of Ingredients competency. However, as noted previously, the sample size for Clemson University is extremely small ($n = 3$) and a larger sample size may reveal different results. Table 14 also shows that two predictors, *UNL* and *UC*, significantly predicted the ratings for Food Chemistry Analysis and Functions of Ingredients and the Food Processing and Manufacturing competencies, although only less than 21% of the variance can be explained by the model. Graduates from UN-L explained 20.9% ($R^2 = 0.21$, $F(1,34) = 7.41$, $p < 0.01$) of the variation whereas graduates from UC explained 10.5% ($R^2 = 0.10$, $F(1,34) = 5.97$, $p < 0.02$) of the variation for Food Chemistry Analysis and Functions of Ingredients. This correlated with the significant difference result reported by the Kruskal-Wallis one way analysis of variance test earlier. Likewise, graduates from UN-L explained 12.8% ($R^2 = 0.13$, $F(1,34) = 4.66$, $p < 0.04$) of the variation whereas graduates from UC explained 9.8% ($R^2 = 0.10$, $F(1,34) = 4.32$, $p < 0.04$) of the variation for Food Processing and Manufacturing.

The results indicated that students from UN-L placed a lower emphasis on both of these competencies, compared to students from UC.

As established in the preceding hypothesis, the graduates' rating of importance for each competency was influenced largely by their positions in the company. As commented by the UN-L graduates in Stage Two of the research:

1. "I think (my university) did a wonderful job in teaching basic food chemistry and functions of ingredients. I think they did a great job in doing that. I would rate that high. I would also rate frequency of usage low. Unfortunately what they excelled and did very well at, I don't use much."
2. "... most large companies are going to want to go out and get their own food chemist before they ask a Culinology® person to do it for them."

The common theme that arose from the interviews revealed that the topic of Food Chemistry Analysis and Functions of Ingredients was taught very well by the universities, however, there was a deficit in the amount of practical application of the concepts taught in food chemistry. Comments from the interviews included: "... to really know the functionality of ingredients and the chemistry itself, you would need to do more research and more hands on lab activities," and "all the background I had was great, but I wanted more (knowledge of) how to do that and then how do I apply it to my development." More than once, graduates commented that they wished they had more applied knowledge of this particular competency during their education, and it was important to have knowledge of this competency in their cross functional teams.

Graduates from the interviews also had the same views on the Food Processing and Manufacturing competency. For this particular competency, an experiential learning

approach may have been more beneficial for the students. This competency included understanding the principles of large scale production systems and scale-up, food processing and packaging technologies, as well as knowledge of basic unit operations. The theoretical aspects of unit operations and food processing technologies can be introduced and taught in the classroom, however reinforcement of these concepts should be conducted in a food processing plant. In one interview, a graduate admitted to not having taken food processing as a required course due to the scheduling of the courses, in spite of the institution's access to a major food processing facility on campus. As quoted by the graduate, "I am just learning that through my time (on the job)." Two other graduates from another institution commented that they "took on a few extra projects" and participated in the RCA student Culinology® competition during their undergraduate education, which helped increase their knowledge in this competency. As quoted by the graduates:

1. "When I started here at (my job) and I actually got out into the plant, I learned 100 times more by actually physically seeing how things worked and being able to work it myself than what I could ever read in a book."
2. "That was something that was very lacking in my university, there was really no talk of scaling up, or from a gold standard to commercialization. There was a little bit discussed about quality control and insurance, but the entire sub categories of food processing and manufacturing was very lacking. I participated one year in the RCA college competition; we were just unprepared for all of the manufacturing and food processing part of it."
3. "Our program did not have good food processing and manufacturing. We had a textbook but the curriculum in which we were given was more mathematical based."

We spent a lot of time dealing with mathematical equations, process and yields and reading spec sheets equipment than we actually did with the theories behind why we actually use the equipment and the intimate understanding behind the yield in losses and product abuse.”

To further illustrate the importance of this competency, one employer stated:

You have to know how you are going to make that food that you developed as a chef in the test kitchen or laboratory. You have to know how that food is going to be scaled up, to be mass manufactured for a large consumer base and a large market. You have to know how that is going to be done and how it’s going to affect the food, how it’s going to cause difference from the original product that we like to call the gold standard that we’ve developed in the kitchen, what’s that going to do to it from a quality standpoint, what’s it going to do to it from a nutritional standpoint, and how are those processing and packaging strategies going to keep it safe.

A subtheme that arose from the interviews revealed that not every institution placed the same emphasis on each competency. As Table 14 shows, students from UN-L placed a lower emphasis on two competencies, Food Chemistry Analysis and Functions of Ingredients and Food Processing and Manufacturing, when compared to students from UC. The extent to which each of the core competencies were taught and / or emphasized at the individual institutions depended on the institutions’ strengths, emphasis area, faculty expertise, fiscal resources, and to some degree, the home department of the Culinology® program in that institution. Not surprisingly, the UN-L’s Culinology® program resided in the Department of Nutrition and Health Sciences, and UC’s Culinology® program resided in the College of

Applied Science. As of Fall 2011, the Culinology® program at UC has been discontinued, due to the merger of the College of Applied Science and the College of Engineering. Further investigation into the curriculum of both institutions may provide more information; however, since the discontinuation of UC's Culinology® program, their current and archived online catalogs do not provide any information on the Culinology® curriculum. The researcher, however, was able to retrieve the original curriculum submitted to the RCA from 2004 for UC (See Appendix M for UC's 2004 Culinology® curriculum).

Upon comparison with a similarly dated curriculum from UN-L (see Appendix N for UN-L's 2004 undergraduate catalog), the researcher noted that UN-L's students completed more credit hours in nutrition compared to UC's students. However, there is only a marginal difference in credit hours between both UN-L's and UC's requirements for Food Chemistry Analysis and Function of Ingredients, and Food Processing and Manufacturing. Thus, there may not have been a causal relationship between the graduates' institutions and the competencies. Regression analysis can be a powerful tool for ascertaining the causal effect of one variable upon another, but the small sample size in this research and the low variance from the regression analysis did not confidently predict the causal relationship. However, because a significant difference was detected, the hypothesis that there is no significant difference between the graduates' perception of importance for each of the identified core competencies and the institution from which they graduated was rejected.

From the results of the three hypotheses, it appears there was a definite difference between which competencies were important versus what was used frequently, and the length of time in their current position and the institution they graduated from had minimal effect on their perception of importance for each competency. Since the researcher failed to reject two

out of the three hypotheses used for Research Question Two, it can be concluded that the RCA's Bachelor of Science in Culinology® was not fully effective in preparing graduates for employment in the food product development industry.

Research Question Three

This research question aimed to identify the nature of the relationship between the employers' assessment and the graduates' self-assessment. This research question was answered by testing the following hypothesis:

Hypothesis Four: There is no significant difference between the employers' and the graduates' perception of importance for each of the identified core competencies.

To test this hypothesis, a nonparametric version of the two-sample *t*-test was applied to determine if the graduates' mean rating of importance differed from the employers' mean rating of importance for each competency. The Wilcoxon Rank-Sum, also called the Mann-Whitney test, was used for this purpose. Table 15 shows there are no significant difference observed between the graduates' and the employers' mean rating of importance for each competency except for the Culinary Arts competency. The graduates' mean rating ($M = 3.69$, $SD = 1.28$) for the Culinary Arts competency was lower than the employers' mean rating ($M = 4.9$, $SD = 0.32$) for the same competency.

The majority of the graduates ($n = 28$ out of 36) who responded to the survey graduated from two institutions, University of Nebraska-Lincoln and University of Cincinnati, which very likely influenced the means rating for each competency. Both institutions have articulation agreements with culinary arts programs for their Culinology® degrees. Both institutions also do not offer their own culinary arts courses, but rather, depended on transfer credits from the culinary arts programs for those competencies. This

resulted in a high number of graduates from both institutions that were initially trained in culinary arts fundamentals and pedagogy before making the transition to food science and food processing courses. The resulting outcome is a student who enters the university system with a passion for culinary arts who has to overcome the fears associated with the rigors of science. There was no data collected on the origin of the graduates' culinary education, but future research may reveal an interesting comparison of graduates who were trained in culinary arts first versus graduates who were trained simultaneously in culinary arts and food science.

Table 15

Wilcoxon Rank-Sum Test comparing Graduates' Mean Rating of Importance against Employers' Mean Rating of Importance

Competency	<i>p</i> value
Culinary Arts	<0.01*
Baking, Pastry and Confectionary Arts	0.26
Food Chemistry Analysis and Functions of Ingredients	0.90
Food Safety and Quality	0.36
Food Processing and Manufacturing	0.82
Nutrition	0.97
Business of Product Development	0.76
Food Policy Analysis and Regulations	0.53
Sensory Evaluation	0.70
Research Methodologies and Experimental Design	0.90

* $p < 0.01$

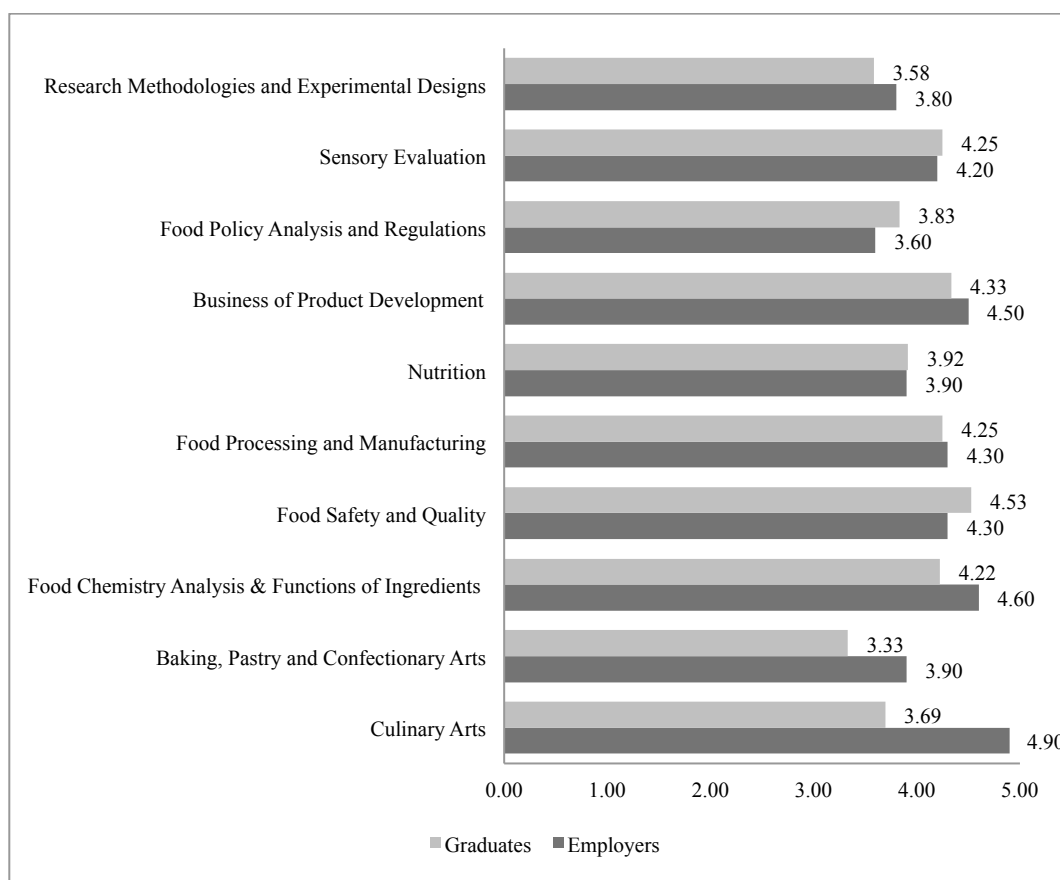


Figure 4. Graduates' mean rating of importance versus employers' mean rating of importance for each competency. Based on five-point Likert-type scale (1 = Not important, 5 = Very important).

Figure 4 illustrates the mean values of the graduates' and employers' mean rating of importance for each competency. The results of the hypothesis testing showed there was a difference between the graduates' mean rating of importance and the employers' mean rating of importance for the Culinary Arts competency only. When asked for more specific information on the Culinary Arts competency in Stage Two of the research, graduates responded that they were usually hired because of their culinary arts competence, yet their jobs did not utilize their culinary skills to their fullest potential. Comments from the graduates included:

1. I think what the Culinology® degree has provided me with is that precious, hidden valuable information and my being able to tap into my thought of what that should taste like. I might not be able to show what it tastes like all the time, but I can describe what it should be. I think that's where culinologists are getting used the most and what they bring from a Culinology® perspective.
2. They also have hired on culinary consultants . . . They are certified chefs, and so again like it was before with the other competencies; we have those culinary people embedded in the division already. So I think . . . for what I use right now, sensory, food processing, and business is probably the most important that I would use. Would I love to use more culinary? Absolutely.
3. I was hired on because I bring that difference; what separates you from the food scientists, your culinary arts. It makes you marketable. It gives you that perspective that others don't have. I think from the position in which I'm in, it's taken a little while for it to take hold and be valued. It could be different in other large companies. Where I work, unless you are a certified executive chef with over several years of restaurant experience, you're not put on to a higher-level entry position. So the position in which I have fulfilled was a fairly low entry-level position. Even though I did great at those skills, it wasn't valued as much as I think it could be.
4. . . . if I was the employer I would have rated (culinary arts) highly but I know that in my job it is not looked at every day. When it comes to a product, developing a product, a product itself or a flavor, I have an advantage knowing what ethnic food isn't a big trend. I can tell you what, when you are looking at these types of

flavors, I have a general knowledge of what that is. That gives me an advantage for a quicker time, development time, spending less time on variations. I find it important but I don't think it is used every day because I don't spend every day making a brand new meal.

Other similar comments included:

1. I am looked at as a culinary person within my division in a large company, so I think for me that's proof that my culinary arts and my limited restaurant side has provided me with enough to be successful in my current role
2. I feel like culinary arts is an advantage, knowing flavors and know how things are put together
3. . . . employers think culinary arts are great, they love it. Graduates don't feel like they are being utilized . . . and it's not how it should be

It can be best summarized with this response:

I think often it depends on what job . . . I think often times the employer will take for granted the fact that they have a culinary background if they are in an R and D position. For myself, I know it's important and I know my culinary background plays a large role in my developing products, but you don't realize it when you are on the bench all day doing more scientific testing rather than working with culinary ingredients and developing such products.

The responses indicated that while culinary arts was recognized as a core competency, employers of Culinology® graduates were not maximizing the capabilities of the graduates' culinary skills. Culinologists were often hired because they possess that extra skillset, culinary arts, yet they were not utilized for their culinary expertise. This was especially

prevalent in larger corporations where roles were more defined, and the culinologist was not automatically recognized as a culinary expert, but rather, more as a technician. Interestingly, time and again, the comments from graduates in Stage Two of the research revealed that their employers who are mostly food manufacturers did not assign the culinary validation tasks to them. Instead, the graduates had to prove their competency in culinary arts, and in one case, it has taken the graduate several years before he was able to establish his expertise in culinary arts. As he quoted, “We are not being utilized as much as we could be doing as far as kitchen, standard work, innovation. A lot of those things are done by chefs, or they are done by people who have been there for a much longer.”

The gap between the perceptions of the employers and the graduates on the culinary arts competency was attributed to a lack of communication between them. More than once, graduates have commented that the employers need to be educated. However, the researcher believed that educating employers alone will not narrow the gap. The Culinology® degree curriculum should also be addressed. As quoted by an employer, “The culinary piece is certainly a critical piece. It is not the only piece, but it is certainly a fundamental to being a culinologist.” The broad scope of the Culinology® curriculum left it wide open to multiple interpretations. As a result, some Culinology® degree programs considered all ten core competencies as equally important while others do not. Hypothesis One, which stated there is no difference in the graduates’ perception of importance and frequency of use for each competency, was rejected earlier, thus disproving the notion that all competencies were equally important and used equally. Similarly, Hypothesis Three, there is no significant difference between the graduates’ perception of importance for each of the identified core competencies and the institution from, was also rejected. Both of the rejected hypotheses

indicated that not all of the ten competencies are equally important, and Culinology® degree programs did not place the same emphasis on each of the competencies. This presented an opportunity for the researcher to develop a new competency model for Culinology® graduates to address this gap. Further discussion of the proposed competency model is presented in Chapter Five.

Although the remaining nine competencies were not significantly different in rating of importance between graduates' and employers, the graduates' mean ratings warranted a discussion. As discovered from the interviews with the graduates in Stage Two, the graduates viewed all competencies as important, but their rating of importance was influenced by their current jobs. Two competencies in particular, the highest and the lowest mean, are discussed below.

Food Safety and Quality, the highest rated competency by the graduates, was considered extremely important by the graduates in Stage One of the research. During the interviews, graduates stated that the majority of their Food Safety and Quality competency were learned while they were in culinary school, under the National Restaurant Association's ServSafe program. Comments regarding this competency included:

1. It could've been more relevant. Actually what I found to be really dry was those courses and just hammering away at the regulations of FDA and everything
2. No one wants to be that person that sources an ingredient that has potential for salmonella
3. . . . because industry has so much regulation on food safety and the trend is that there are more and more regulations around it so understanding what is at risk and how you are going to do it

4. Food safety and quality, I think it was hammered down on multiple times. So with that aspect of it I have a pretty good handle on it, or like the food microbiology classes which I took, it was a little too in depth

One graduate said:

I think food safety probably has the largest effect on the food industry as far as any other competency. Food safety is directly (related to) every other aspect of the job and food safety alone is what can bring a company down in a day. Everything else whether it be your personal ability to cook or whether it be your personal knowledge of functional ingredients, they primary effect your job performance. Food safety is one of those rare ones that affect other people's lives. So I can understand as a basic principle that safety is number one. When you have somebody else's life in your hands and you are capable of destroying or bringing harm to another person life, it has a higher rating of importance than any other department or category.

The graduates' view on the importance of the Food Safety and Quality competency has merit, and when the mean ($M = 4.53$, $SD = 0.74$) was compared to the employers' ($M = 4.30$, $SD = 0.82$), the difference was not significant. However, it has the highest average mean for importance of all the competencies rated by the graduates.

The lowest mean rating of importance ($M = 3.33$, $SD = 1.35$) rated by the graduates was the Baking, Pastry, and Confectionary Arts competency. There was no significant difference between the graduates' and the employers' rating of importance for this competency. From the interviews conducted with the graduates in Stage Two of the research, they stated that even though only a baseline knowledge of baking was needed, the

skills learned in baking are transferable to other aspects of their jobs, such as formula ratios, order of ingredients, and gluten development. Comments from the graduates include:

1. Even though the position doesn't directly deal with dough products, pastry products, the principles of baking and the formula part of it, is important to what you do as a product developer
2. . . . to know what pie crust dough is compared to bread compared to different ethnic varieties of bread is important because you don't know when you're (going) to need that
3. I think it depends on (the) position you currently have. For mine, I am more focused on culinary and less on baking. However, baking would be important to learn about for someone who is going into that.

The results indicated the Baking, Pastry, and Confectionary Arts competency is moderately important, but emphasis on baking would only come from a position that is directly involved in the baking industry. As summarized by one graduate:

Because the baking industry is not as large as every other industry out there, I believe. I think a lot of companies that deal with baked goods have been doing the same recipe with slight modifications since the day they started. I don't think there is a huge jump in innovation. The main drive in baking seems to be cost and nutrition. With that being said, my previous workplace was a baking science job, and when you are in that industry, it is all you see. But when you are not in it, you don't see really any part of the baking industry because they have been doing the same thing. Bread is bread.

In conclusion, the results indicated that while the core competencies of the RCA's Bachelor of Science in Culinology® clearly identified the core competencies needed for success in the food product development industry, the delivery, instruction, and proficiency level of each competency in the undergraduate curriculum needed to be more consistent, and perhaps required more oversight from the RCA.

Research Question Four

The final research question aimed to identify the implications for curricular reform in Culinology® education that arose out of this study. Two distinct themes emerged from the analysis of the first and second stages of the research.

1. There is a gap between what the employers and the graduates perceived as the most important competency for culinologists.
2. Graduates of Culinology® degree programs were not fully prepared for the workplace.

Both of these themes provide opportunities for curricular reform in Culinology® education. Curricular reform involves three distinct phases: identification of the problem, developing a curricular plan, and implementing the curricular plan. In order to properly define the problem, Shapiro and Mendelson (2005) recommended engaging stakeholders, identifying curricular issues and confronting organizational issues. Stakeholders were engaged via the survey and interviews. Graduates and employers of Culinology® graduates were researched on their perceptions of importance and frequency of use for each of the Culinology® degree core competencies. The two themes that emerged are related to the Culinology® degree core competencies, which drove the design of the Culinology® curriculum in each of the RCA-approved Culinology® programs. A larger organizational

issue was identified during the research – there was a lack of communication between the RCA and the Culinology® degree programs regarding the degree of proficiency that each competency needed to be covered to. In particular, the lack of any oversight or mandate from the RCA on ensuring Culinology® degree programs were conducting outcomes assessment created the opportunity for curricular reform in Culinology® education.

The second phase of curricular reform involved developing a curricular plan. A curricular plan needs to have a shared vision (Shapiro & Mendelson, 2005). By virtue of being RCA approved, each Culinology® degree program subscribes to the vision of the RCA – Culinology® is universally valued and its practitioners define and create the future of food (RCA, 2010). The RCA has to strive to ensure shared ownership of the vision with all RCA-approved Culinology® degree programs. While there is always an apprehension that the educational system should never be dictated or controlled by profit, a harsher reality exists with underpreparing Culinology® graduates for employment. Ensuring that graduates of Culinology® degree programs will define and create the future of food requires collaboration between the industry and academia. Communicating the vision and mission of the RCA effectively and relating it to the RCA's Culinology® degree core competencies will help foster its acceptance. When it comes to drafting the curricular plan, open and frequent communication between the RCA and the Culinology® degree programs' faculty and administrators is vital. This will facilitate the translation of the shared vision into a curricular structure with specific learning outcomes.

In the last phase of curricular reform, strategies for implementation, Shapiro & Mendelson (2005) recommended demonstrating the viability of the curricular plan and seeking closure. Pilot projects are recommended, starting with identification of various parts

of the curricular plan that are most likely to succeed initially. As an example, utilizing existing capstone courses as models of how culinologists can create and define the future of food will assist with securing early success and wide-spread adoption of the curricular plan. Assessment results should be transparent, and additional input should be sought from the practitioners of Culinology®. The results of the implementation also need to be shared with the RCA community at large. This communication between the RCA (and its Culinology® graduates) and the employers of Culinology® graduates will result in a clearer understanding of the capabilities and competencies of the culinologist. The implementation of the proposed competency model for Culinology® graduates will demonstrate the success of the curricular reform, and is discussed in greater detail in the next chapter. The next and final chapter presented the researcher's conclusions and recommendations from this research.

CHAPTER 5: CONCLUSIONS

The purpose of this research was to determine if the core competencies of the Research Chefs Association's (RCA) Bachelor of Science in Culinology® prepared graduates to meet the needs of the food product development industry. The results and discussions from the previous chapter indicated that while the competencies met the needs of the employers, the employers' perception of the importance of Culinary Arts was different from the graduates'. The results also showed a significant difference existed between graduates' perception of importance and frequency of use for each core competency except for three: Culinary Arts, Food Safety and Quality, and Sensory Evaluation. There was also a significant difference between graduates' perception of importance for each core competency and the institution they graduated from.

The conclusions derived from this research will be discussed in five sections. The first section presents a summary and discussion of the two themes that emerged from the previous chapter. The second section discusses the general implications of those themes. The third section presents the proposed competency model for Culinology® graduates. The fourth section covers the general limitations of the study, and finally, the last section provides suggestions for future directions.

Summary and Discussion of Findings

First Theme: Most Important Competency

One of the research objectives was to determine if there was a difference between the graduates' and employers' perception of importance for each of the RCA Bachelor of Science in Culinology® core competencies. The results indicated that a significant difference existed between the graduates' perception of importance for the Culinary Arts

competency compared to the employers' perceptions. Culinary Arts was rated much higher by the employers ($M = 4.9$, $SD = 0.32$) than the graduates ($M = 3.69$, $SD = 1.28$). The importance of Culinary Arts in the day-to-day responsibilities of a culinologist has been underscored in the literature (Birdir & Pearson, 2000; Bisset et al., 2010b; Feder, 2009; McMeen, 2003; Mermelstein, 2003; Ottenbacher & Harrington, 2007; Thomas, 2008) and reiterated in the RCA Survey (see Appendix K for the results of the survey) as well as by employers in the interviews during Stage Two of the research. It is therefore undeniable that the industry and employers of culinologists highly value culinary arts for food product development activities. However, the results do not indicate that graduates of Culinary Arts® degree programs have the same perceptions towards culinary arts. Furthermore, it is surprising to discover that the graduates' responses actually ranked Culinary Arts as eighth most important, when the means are sorted from high to low.

There are several possible reasons for this phenomenon. The interviews conducted with graduates in Stage Two of the research revealed that the graduates' responses are largely influenced by their current job positions. None of the graduates had over five years of experience, and only six had two to five years of experience. Over 83.3% ($n = 30$) of the graduates had less than two years of experience in their current position, suggesting that they are still in entry-level positions. Hypothesis Four, there is no significant difference between the employers' and the graduates' perception of importance for each of the identified core competency, was rejected, and the interviews revealed that graduates were often hired for their culinary arts competence, but their positions did not utilize those culinary skills to their fullest potential. Instead, employers tended to delegate the culinary tasks to culinary professionals who are either consulting for their companies, or are already within the

company. These entry-level positions are usually in a support function, and are supervised by a corporate chef. The majority of these corporate chefs are classically trained chefs with many years of experience. An interview with four corporate chefs reported by foodprocessing.com indicated that these chefs were hired for their culinary talent, creativity, and ability to translate mainstream flavors into commercial products (Foodprocessing.com, 2012). Corporate chefs usually have an average of ten years or more of professional cooking experience. As such, Culinology® graduates working with a corporate chef may feel intimidated, and may also be relegated to more mundane and technical tasks in the work place while they gain experience and fine-tune their skills. This could result in the graduate viewing their culinary skills are not as important in their day-to-day responsibilities, compared to the other competencies.

A second reason for this difference lies with the employers themselves. While many employers indicated culinary skills as the most important skillset for culinologists, the hierarchy of their company's product development team very seldom allow a young Culinology® graduate to obtain the position of corporate chef without a minimum of three years experience. Thus, Culinology® graduates are often hired into more scientific and technical roles as food technicians or food technologists. The titles of those positions themselves imply expertise in food science, not Culinology®. The researcher believes that the industry as a whole still delineates the functions of a chef and a food scientist, resulting in a state of confusion when presented with a candidate that has both culinary arts and food science skills. A lack of communication between the employers and graduates regarding the skill set of the culinologist was attributed as the primary reason. Furthermore, the size and business focus of the company added an additional dimension to the analysis. Flavor

companies and smaller- to medium-sized companies tend to seek culinologists who are able to do culinary presentations, compared to larger companies like Kraft Foods (H. Johnson, personal communication, June 11, 2012). Therefore, these companies prefer culinologists who are highly trained in Culinary Arts. A simple solution that will provide more emphasis to the role of the culinologist is to title the positions as culinologist, and not food technician or food technologist. By doing so, it draws attention to the fact that the Culinology® graduate does possess competence in culinary arts and food science.

A third possible reason for this phenomenon has to do with the graduates' educational and work experience. The graduates from the interviews mentioned that they perceived all competencies as equally important, yet their rating of importance for each competency differed. This can be remedied by implementing a designated proficiency level for each competency, and communicating to the Culinology® degree programs the importance of differential emphasis in their Culinology® curriculum. However, until the changes are implemented, students of Culinology® are likely to continue receiving the same emphasis level for each competency from their institutions. Since seven out of the ten competencies being evaluated are food science related, this creates the impression that food science is more valuable than culinary arts to the graduate, which could lead towards a lower score in importance for the Culinary Arts competency by the graduates. With experience and longevity on the job, the graduates' perception towards the Culinary Arts competency could change. A longitudinal study on Culinology® graduates cohorts with the proposed competency model for Culinology® graduates may reveal a different perception towards the competencies over time.

A fourth reason for the difference in importance placed on Culinary Arts by the graduates and employers is due to the perceived value of the Culinology® degree by the graduates themselves. Culinology® students usually start their Culinology® degree by taking culinary arts courses at community colleges prior to transferring to the Culinology® degree granting institution. When transitioning to food science courses, a large majority of them will not persist due to the rigor inherent in food science courses. For those that do complete the degree, they viewed it as an accomplishment because they successfully passed their required food science courses. This creates an immediate impression that food science is harder than culinary arts, thus it is more important to them. As commented by a graduate, “If there had been culinary classes interlinked with it, my mind would have stayed fresher and my passion would have stayed stronger, and my I wouldn’t have been so burnt out by the end of it.”

There are two limitations related to this research question. One, the sample size of the graduates is small ($n = 36$). A larger sample size may yield different results. Two, the average time in their current position reported by the graduates in this sample size is less than two years. A longitudinal study may reveal that the longer the graduate spends in their current position, the more valuable their skillset in culinary arts becomes. For many young Culinology® graduates who have limited work experience in research and development, the many challenges faced by them as they enter the workforce is compounded by all the limiting factors mentioned above. As one of the graduates commented:

You can’t just roll out with a Bachelors at 22 or 23 and just assume that you’re going to be running the place. It’s not going to happen. I’ve learned soft skills; communication, relationship building, connecting, I’ve learned that through just

experience. I came out of school with just a lot of technical skills, but my communication was probably not very good . . . I think that there is room for improvement on understanding where you sit and it being different as of right now. In addition, a longitudinal study may also reveal a change in the graduate's perceptions of importance for each competency. As the graduate gains more experience and becomes more proficient in their product development skills, they may discover a different set of skills are needed in order for them to advance in their company, such as project management skills. These new skills could result in reduced emphasis on their technical skills related to culinary arts and food science as their focus shifts towards managing multiple product developers and projects simultaneously.

Second Theme: Culinology® Graduates' Employability Skills

A leading objective in this research was to measure the effectiveness of the RCA's Bachelor of Science in Culinology® core competencies in preparing graduates for employment in the food product development industry. Employability skills include the technical competencies needed to do the job as well as the soft skills that are sought after by employers (Schawbel, 2012). Spowart (2011) states "employers are dependent on the institutions of higher learning to produce graduates that are work ready" (p. 171). The curriculum is not the only answer, as getting students to take ownership and understanding the importance of these competencies in preparing them for their careers is also crucial (Yorke & Harvey, 2005). The results indicated the RCA's Bachelor of Science in Culinology® is not fully effective in preparing graduates for employment, due to two discoveries made from the research:

1. a disparity existed among Culinology® degree graduates in their perceptions of knowledge competencies based upon the institution they graduated from
2. a gap existed between the competencies perceived by the graduates as important versus the competencies used most frequently on the job

Both factors are attributed to:

- lack of communication between the expectations of the industry and the graduate as well as the institution
- ambiguity regarding the Culinology® graduate's skillset by the industry
- two seemingly separate set of competencies required by the industry: one for practicing culinologists and another for Culinology® graduates
- the absence of an assessment process for Culinology® degree programs

Culinology® as an academic discipline is still young, and was developed by the RCA and industry professionals (Cheng et al., 2011). The academic framework of the Culinology® degree was developed in response to job competencies needed by the research chef. There were nine new Culinology® degree programs launched from 2001 to 2007, but the growth tapered off after that. The declining growth could be attributed to several reasons: economic slowdown from 2007 – 2012, reduced funding from the federal government for state supported higher education institutions, and general cautiousness by academic administrators towards implementing new academic programs without adequate workforce statistics.

The obvious solution is to call for a paradigm shift in Culinology® education. Huba and Freed (2000, p.4) classified it as “shifting from a traditional teaching paradigm to a learner-centered paradigm.” Changing to a learner-centered paradigm requires that educators

rethink their roles and the roles of the student in the learning process. This results in new rules, new boundaries, and new ways of behaving. Some key features of the learner-centered paradigm are:

- active student involvement
- learning and assessment are intertwined
- emphasis is on using and communicating knowledge effectively to address enduring and emerging issues and problems in real-life contexts (Huba & Freed, 2001, p.5)

A systems perspective needs to be implemented for a paradigm shift to happen in Culinology® education. The RCA-approved Culinology® degree programs are all part of a system: the Research Chefs Association and Culinology®. There is no other avenue where culinary arts and food science are so intricately integrated for a common purpose - to define the future of food (RCA, 2011). Therefore, efforts to promote student-centered learning and assessing should be made at the system level (the RCA) as well as at the academic program and institutional levels. In a system framework, the universities and the RCA work together to “design and deliver a curriculum that is coherent to students rather than work separately to design individual courses” (Huba & Freed, 2000, p. 7) that benefits an individual program. This collaboration leads towards improving the employability skills of the Culinology® graduate by ensuring students in all RCA-approved Culinology® degree programs are learning the same set of core competencies.

As stated previously, learning and assessment are intertwined. “Assessment is a learner-centered movement which encourages us to focus on the student learning component of our teaching as it takes place within the entire system of (the RCA) and within the smaller systems of our academic programs and courses” (Huba & Freed, 2000, p. 7). Assessment

forces us to ask if we are focusing on developing the knowledge, skills, and abilities that the RCA as a whole have agreed are important to the culinologist. By doing so, we are able to address the second concern: the gap that currently exists between perceived competencies that are important and competencies that are used most frequently on the job.

As students go through their undergraduate programs, they integrate new information with current understanding. The knowledge, skills, and abilities that Culinology® students accumulate by the time they graduate is a result of the combination of their learning experiences along with other co-curricular experiences. By shifting the focus from traditional teaching to learner-centered, the outcome will be Culinology® graduates that have the employability skills needed by the food product development industry.

General Implications of Findings

Initiating the Paradigm Shift

The growth of new Culinology® programs in the early years of the discipline's formation was not accompanied by the development and implementation of outcomes assessment measures. Cheng et al. (2011) reported that the move towards an outcomes-based curriculum was not implemented until 2007. The four Culinology® programs represented by this research's sample size revealed variability in what competencies were considered important by their graduates. At present, the RCA only requires the completion of an annual report from each RCA-approved Culinology® program, requesting mostly demographical information and updates regarding changes to the program's curriculum or faculty. In addition, there is no consequence imposed by the RCA for programs that do not submit an annual report, hence there is a lack of accountability on the programs' part.

Implementation of a well-defined assessment plan will ensure the academic quality of each and every RCA-approved Culinology® degree program. The same plan will also help to reduce the variability between Culinology® degree programs. This combined effort between the RCA and the universities will assure the industry that Culinology® graduates possess the requisite competencies needed by the food product development industry. In turn, the gap between the competencies perceived as important and the competencies used most frequently will narrow. Furthermore, the disconnect between what the graduates and the employers perceived as the most important competency may be resolved.

This approach requires that the RCA expand its efforts towards the degree programs. Beyond the degree programs, the RCA is also vested in the delivery of non-credit programs for chefs and scientists. In addition, the RCA conducts a rigorous certification process for its members. A similar approach involving marketing the Culinology® degree programs to its members will increase the awareness and the likelihood for employment of Culinology® graduates. In a similar fashion, the research and development capability of the universities can be harnessed by the industry. Pending intellectual property issues, the industry can benefit from the faculty expertise and students available at the universities for their product development projects. The Culinology® students also benefit from exposure to these companies and gain the opportunity to apply their theoretical knowledge into real-world projects. This results in a higher level of applied product commercialization competence, and directly enhances the graduates' competence in the top three most important competencies rated by the employers:

1. Culinary Arts
2. Food Chemistry Analysis and Functions of Ingredients

3. Business of Product Development

In addition, continued partnerships between the institutions and the industry may result in long-term benefits for the institutions, such as scholarships, sponsorships, or access to pilot plant facilities. The subject matter expertise between universities and industry can go both ways: the universities can tap into the companies subject matter experts for the classroom, and the smaller food manufacturing companies can tap into the universities' resources for product formulation or nutritional analysis. Lastly, Culinology® graduates will also benefit from having the opportunity to practice their “soft skills”, such as verbal and written communication skills, professional presentation skills, time management skills, and ability to manage multiple projects and work in teams.

Proposed Competency Model for Culinology® Graduates

Before implementing an outcomes assessment initiative, underlying concerns regarding the competencies of the Culinology® graduate must be resolved. This research has proven that Culinology® graduates and employers valued Culinary Arts differently. Employer feedback also calls for the elimination of some content areas that are not needed, such as knowledge of ISO 9000 and OSHA systems. Graduates' feedback revealed more practical application of theory is needed. Both employers and graduates are interested in the implementation of a differential emphasis on the competencies. The importance of networking early for Culinology® students was also mentioned in the surveys. A convergence of all these new information is needed, and using the process outlined by the *Customized Generic Model Method*, the researcher proposes the adoption of a new competency model for Culinology® graduates, as shown in Figure 5.



Figure 5. Proposed Competency Model for Culinology® Graduates

The *Customized Generic Model Method* (Dubois, 1993; Lucia & Lepsinger, 1999) begins with the identification of a universe of Culinology® competencies that characterizes the attributes of the successful culinologist. This universal list of competencies was then researched and interpreted via surveys and interviews in this study. As a result, the specific competencies that characterized the successful culinologists are verified or denied by the research, leading toward the development of the competency model for Culinology® graduates (as shown in Figure 5).

The competency model for Culinology® graduates is a visual manifestation of the themes that emerged from this research and the literature review that accompanied it. It has been modified to reflect the equal importance of culinary arts and food science to the culinologist. The model also includes new content areas that were not previously identified in the RCA's existing model. It is presented in a manner that facilitates ease of use.

Campion et al. (2011) stated "Models may be in the form of lists but are also sometimes presented in terms of pictures or schematics to facilitate understanding and memorableness or 'stickiness'" (p. 228). At the very forefront of the illustration is the image of a graduate in a mortarboard. This symbolizes the shift towards a learner-centered paradigm, as well as the focus of the competency model on Culinology® graduates. The face is composed of a "word cloud" filled with keywords that describes observable behaviors that represent proficiency in the competencies. The "collar" is made up of four success factors that employers want: Internships, More Practical Application of Theories, Networking, and Presentation and Communication Skills. The mortarboard illustrates the three differential emphasis levels placed on each of the 12 competencies.

Following the guidelines recommended by Champion et al. (2011), Dubois (1993), Lucia & Lepsinger (1999), and Parry (1996), the researcher identified 12 core competencies for the Culinology® graduate. Champion et al. (2011) recommended 12 as the appropriate number of competencies for a competency model. While details in competency models are helpful for developing human resource systems and demonstrating job relatedness, brevity is better for getting organizational members to remember and actually use the competencies, and can support integrated systemic change (Champion et al., 2011; Mirabile, 1997).

Therefore, the 12 new competency titles are purposely kept short, and to the point. The

proficiency levels used in this new competency model are adapted from the National Institutes of Health Competencies Proficiency Scale (NIH, 2012). The three different levels are defined as follows:

1. **Baseline:** Possesses theoretical knowledge of the competency. Shows basic knowledge and understanding sufficient to handle routine tasks. The focus is on learning. A Culinology® graduate with baseline level proficiency means:
 - a. You are training or on-the-job training;
 - b. You are beginning to develop this competency and have the level of experience gained in a classroom;
 - c. You understand and can discuss terminology, concepts, principles, and issues related to this competency;
 - d. You utilize the full range of reference and resource materials in this competency.

2. **Progressing:** Has limited practical application and experience. Has depth/breadth of knowledge to handle non-routine situations. Help from an expert may be required from time to time, but you can usually perform the skill independently. Focus is on applying and enhancing knowledge or skill. A Culinology® graduate with progressing level proficiency means:
 - a. You have applied this competency in occasional situations and still require minimal guidance to perform successfully;
 - b. You understand and can discuss the application and implications of changes to processes, policies, and procedures in this competency.

3. **Advanced:** Has practical application and experience. You are recognized within your immediate organization as “a person to ask” when difficult questions arise regarding this competency. You can handle broad organizational/professional issues; work independently; and have long-term perspective. A Culinology® graduate with advanced level proficiency means:
- a. You are able to consistently provide practical/relevant ideas and perspectives on process or practice improvements which may easily be implemented;
 - b. You are capable of coaching others in the application of this competency by translating complex nuances relating to this competency into easy to understand terms;
 - c. You assist in the development of reference and resource materials in this competency.

The 12 competencies proposed for the Culinology® graduate are listed below, in order of advanced, progressing, and baseline levels:

Advanced level

1. Product Development
2. Culinary Applications
3. Food Processing
4. Culinary Skills

Progressing level

5. Sensory Evaluation
6. Food Chemistry

7. Food Trends

8. Food Safety

Baseline level

9. Foodservice Operations

10. Food Regulations

11. Nutrition

12. Baking

Each of the competencies are grouped in their respective levels based on the results obtained from this research. While it may be easy to specify the same advanced level for all competencies, the research has shown that the outcome is not successful. Rather, differential emphasis based on the entry-level jobs that culinologists are most likely to be hired for will result in a consistent approach towards educating future culinologists. Specifying levels of proficiency for each competency will also align the expectations of the employers with the skillset of the culinologist. Clarity of the culinologist's capabilities will aid in optimal job placements.

The competencies are now also equally distributed between culinary arts and food science, symbolizing a balance in emphasis between both disciplines. The competencies stem from the culinary arts and food science disciplines because Culinology® is the blending of culinary arts and the science of food (RCA, 2010). Each of the 12 competencies were identified from the universal list of culinary arts and food science competencies, and then researched and interpreted via surveys and interviews in this study (Dubois, 1993; Lucia & Lepsinger, 1999). Each competency title (Campion et al., 2011) uses familiar language, is

short, mutually exclusive, focuses on future needs, does not include personality traits, and is clustered (Parry, 1996).

For each competency identified in the proposed competency model for Culinology® graduates, the researcher has developed a definition in detailed behavioral terms (Campion et al. 2011; Mirabile, 1997; Parry, 1996), including the proficiency level required (Campion et al., 2011):

1. *Product Development* – Product development includes knowledge of: the stages of new product development (NPD) from ideation to commercialization, including key aspects of each stage; the technological and scientific aspects of NPD in the food sector, as well as factors influencing food choice; the integration of market and sensory analysis, marketing of novel foods, food safety and shelf-life aspects of NPD, and use of innovative food ingredients and innovative processing technologies in the development of successful, market-oriented food products. Learning outcomes include demonstrated ability to convert recipes to formulas, development of bench-top prototypes using appropriate culinary techniques and ingredients in conjunction with commercial and technical ingredients, application of scientific, quantitative and qualitative methods in the research, design and manufacture of a new food product in a pilot plant environment.

Proficiency level: Advanced.

2. *Culinary Applications* – Culinary applications is the application of the appropriate culinary techniques in a variety of commercial functions, ranging from ‘Gold Standard’ recipe development to bench top formulation. Culinary techniques

include: knowledge of cooking methods; proper selection and preparation of various culinary ingredients; knowledge of food presentation; and ability to taste, discern what is needed, and make adjustments as needed during food preparation.

Proficiency level: Advanced.

3. *Food Processing* – Food processing includes the principles of: food preservation including low and high temperatures, water activity, etc.; food processing techniques, such as freezing, freeze drying, high pressure, aseptic processing, extrusion, etc.; heat exchange / heat transfer applications; product shelf life; and packaging selection and applications. It also includes knowledge of transport processes and unit operations in food processing as applied in food manufacturing and processing as well as the effects of processing parameters on product quality.

Proficiency level: Advanced.

4. *Culinary Skills* – Culinary skills encompasses knowledge of: the basic principles and processes of cooking; equipment identification; weight and measurement conversions; knife skills; traditional stocks, sauces, and soups and their classifications; proper identification, sourcing, storage, and use of starches, produce, fats, grains, dairy, and eggs products; protein identification, composition and fabrication; international and regional cuisines; flavor profiles from culinary preparation and cooking processes; and preparation of cold foods.

Proficiency level: Advanced.

5. *Sensory Evaluation* – Sensory evaluation includes knowledge of principles and techniques of sensory analysis, including: common sensory terminology; the role of sensory analysis in the product development process; and factors affecting

perception of flavors. Learning outcomes include the application of appropriate sensory tests to achieve test objectives, and demonstrated ability to distinguish gustatory sensations of basic taste profile (sweet, salty, etc.), and describe how they are derived, how to enhance them, and how tastes are perceived in various foods.

Proficiency level: Progressing.

6. *Food Chemistry* – The food chemistry competency includes the knowledge, comprehension and application of the principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients; usage of functional ingredients; structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives; the chemistry of changes occurring during processing, storage, and utilization; and the major chemical reactions, including enzymatic and non-enzymatic reactions. Learning outcomes include demonstrated practical proficiency in a food analysis laboratory, ability to identify laboratory techniques common to basic and applied food chemistry, identification of the chemistry underlying the properties and reactions of various food components, and summarizing the principles behind analytical techniques associated with food.

Proficiency level: Progressing.

7. *Food Trends* – Food trends encompasses knowledge of current and projected trends, including micro and macro trends; ability to develop business strategies to maximize market share of emerging trends; and knowledge of competitive

products and competitive product analysis.

Proficiency level: Progressing.

8. *Food Safety* – Knowledge of food safety includes: basic sanitation practices (ServSafe, HACCP); basic concepts and processes in food microbiology; control of pathogenic and spoilage microorganisms in food; methods of food preservation; process lethality and thermal death curves; challenges and solutions for food safety in the food production continuum; and ability to identify and categorize threats to the food system, and how each can be prevented, controlled, and/or mitigated in the food production system.

Proficiency level: Progressing.

9. *Foodservice Operations* – Foodservice operations encompasses knowledge of: menu planning, development and product mix; food and beverage cost controls; the organization, structure, and functional areas in foodservice operations; and the ability to recognize and distinguish between various foodservice sectors. Learning outcomes include demonstrated operational proficiency in back- and front-of-the-house positions in a variety of foodservice settings.

Proficiency level: Baseline.

10. *Food Regulations* – Knowledge of government food regulations includes identification of: governmental agencies and their primary responsibilities; food labeling guidelines for various dietary and health-related claims, including organic and natural; permissible functional and enrichment additives; and the Code of Federal Regulations. Learning outcomes include distinguishing various standard of identities for food, recognizing the top eight commonly identified

food allergens as listed by the FDA, and defining the standards of organic products.

Proficiency level: Baseline.

11. *Nutrition* – Knowledge of nutrition includes: the theory and application of basic nutrition principles as related to essential nutrients, lifestyle, genetics, and environmental factors; health issues and trends as related to food product development; and the application of functional ingredients for nutrition composition and protection.

Proficiency level: Baseline.

12. *Baking* – Baking includes knowledge of: principles and processes of baking; ingredient composition and functionality as related to baking; formulas and mixing methods; identification and utilization of proper mixing and baking methods; and application of Baker’s percentage.

Proficiency level: Baseline.

These competencies and proficiency levels are the knowledge, skills and abilities that are needed for effective performance as a culinologist. This set of competencies form a competency model for the Culinology® graduate. It is future-oriented and is used to train graduates of Culinology® degree programs for employment as culinologists in the food product development industry. This competency model can set the foundation for implementing an outcomes assessment plan. From these competency statements, measurable learning outcomes can be created. Only then will we be able to move towards a learner-centered paradigm.

Based on the findings of this study, a review of the literature, and the researcher's insights on the development of the Culinology® degree core competencies, the following recommendations are offered to the Research Chefs Association.

1. Use the model developed. The model developed followed the recommended process implemented by Lucia and Lepsinger (1999), and the resulting model is reliable and appears to have high face and content validity.
2. Increase the visibility of Culinology® degree programs and graduates. The RCA recognizes and acknowledges the importance of education for its professional members. The same focus should transcend over to Culinology® degree programs and graduates as well. Without the support of the RCA, the Culinology® degree is worthless to the Culinology® graduates. The RCA needs to expand its marketing efforts to increase the visibility of Culinology® degree programs and the Culinology® graduate, as well as develop a process for assisting Culinology® students and graduates to move into the realm of the Culinology® professional after graduation.
3. Plan for system-wide communication and education about the competencies and their use in the Culinology® ecosphere. The proposed competency model prepares graduates of RCA-approved Culinology® degree programs for employment in the food product development industry. Leverage the common understanding of competencies within the Culinology® population to promote and enhance the adoption of this competency model in the food product development industry. Communicate with the stakeholders and constituents of Culinology® regarding the new and validated competency model for

Culinology® graduates, and clearly establish the role of the culinologist in the food product development industry.

4. Develop an assessment plan. Review the proposed set of competency statements and develop a list of topics for each competency that Culinology® students should know, understand, and be able to do with their knowledge when they graduate. Then develop or select specific and actionable assessment measures, including both direct and indirect assessments of student learning. Next, create product development experiences for Culinology® students that will help them achieve and apply the intended learning outcomes. Finally, utilize the assessment data to identify gaps and make modifications to the competency model as needed. New information that arise from the assessment data should be disseminated to the entire RCA membership for validation. The RCA will also need to invest resources into ensuring the assessment plan is properly designed and executed.

As Culinology® education becomes more popular in the United States and abroad, action must be taken by the Research Chefs Association to ensure the quality of its brand, Culinology®. The proposed competency model serves as the foundation for establishing and ensuring educational quality in all of the RCA-approved Culinology® programs. Immediate action by the RCA is needed before more Culinology® graduates enter the workforce under the current curriculum structure and the gap between industry and academia continues to grow.

Limitations

This research study intended to reach the entire population of Culinology® graduates. One hundred and one names were collected from the nine RCA-approved Culinology®

degree programs under this study, and 81 email addresses were located. The population of study consisted of the 81 graduates with email addresses. Multiple attempts were made to encourage a higher response rate, but unfortunately, only 47 graduates responded to the survey. The usable responses were 36, due to some incomplete responses on the competencies questions from some respondents. The graduates were also asked to provide the contact information of their employers, but only 29 employers of the 47 graduates responses agreed to participate in the study. Fourteen employers responded, resulting in ten usable responses from the employers group. While there is no national average regarding response rates for Internet surveys, the low percentage of responses decreases the statistical confidence of the results.

A second limitation with regard to sample size and response rate is the representation or diversity and variety of the number of graduates that responded to the survey from each institution. The sample size only included graduates from four institutions, out of a total of nine institutions that met the criteria. The researcher recommends repeating the study in the near future to validate the findings and obtain a more accurate representation of the population of interest. Representation from each RCA-approved Culinology degree program is needed in order to verify the results of this study.

Future Directions

The results of this study showed that the added perspectives of the graduates and the employers provided new recommendations for competencies that should be required for Culinology® degree graduates. This resulted in the creation of a competency model for Culinology® graduates. Future research in this arena can include:

- Longitudinal study of the graduates to determine the effects of the proposed competency model on the employability skills of Culinology® degree graduates. Cohort of graduates from each of the RCA-approved Culinology® degree programs can be tracked and studied in five or ten years, and the results can be analyzed and compared to this study.
- New study to identify the employability skills of the Culinology® graduate versus the employability skills of the culinologist who graduated from a non-RCA-approved program of study. This study did not include graduates from non-RCA-approved culinary science programs, yet there are practicing culinologists who have graduated from these programs and have been very successful.
- New research in identifying success factors of Culinology® degree graduates who followed the proposed competency model compared to those that graduated under the present RCA Bachelor of Science in Culinology® core competencies.
- Comparative study to evaluate the competencies of the practicing culinologist against the competencies of the Culinology® graduate. Both sets of competencies do not align perfectly; yet both sets of competencies strive to identify the competencies needed to be a successful culinologist.

Ultimately, the objective of this study was to evaluate the competencies of the Culinology® graduate. This study marks the first time that employability skills of Culinology® graduates have been studied. This study can also serve as the foundation for future studies involving Culinology® competencies. Furthermore, this study incorporated two new dimensions of research in Culinology® competencies assessment – feedback from graduates of RCA-approved Culinology® degree programs and their employers.

The outcome from this research is the proposed competency model for Culinology® graduates. It addresses the employability skills of Culinology® graduates, and provides Culinology® program administrators and educators with a basis for curriculum development, expansion, and program growth. It also serves as an advisory reference in understanding the knowledge or competencies the food product development industry is seeking in Culinology® graduates. And finally, it is a contribution to the sparse body of empirical research on Culinology® competencies. As Culinology® education continues to evolve and mature, it is critical for RCA to remain on the forefront of this new and innovative discipline and ensure that academic quality processes are developed, implemented, and evaluated.

APPENDIX A
AMERICAN CULINARY FEDERATION FOUNDATION
ACCREDITING COMMISSION
REQUIRED KNOWLEDGE AND COMPETENCIES



Culinary Arts Program

**Required
Knowledge and Competencies**

For the

ACFF ACCREDITING COMMISSION

KNOWLEDGE AREA: Basic Baking

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To apply the fundamentals of baking science to the preparation of a variety of products. To use and care for equipment normally found in the bakeshop or baking area.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Define baking terms 2. Identify equipment and utensils used in baking and discuss proper use and care. 3. Demonstrate proper selection of equipment and utensils for specific application 4. Identify ingredients used in baking 5. Demonstrate proper scaling and measurement techniques 6. Apply basic math skill to recipe conversions. 7. Describe properties and list function of various ingredients. 8. Define and Describe the steps in the production of yeast-leavened breads. 9. Prepare a variety of yeast-leavened breads. 10. Evaluate the quality of yeast-leavened breads. 11. Define and describe quick-breads and the mixing methods utilized to produce them. 12. Prepare and Evaluate the quality of a variety of quick-breads. 			

13. Define and describe the various types of pies and tarts and the mixing methods utilized to produce them.
14. Prepare a variety of pies and tarts.
15. Evaluate the quality of prepared pies and tarts.
16. Define and describe the variety of cookie types and the mixing methods utilized to produce them.
17. Produce a variety of types of cookies.
18. Evaluate the quality of prepared cookies.
19. Define and describe the variety of cake types and the mixing methods utilized to produce them.
20. Prepare a variety of cakes.
21. Evaluate the quality of prepared cakes.
22. Demonstrate basic icing and decorating techniques
23. Evaluate the quality of iced and decorated cakes.
24. Define and describe the variety of laminated dough's.
25. Explain the process of lamination as it applies to dough's.
26. Prepare a variety of laminated dough products.
27. Evaluate the quality of prepared laminated dough products.
28. Define and describe pate choux, its uses, method of preparation, baking and finishing.
29. Prepare a variety of pate choux products.
30. Evaluate the quality of prepared pate choux products.
31. Define and describe meringues, its various types, uses, and methods of preparation.

32. Prepare a variety of meringues.
33. Evaluate the quality of prepared meringues.
34. Define and describe creams, custards, puddings and related sauces.
35. Describe the various types of uses of and preparation methods of various creams, custards, puddings and related sauces.
36. Prepare a variety of creams, custards, puddings and related sauces.
37. Evaluate the quality of prepared creams, custards, puddings and related sauces.
38. Define and describe the various types, uses, and methods of preparation of dessert sauces.
39. Prepare a variety of dessert sauces.
40. Evaluate the quality of prepared dessert sauces.
41. Discuss the application of mixes and other value added products
42. Define and describe a variety of fillings and toppings for pastries and baked goods.
43. Discuss methods of preparation and finishing techniques for various fillings and toppings.
44. Prepare a variety of fillings and toppings for pastries and baked goods.
45. Demonstrate the presentations of baked goods and desserts.
46. Evaluate the quality of presentations of baked goods and desserts.
47. Discuss nutritional concerns as they apply to baking.
48. Discuss recipe modification to create more nutritionally beneficial baked goods and desserts.

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To become familiar with and varieties of alcoholic and non-alcoholic beverages. To develop an appreciation for wine and food affinity. To explain laws and procedures related to responsible alcohol service.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Identify local, state and federal laws pertaining to the purchase and service of alcoholic beverages. 2. Discuss the basic production process for distillation and fermentation. 3. Distinguish wines by grape and/or other fruit variety, country, growing region and production process 4. Evaluate the relationship of beverages to food 5. Identify and discuss the presentation and service of alcoholic, non-alcoholic and de-alcohol zed beverages, including coffee and tea 6. Identify equipment and glassware used for beverage preparation and service 7. Discuss opening and closing procedures of a beverage operation 8. Discuss the fundamentals and importance of responsible alcohol service 9. Identify levels of intoxication and methods to control excessive consumption by guests 10. Discuss Dram Shop Act and liquor law liability. 11. Explain procedures for implementing internal beverage controls. 			

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To perform mathematical functions related to foodservice operations

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Perform basic math function 2. Calculate and forecast purchase and preparation requirements based on a product's yield on cooking, fabrication, and intangible waste factors. 3. Calculate food costs and percentages 4. Calculate beverage costs and percentages. 5. Calculate labor costs and percentages. 6. Perform recipe yield conversions 7. Perform the process of recipe costing. 8. Determine selling price of menu items. 9. Define and describe a profit and loss statement. Discuss how it is utilized in food-service operations as a tool to determine profitability. 10. Review profit and loss statements to determine profitability. 11. Perform calculations using current technology (i.e. computers, calculators, POS). 			

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To perform dining room service functions using a variety of types of service. To demonstrate an understanding of quality customer service.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Demonstrate the general rules of table settings and service 2. Describe American, English, French and Russian Service 3. Discuss service methods such as banquets, buffets and catering and a la carte 4. Describe the functions of dining service personnel 5. Discuss training procedures for dining room staff. 6. Discuss procedures for processing guest checks using current technology. 7. Demonstrate an understanding of guest service and customer relations, including handling of difficult situations and accommodations for the disabled. 8. Explain inter-relationships and work flow between dining room and kitchen operations. 9. Discuss sales techniques for service personnel including menu knowledge and suggestive selling. 			

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To develop skills in knife, tool and equipment handling and apply principles of food preparation to produce a variety of food products. To operate equipment safely and correctly. To apply knowledge of laws and regulations relating to safety and sanitation in the kitchen.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Demonstrate knife skills, hand tool and equipment operation, emphasizing proper safety techniques. 2. Identify the parts/components of a recipe. 3. Describe and use a standardized recipe. 4. Outline the procedure for writing a standardized recipe. 5. Write a standardized recipe. 6. Identify and use utensils, pots and pans and demonstrate safe practices using stoves, mixers, ovens, etc. 7. Define and describe the sautéing process. 8. Prepare a variety of foods using the sauté techniques. 9. Evaluate the quality of sautéed items. 10. Define and describe the processes of pan-frying and deep-frying. 11. Fry a variety of foods to their proper doneness. 12. Evaluate the quality of fried foods. 13. Define and describe the roasting and baking processes. 14. Compare and contrast roasting to baking, poeleing, 			

smoke-roasting and spit-roasting.

15. Roast meats, poultry, and fish to the correct doneness to develop the best flavor and texture in the finished dish.

16. Evaluate the quality of roasted items.

17. Define and describe the barbecue process.

18. Select and prepare meats and seasonings and barbecue them to the appropriate doneness.

19. Evaluate the quality of barbecued items.

20. Define and describe the process of grilling and broiling.

21. Grill and broil foods to the proper doneness.

22. Evaluate the quality of grilled and broiled items.

23. Define and describe the processes of braising and stewing, noting the similarities and differences.

24. Braise and stew foods to the proper doneness.

25. Evaluate the quality of braised and stewed items.

26. Define and describe the process of shallow-poaching.

27. Prepare shallow-poached foods properly and produce a sauce that incorporates the cooking liquid.

28. Evaluate the quality of shallow-poached items.

29. Define poaching and simmering and correctly identify the temperature range at which each occurs.

30. Poach and simmer foods to the proper doneness.

31. Evaluate the quality of poached and simmered foods.

32. Define and describe the boiling and steaming

process.

33. Prepare boiled and steamed foods to the proper doneness.

34. Evaluate the quality of boiled and steamed items.

35. Utilize standard weights and measures to demonstrate proper scaling and measurement techniques.

36. Identify and use herbs, spices, oils and vinegar, condiments, marinades and rubs.

37. Evaluate the quality of herbs, spices, oils, vinegar, condiments, marinades, and rubs.

38. Perform basic fabrication tasks with meat, poultry, seafood and variety meats.

39. Using the basic cooking methods, prepare meat, seafood, poultry, and variety meats to the proper doneness.

40. Evaluate the quality of prepared meats, seafood, poultry, and variety meats

41. Define stock and describe its uses.

42. Identify different types of stocks.

43. List the basic ingredients needed for making stocks.

44. Describe the functions of the ingredients.

45. Describe the process of making stocks.

46. Prepare a variety of stocks.

47. Evaluate the quality of a properly made stock.

48. Define, describe and explain the purpose of sauces.

49. Identify and prepare the grand sauces.

50. Prepare a variety of non-grand/classical sauces.
51. List the basic ingredients needed for making grand and non-grand sauces.
52. Describe the functions of the ingredients in sauces.
53. Evaluate the quality of a properly made sauce.
54. Define and describe soup and identify its two basic categories.
55. Prepare a variety of soups from each category.
56. Describe the process of making each category of soup.
57. Evaluate the quality of a properly made soup.
58. Identify a variety of fruits, vegetables, starches, legumes and grains.
59. Prepare a variety of fruits, vegetables, starches, legumes and grains using the basic cooking methods.
60. Evaluate the quality of prepared fruits, vegetables, starches, legumes and grains.
61. Define salad dressing and describe its purposes.
62. Identify, define, and describe the types of salad dressings.
63. Prepare a variety of salad dressings and evaluate the quality of each.
64. Identify a variety of common salad greens.
65. Prepare and dress greens for a salad.
66. Evaluate the quality of properly prepared and dressed green salad
67. Identify, describe, and prepare a variety of composed salads.

68. Evaluate the quality of composed salads.
69. Identify, and describe the purpose of the elements of a sandwich.
70. Prepare a variety of hot and cold sandwiches.
71. Evaluate the quality of sandwiches.
72. Identify and prepare a variety of breakfast meats.
73. Evaluate the quality of prepared breakfast meats.
74. Describe a variety of preparation techniques used in egg cookery.
75. Cook eggs using a variety of preparation techniques.
76. Evaluate the quality of prepared eggs.
77. Identify and prepare a variety of breakfast batter products.
78. Evaluate the quality of prepared breakfast batter products.

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To develop skills in producing a variety of cold food products. To prepare items appropriate for buffet presentation, including decorative pieces.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Identify tools and equipment used in garde manger, emphasizing safety and sanitation procedures. 2. Define and describe hors d'oeuvre, appetizers, and canapés. 3. Explain the importance of presentation and garnishing for hors d'oeuvre, appetizers, and canapés. 4. Prepare a variety of hors d'oeuvre, appetizers, canapés and basic garnishes. 5. Evaluate the quality of hors d'oeuvre, appetizers, and canapés. 6. Define aspic gelee and describe its functions. Demonstrate fundamental skills in the preparation and uses of aspic. 7. Evaluate the quality of aspic gelee and items coated with it. 8. Define and describe forcemeat and its various forms including pate, terrine, galantine, mousseline, and sausage. 9. Prepare and present a variety of forcemeat products. 10. Evaluate the quality of forcemeat products. 11. Demonstrate food presentation techniques using a variety of plates, platters and trays. 12. Evaluate the quality of prepared plates, platters and trays. 			

13. Produce decorative centerpieces (i.e. fruit, vegetable carvings, salt dough, tallow and ice carvings).
14. Define and describe various methods in which food is preserved (i.e. brining, salting, curing, and smoking).
15. Prepare foods for preservation and prepare preserved foods.
16. Evaluate the quality of preserved foods.
17. Define and describe a variety of cheese categories.
18. Discuss how various cheeses are made and their uses.
19. Use cheese as an ingredient in recipes.
20. Taste various cheeses and evaluate their quality.

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To prepare for the transition from employee to supervisor. To evaluate styles of leadership and develop skills in human relations and personnel management.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Describe process of management through effective communication skills. 2. Summarize leadership styles and analyze when each is most appropriate. 3. Outline the supervisor's role in decision-making, problem solving and delegation of duties. 4. Explain the role of job descriptions and specifications and develop written examples. 5. Perform mock interviews; prepare resumes, job applications and cover letters. 6. Describe procedures of new employee orientation. 7. Compare training methods; discuss the importance of an effective employee training program. Discuss follow-up training and cross-training. 8. Analyze types and methods of employee evaluation. 9. Describe necessity of change and ways of implementing change with the least employee resistance. 10. Evaluate methods of conflict resolution and grievance procedures (union/non-union). 11. Identify reasons for disciplinary problems and discuss the supervisor's role in handling them. 12. Describe the procedure for terminating employees. 13. Analyze motivational techniques/problems; discuss 			

procedures for attitudinal changes.

14. Analyze ways of dealing with stress in the workplace.

15. Discuss time management and other organizational management techniques.

16. Discuss legal issues related to managerial decisions (sexual harassment, discrimination, violence/anger and unemployment compensation)

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To develop an understanding of the hospitality industry and career opportunities in the field. To investigate trade publications and professional organizations appropriate for continuing education. To become familiar with the organizational structure and basic functions of departments within hospitality and foodservice establishments.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Define hospitality and the philosophy of the hospitality industry. 2. Trace the growth and development of the hospitality and tourism industry. 3. Describe the various cuisines and contributions of leading culinarians. 4. Identify professional organizations within the field; explain purposes and benefits. 5. Outline the organization, structure and functional areas in various hospitality organizations as a perspective for later courses in menu planning, purchasing, food production and service, food and beverage controls, management, etc. 6. Evaluate career opportunities through participation in field trips and guest speakers in class. 7. Discuss/evaluate industry trends as they relate to career opportunities and the future of the industry. 8. Discuss and evaluate industry trade periodicals. 9. Discuss professional ethics practiced in the Industry. 			

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To apply the principles of menu planning and layout to the development of menus for a variety of types of facilities and service.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. List basic menu planning principles 2. Identify principles of menu layout and design 3. Create menu item descriptions following established truth-in-menu guidelines 4. Apply principles of nutrition to menu development 5. Determine menu prices utilizing proper cost controls and appropriate technology 6. Plan a variety of menus i.e. a la carte, cycle, ethnic, holiday, banquet, reception and buffet 7. Discuss importance of product mix, check average and their impact on profit contribution. 8. Develop a menu layout for a foodservice operation. 9. Discuss the availability of Food and Seasonal Menus. 10. Discuss Menu Planning resources (Internet, professional and vendors). 			

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To describe the characteristics, functions, and food sources of the major nutrients and how to maximize nutrient retention in food preparation and storage. To apply the principles of nutrient needs throughout the life cycle to menu planning and food preparation.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Identify current USDA My Pyramid principles and food groups 2. List the nutrient contributions of each food group 3. Discuss the nine areas where dietary guidelines make recommendations. 4. Develop recipes and menus using dietary guide-line recommendations, food guides and food labels 5. Evaluate recipes and menus using dietary guideline recommendations, food guides and food labels 6. Discuss characteristics, functions and best sources of each of the major nutrients. 7. List the primary characteristics, functions and sources of vitamins, water and minerals 8. Describe the process of human digestion 9. Determine energy needs based upon basal metabolic rate and exercise expenditure 10. Discuss and demonstrate cooking techniques and storage principles and portion sizes for maximum retention of nutrients and effective weight management 11. Discuss exchange groups. 12. Identify common food allergies and determine appropriate substitutions. (i.e. Gluten, sugar, lactose free) 			

13. Discuss contemporary nutritional issues (i.e. vegetarianism, heart healthy menus and religious dietary laws).

14. Apply emerging technologies (computerization) for nutrient analysis (i.e. Internet, recipe analysis software)

15. Discuss marketing of healthy menu options

16. Discuss weight management and exercise and nutrition over the life cycle

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To understand the overall concept of purchasing and receiving practices in quality foodservice operations. To apply knowledge of quality standards and regulations governing food products to the purchasing function. To receive and store food and non-food items properly.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Discuss the flow of goods in a foodservice operation. 2. Discuss how HACCP practices are addressed in the purchasing, receiving, storing, and issuing procedures. 3. Describe formal and informal purchasing methods 4. Analyze market fluctuations and product cost 5. Discuss legal and ethical considerations of purchasing 6. Explain regulations for inspecting and grading of meats, poultry, seafood, eggs, dairy products, fruits and vegetables 7. Outline yield and quality grades and National Association of Meat Purveyors (NAMP) specifications for meats 8. Write a bid specification 9. Evaluate received goods to determine conformity with user specifications 10. Receive and store fresh, frozen, refrigerated and staple goods. Describe the importance of receiving and inspecting product as it enters the facility. 11. Conduct yield and quality tests on items such as canned, fresh, frozen and prepared products. 			

12. Explain proper receiving and storing of cleaning supplies and chemicals.
13. Conduct a yield and cost comparison test of pre-fabricated products and on-premises butchered products.
14. Inventory food and non-food items using current technology.
15. Explain the procedures for rotation of stock and for costing and evaluating, including FIFO and LIFO.
16. Define and describe par stock.
17. Describe proper procedures of issuing product according to requisition
18. Describe current computerized systems for purchasing and inventory control.

Course Numbers (s) and Titles Where Competencies are met (attach Course outlines/Syllabi):

PURPOSE: To develop an understanding of the basic principles of sanitation and safety and to be able to apply them in the foodservice operations. To reinforce personal hygiene habits and food handling practices that protects the health of the consumer.

COMPETENCIES: Students will be able to:	Course Number	Contact Lecture	Hours Lab
<ol style="list-style-type: none"> 1. Identify microorganisms which are related to food spoilage and food-borne illnesses; describe their requirements and methods for growth. 2. List and describe symptoms common to food-borne illnesses and list various ways these illnesses can be prevented. 3. List and define the fundamentals of good personal hygiene 4. Demonstrate good personal hygiene and health habits in a laboratory setting. 5. Demonstrate acceptable procedures when preparing potentially hazardous foods to include time/temperature principles. 6. List the major causes of food spoilage 7. Define food spoilage indicators. 8. Outline the flow of food through an establishment and list the various ways contamination may be prevented along the pathway. 9. Outline the requirements for proper receiving and storage of both raw and prepared foods. 10. Recognize sanitary and safety design and construction features of food production equipment and facilities. (i.e., NSF, UL, OSHA ADA, etc.). 			

11. Describe types of cleaners and sanitizers and their proper use.
12. Identify the seven HACCP Principles and the critical control points during all food handling processes as a method for minimizing the risk of food-borne illness.
13. Review Material Safety Data Sheets (MSDS) and explain their requirements in handling hazardous materials. Discuss right-to-know laws.
14. Develop cleaning and sanitizing schedule and procedures for equipment and facilities.
15. Identify proper methods of waste disposal and recycling.
16. Describe appropriate measures for insects, rodents and pest control eradication.
17. Conduct a sanitation self-inspection and identify modifications necessary for compliance with standards
18. List common causes of typical accidents and injuries in the foodservice industry and outline a safety management program
19. Demonstrate appropriate emergency policies for kitchen and dining room injuries.
20. Describe appropriate types and use of fire extinguishers used in the foodservice area.
21. Review laws and rules of the regulatory agencies governing sanitation and safety in foodservice operation.
22. Identify food bio-terrorism laws and RFID technology and the impact these regulations and technology have on food safety and sanitation.

APPENDIX B
INSTITUTE OF FOOD TECHNOLOGISTS
HIGHER EDUCATION REVIEW BOARD EDUCATION STANDARDS

The "Core Competencies in Food Science" (see table below) provides guidelines to prepare students for the B.S. degree in food science. The curricular standards encompass two elements: specific curricular content and desired competencies of student learning. Note that the competencies listed are quite broad and it is expected that each food science program will develop its own set of detailed outcomes for each food science course and for the program as a whole. The term "outcomes" refers to measurable results of learning. Outcomes need to specify the level of learning, based on Bloom's Taxonomy or a similar approach. Each program also will need to develop the assessment tools used to measure the learning outcomes. The Higher Education Review Board is available to provide assistance in developing specific outcomes and methods of assessment.

Background Courses

For food science students to meet the core competencies, several background courses will be necessary. These will generally include:

- Chemistry. Two courses in general chemistry followed by one course each in organic chemistry and biochemistry. Analytical chemistry and physical chemistry are recommended.
- Biological Sciences. One course in biology, and one course in general microbiology that has a laboratory.
- Nutrition. One course dealing with the basic concepts of human nutrition and the relationship of consumption of foods to health and well-being.
- Physics and Mathematics. One course in calculus and one in general physics. - Statistics. One course.
- Communications. Two courses, generally taught outside of the food science program, that provide the fundamentals of speaking and writing skills.

The choice of background courses for a program will be based on the resources available at the university and any constraints within which the program must operate (e.g., credit hour limitations). The Higher Education Review Board will work with each program to ensure that the courses selected provide the necessary background for students to meet the food science competencies.

Core Competency	Content	By the completion of Food Science program, the student should:
Food Chemistry and Analysis	<p>Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives</p> <p>Chemistry of changes occurring during processing, storage and utilization</p> <p>Principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients.</p>	<ul style="list-style-type: none"> • Understand the chemistry underlying the properties and reactions of various food components • Have sufficient knowledge of food chemistry to control reactions in foods. • Understand the major chemical reactions that limit shelf life of foods. • Be able to use the laboratory techniques common to basic and applied food chemistry. • Understand the principles behind analytical techniques associated with food. • Be able to select the appropriate analytical technique when presented with a practical problem. • Demonstrate practical proficiency in a food analysis laboratory.
Food safety and microbiology	<p>Pathogenic and spoilage microorganisms in foods</p> <p>Beneficial microorganisms in food systems</p>	<ul style="list-style-type: none"> • Identify the important pathogens and spoilage microorganisms in foods and the conditions under which they will grow. • Identify the conditions under which the important pathogens are commonly inactivated, killed or made harmless in foods. • Utilize laboratory techniques to identify microorganisms in foods. • Understand the principles involving food preservation via fermentation processes.

	<p>Influence of the food system on the growth and survival of microorganisms</p> <p>Control of microorganisms</p>	<ul style="list-style-type: none"> • Understand the role and significance of microbial inactivation, adaptation and environmental factors (i.e., aW, pH, temperature) on growth and response of microorganisms in various environments. • Be able to identify the conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.
<p>Food processing and engineering</p>	<p>Characteristics of raw food material</p> <p>Principles of food preservation including low and high temperatures, water activity, etc</p> <p>Engineering principles including mass and energy balances, thermodynamics, fluid flow, and heat and mass transfer</p> <p>Principles of food processing techniques, such as freeze drying, high pressure, aseptic processing, extrusion, etc.</p> <p>Packaging materials and methods</p>	<ul style="list-style-type: none"> • Understand the source and variability of raw food material and their impact on food processing operations. • Know the spoilage and deterioration mechanisms in foods and methods to control deterioration and spoilage. • Understand the principles that make a food product safe for consumption. • Understand the transport processes and unit operations in food processing as demonstrated both conceptually and in practical laboratory settings. • Be able to use the mass and energy balances for a given food process. • Understand the unit operations required to produce a given food product. • Understand the principles and current practices of processing techniques and the effects of

	Cleaning and sanitation	<p>processing parameters on product quality.</p> <ul style="list-style-type: none"> • Understand the properties and uses of various packaging materials.
	Water and waste management	<ul style="list-style-type: none"> • Understand the basic principles and practices of cleaning and sanitation in food processing operations.
Applied food science	Integration and application of food science principles (food chemistry, microbiology, engineering/processing, etc.) Computer skills	<ul style="list-style-type: none"> • Be able to apply and incorporate the principles of food science in practical, real-world situations and problems. • Know how to use computers to solve food science problems
	Statistical skills	<ul style="list-style-type: none"> • Be able to apply statistical principles to food science applications
	Quality assurance	<ul style="list-style-type: none"> • Be able to apply the principles of food science to control and assure the quality of food products.
	Analytical and affective methods of assessing sensory properties of food utilizing statistical methods Current issues in food science	<ul style="list-style-type: none"> • Understand the basic principles of sensory analysis.
	Food laws and regulations	<ul style="list-style-type: none"> • Be aware of current topics of importance to the food industry. • Understand government regulations required for the manufacture and sale of food products. •
Success skills	Communication skills (i.e., oral and written communication, listening, interviewing, etc.)	<ul style="list-style-type: none"> • Demonstrate the use of oral and written communication skills. This includes such skills as writing technical reports, letters and memos; communicating technical information to a nontechnical audience; and making formal

Critical thinking/problem solving skills (i.e., creativity, common sense, resourcefulness, scientific reasoning, analytical thinking, etc.)

Professionalism skills (i.e., ethics, integrity, respect for diversity)

Life-long learning skills

Interaction skills (i.e., teamwork, mentoring, leadership, networking, interpersonal skills, etc.)

Information acquisition skills (i.e., written and electronic searches, databases, Internet, etc.)

Organizational skills (i.e., time management, project management, etc.)

and informal presentations.

- Define a problem, identify potential causes and possible solutions, and make thoughtful recommendations.
 - Apply critical thinking skills to new situations.
 - Commit to the highest standards of professional integrity and ethical values.
 - Work and/or interact with individuals from diverse cultures.
 - Explain the skills necessary to continually educate oneself.
 - Work effectively with others.
 - Provide leadership in a variety of situations.
 - Deal with individual and/or group conflict.
 - Independently research scientific and nonscientific information.
 - Competently use library resources
 - Manage time effectively.
 - Facilitate group projects.
 - Handle multiple tasks and pressures.
-

APPENDIX C
RESEARCH CHEFS ASSOCIATION
HIGHER EDUCATION SUBCOMMITTEE
BACHELOR OF SCIENCE IN CULINOLOGY® CORE COMPETENCIES

Core Competency: Culinary Arts	
1. Basic understanding of principles and processes of cooking	<ul style="list-style-type: none"> • Implement principles of <i>mise en place</i> • Recite and use proper culinary terminology • Recite and proper use of a standardized recipe • Describe and develop a standardized recipe. • Explain basic principles of heat transfer in cooking • Demonstrate proficiency in basic cooking methods: <ul style="list-style-type: none"> ○ Dry heat methods such as sautéing, roasting, broiling, baking, grilling, pan frying, and deep frying ○ Moist heat methods such as poaching, simmering, boiling, braising, and steaming • Utilize standard weights and measures to demonstrate proper scaling and measurement techniques. • Using the basic cooking methods, prepare and evaluate meat, seafood, poultry, and variety meats to the proper doneness. • Identify, describe, prepare and evaluate stocks and their uses • Identify, describe, prepare, and evaluate mother, small and classical sauces. • Define, describe, prepare, and evaluate soup and identify its various categories • Identify, prepare, and evaluate a variety of fruits, vegetables, starches, legumes and grains, and their basic cooking methods.
2. Equipment identification	<ul style="list-style-type: none"> • Demonstrate proper and safe use of hand tools and equipment • Identify and use utensils, pots and pans and demonstrate safe practices using stoves, mixers, ovens, etc.
3. Knife Skills	<ul style="list-style-type: none"> • Demonstrate proficiency in knife skills
4. Identification and use of ingredients	<ul style="list-style-type: none"> • Identification of proteins, fruits, vegetables, dairy products, herbs and spices • Identify, evaluate, and use herbs, spices, oils and vinegar, condiments, marinades and rubs
5. International and regional cuisines	<ul style="list-style-type: none"> • Research, report and prepare authentic international and regional cuisines. • Report how Classical and Western Mediterranean Cuisine, and International and Eastern Mediterranean Cuisine of the world have impacted the development of our own native cuisine as well as other international cuisine. • Prepare Classical and Western Mediterranean Cuisine menus with an emphasis on proper <i>mise en place</i>, timing, sanitation, knife skills, and use of the fundamental techniques of cooking. • International and Eastern Mediterranean Cuisine menus, utilizing ingredients indigenous to those countries or regions for the specified menu. • International and Eastern Mediterranean Cuisine menus, utilizing ingredients indigenous to those countries or regions for the specified menu.

<ul style="list-style-type: none"> • Write menus and prepare meals utilizing a particular country's or region's indigenous ingredients, philosophies, and cooking techniques, with consideration for cultural, religious, or ethnic influences • Demonstrate ability to utilize common ratios and timing pertaining to the preparation of Classical and Western Mediterranean Cuisine, and International and Eastern Mediterranean Cuisine menus and the writing of recipes, as well as the application of the "Total Utilization" concept.
6. Food presentation
<ul style="list-style-type: none"> • Apply BUFF (Balance, Unity, Focal Point, Flow)
7. Menu development
<ul style="list-style-type: none"> • Identify culinary trends • List basic menu planning principles. • Identify principles of menu layout design. • Create menu item descriptions following established truth-in-menu guidelines. • Apply principles of nutrition to menu development. • Determine menu prices utilizing proper cost controls and appropriate technology. • Plan a variety of menus i.e. a la carte, cycle, ethnic, holiday, banquet, reception and buffet. • Discuss importance of product mix, check average and their impact on profit contribution. • Develop a menu layout for a foodservice operation
8. Culinary History
<ul style="list-style-type: none"> • Report on those individuals directly responsible for the birth, development, and continued growth of the cuisine of Europe: DiMedici, Careme, Escoffier, Point, and Bocuse. • Describe the Brigade system
9. Knowledge of foodservice operations
<ul style="list-style-type: none"> • Compare and contrast various foodservice sectors • Practical experience in BOH and FOH • Discuss professional ethics • Outline the organization, structure and functional areas in various foodservice organizations as a perspective for later courses in menu planning, purchasing, food production and service, food and beverage controls, management, and supervision.
10. Beverages
<ul style="list-style-type: none"> • Identify local, state and federal laws pertaining to the purchase and service of alcoholic beverages. • Discuss the basic production process for distillation and fermentation. • Distinguish wines by grape and/or other fruit variety, country, growing region and production process. • Evaluate the relationship of beverages to food. • Identify and discuss the presentation and service of alcoholic, non-alcoholic

beverages, including coffee and tea
11. Flavor profiles
<ul style="list-style-type: none"> • Apply flavor layering and balance
12. Garde manger and butchery
<ul style="list-style-type: none"> • Identify tools and equipment used in garde manger, emphasizing safety and sanitation procedures. • Describe, prepare and evaluate a variety of hors d'oeuvre, appetizers, and canapés. • Explain the importance of presentation and garnishing for hors d'oeuvre, appetizers, and canapés • Demonstrate fundamental skills in the preparation and uses of aspic. • Describe, prepare and evaluate forcemeat and its various forms including pate, terrine, galantine, mousseline, and sausage. • Demonstrate proficiency in food presentation techniques using a variety of plates, platters and trays. • Describe, prepare, and evaluate various methods in which food is preserved (i.e. brining, salting, curing, and smoking). • Describe, prepare, and evaluate cheeses and their use in food. • Identify, define, describe, and prepare types of salad dressings and cold sauces. • Identify, describe, prepare, and evaluate a variety of salads. • Describe, prepare, and evaluate hot and cold sandwiches. • Perform basic fabrication tasks with meat, poultry, seafood and variety meats

Core Competency: Baking, Pastry and Confectionary Arts
1. Basic understanding of principles and processes of baking
<ul style="list-style-type: none"> • Define baking terms. • Apply basic math skill to recipe conversions • Define, describe, prepare and evaluate: <ul style="list-style-type: none"> ○ leavened and unleavened breads ○ pies and tarts ○ cookies ○ cakes ○ icing and decorating techniques ○ laminated dough ○ pate a choux ○ meringues ○ creams, custards, puddings and dessert sauces ○ fillings and toppings
2. Equipment identification
<ul style="list-style-type: none"> • Identify and demonstrate proper use and care of equipment and utensils
3. Knowledge of ingredient functionality
<ul style="list-style-type: none"> • Explain and utilize the appropriate ingredient functionality to any given food application or process

4. Understanding formulas and mixing methods
<ul style="list-style-type: none"> • Identify, and describe functions of ingredients • Discuss the application of mixes and other value added products.
5. Presentation
<ul style="list-style-type: none"> • Demonstrate proper scaling and measurement techniques. • Apply BUFF (Balance, Unity, Focal Point, Flow)

Core Competency: Food Chemistry Analysis & Functions of Ingredients
1. Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
<ul style="list-style-type: none"> • Explain the chemistry underlying the properties and reactions of various food components
2. Knowledge of flavors
<ul style="list-style-type: none"> • Describe the chemical reactions involved in flavor compounds formation in foods • Summarize the effects of food components, processing parameters and storage conditions on flavor
3. Knowledge of ingredient functionality
<ul style="list-style-type: none"> • Explain and utilize the appropriate ingredient functionality to any given food application or process
4. Chemistry of changes occurring during processing, storage and utilization
<ul style="list-style-type: none"> • Demonstrate sufficient knowledge of food chemistry to control reactions in foods • Classify the major chemical reactions that limits shelf life of foods • Demonstrate the laboratory techniques common to basic and applied food chemistry
5. Basic principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients
<ul style="list-style-type: none"> • Cite the principles behind analytical techniques associated with food • Name the appropriate analytical technique when presented with a practical problem • Demonstrate practical proficiency in a food analysis laboratory

Core Competency: Food Safety and Quality
1. Basic sanitation practices such as basic ServSafe, HACCP
<ul style="list-style-type: none"> • Distinguish the principles of HACCP. • Contrast the challenges and benefits of implementing HACCP in the food service environment. • Describe the difference between hazards and risk. • State the major populations that are at an increased risk of food borne illness. • Identify major food borne illnesses and their symptoms. • Distinguish the difference between bacteria, yeast and molds, parasites, and viruses.

<ul style="list-style-type: none"> Describe the difference between sanitation and cleaning
2. Control of pathogenic and spoilage microorganisms in foods
<ul style="list-style-type: none"> Distinguish the difference between spoilage organisms and pathogens. Identify major food borne pathogens, describe how they are best controlled, and their origins in different food systems. Summarize the meaning of critical limits. Describe the different phases of microbial growth and the general metabolic state of bacteria at each phase. Describe the effect of temperature on microbial survival. Describe how temperature, time, water activity, pH, modified atmosphere, and high pressure can impact microbial growth/survival.
3. Use of microorganisms in food production
<ul style="list-style-type: none"> Characterize the difference between spores and vegetative cells and describe how they respond to environmental stress commonly encountered in the food production environment. State the major food borne allergens.
4. Food Safety and Security (GMP, SOP, HAACP & CARVER-Shock)
<ul style="list-style-type: none"> Illustrate Good Manufacturing Practice (GMP) and HACCP

Core Competency: Food Processing and Manufacturing
1. Principles of large scale production systems and scale up
<ul style="list-style-type: none"> Demonstrate knowledge of product scale up in manufacturing to meet production specifications
2. Principles of food processing technologies
<ul style="list-style-type: none"> Discuss the effects of food processing equipment, conditions and techniques on the final product quality and safety. Illustrate the importance of documentation in a production environment
3. Principles of packaging technologies
<ul style="list-style-type: none"> Demonstrate knowledge of mainstream packaging material properties and applications, and their impact on the environment
4. Quality Control and Assurance
<ul style="list-style-type: none"> Identify fundamental processes that assure product quality and consistency Categorize different critical control points based on process (unit) operations.
5. Knowledge of basic unit operations
<ul style="list-style-type: none"> Identify the various types of processes and process operations. Demonstrate knowledge of basic unit operations and their application in food production. Demonstrate fundamental knowledge of mass and energy balances
6. Food preservation and shelf life extension
<ul style="list-style-type: none"> Outline shelf life extension strategies

Core Competency: Nutrition
1. Knowledge of theory and application

<ul style="list-style-type: none"> • Describe basic nutrition principles and rationale for: <ul style="list-style-type: none"> ○ Calories, protein, carbohydrate, fat, vitamins, minerals, water ○ Application to lifestyle, genetics, environment factors
2. Knowledge of health issues and trends
<ul style="list-style-type: none"> • Compare and discuss general health and therapeutic diet components as they apply to food product development
3. Knowledge of functional applications
<ul style="list-style-type: none"> • Apply functional properties as related to: <ul style="list-style-type: none"> ○ nutrition composition (i.e. antioxidants, etc) and protection (i.e., stability during processing, etc) ○ implications of recipe formulation on nutrition
4. Knowledge of laws and evaluation systems
<ul style="list-style-type: none"> • Explain parameters of: <ul style="list-style-type: none"> ○ current food composition and labeling laws ○ government and health evaluation systems, i.e., food pyramid, dash diet

Core Competency: Business of Product Development
1. Principles of Marketing
<ul style="list-style-type: none"> • Be able to read, understand and interpret market trends and data
2. Food product development process
<ul style="list-style-type: none"> • Demonstrate the steps necessary to develop new products from ideation to product roll out. • Describe cost controls, including cost evaluation of products, ROI and COGs • Describe current and projected trends
3. The “Gold Standard”
<ul style="list-style-type: none"> • Evaluate Gold Standard recipes as part of the food product process
4. Product commercialization
<ul style="list-style-type: none"> • Demonstrate the steps required for recipe development and conversion to formula ratios • Documentation • Ability to develop prototype/protocept • Explain the limitations of large scale production toward goals

Core Competency: Food Policy Analysis and Regulations	
1. Food laws and regulations	<ul style="list-style-type: none"> • Explain food legislation in the US • Explain the role of the national vs. state laws
2. FDA, USDA, and ATF food regulations	<ul style="list-style-type: none"> • Explain the role of the USDA and FDA • Recognize the US code • Interpret the Code of Federal Regulations (CFR)
3. Food and beverage labeling	<ul style="list-style-type: none"> • Define Fair Packaging and Labeling Act (NLEA) • Apply requirements to labeling food products • Interpret Relative Type/Size Requirements • Describe Nutritional Labeling • Describe Labeling Ingredients • Explain labeling bulk food for retail sale • Explain labeling for food service products • Organic Regulation (Labeling Act)
4. Food additives, Nutraceuticals, Dietary supplements	<ul style="list-style-type: none"> • Discuss the Federal Food, Drug and Cosmetic Act • Distinguish the role of Federal Trade Commission • Differentiate dietary supplement and nutrients • Categorize color derived from spices
5. ISO 9000	<ul style="list-style-type: none"> • Explain Import and Export Laws
6. Legal Aspects	<ul style="list-style-type: none"> • Describe Intellectual Property (Patents, copyrights, trademarks, Confidentiality) • Environmental Laws, Contracts, Insurance • Explain Environmental Compliances
7. Multicultural Competency	<ul style="list-style-type: none"> • Discuss Kosher and Halal requirements and distribution and other evolving multicultural issues • Discuss multicultural dietary restrictions
8. OSHA System (Factory Inspections)	<ul style="list-style-type: none"> • Describe factory inspections

Core Competency: Sensory Evaluation
1. Fundamental principles and techniques of sensory evaluation
<ul style="list-style-type: none"> • Explain the meaning of sensory evaluation • Describe the basic physiology and function of the senses. • Describe how each of the senses can impact overall perceived flavor (interactions between senses) • Describe common sensory terminology • Explain the role of sensory analysis in the product development process • Describe the difference between affective, discrimination, and descriptive methods. • Explain how to apply the appropriate sensory tests to achieve your goal • Prepare a sensory evaluation questionnaire • Assess major sources of error when conducting basic sensory tests. • Distinguish by sensory evaluation the gustatory sensations of bitter, sour, salty, sweet and umami. • Determine papillae types and functions. • Describe the history of sensory evaluation.
Core Competency: Research Methodologies and Experimental Design
1. Quantitative and qualitative methods
<ul style="list-style-type: none"> • Describe and apply quantitative and qualitative research methodology
2. Statistical and data interpretation
<ul style="list-style-type: none"> • Utilize basic statistical methods to display and interpret data
3. Knowledge of research process and scientific methods
<ul style="list-style-type: none"> • Design experiments to solve research questions • Apply scientific methods • Document entire research process for technical and legal requirements

APPENDIX D
RESEARCH CHEFS ASSOCIATION CERTIFICATION COMMISSION
CULINARY ARTS AND FOOD SCIENCE LEARNING OUTCOMES FOR
THE CRC AND CCS EXAMS

RCACC Culinary Arts and Food Science Learning Outcomes for the CRC and CCS Exams - Final*

*7/09/2010

CULINARY ARTS

Note: 90% of CCS exam questions come from CULINARY ARTS and 10% come from FOOD SCIENCE. In addition to these learning outcomes, please reference the most recent editions of *On Cooking: a Textbook of Culinary Fundamentals* (Sarah R. Labensky, Alan M. Hause) and *Elementary Food Science* (Ernest R. Vieira) and *Understanding Food Science and Technology* (Peter S. Murano)

~ APPLICATIONS ~

KNOWLEDGE OF ALLERGENS

1. List at the top 8 commonly recognized food allergens as listed by the FDA. [Note: "On Cooking" does not separately list fin fish or tree nuts.]
2. Discuss why knowledge of allergens is critical.
3. Name several grains that can be eaten by someone who cannot consume gluten and explain why they can be tolerated.

KNOWLEDGE OF CARBOHYDRATES (PART I)

Carbohydrates (including vegetables, fruits, cereals, grains)

1. Characterize the benefits which the two essential nutrients found in carbohydrates provide the body.
2. List the components that make up a carbohydrate.
3. Define difference between simple and complex carbohydrates and list examples.
4. Explain why dietary fiber is a unique carbohydrate.
5. Outline difference between two types of dietary fiber.

Vegetables

1. Detail the two categories that make up the nine types of vegetables.
2. Explain why some fruits are often labeled as vegetables.
3. Define the term vegetable.
4. Identify vegetables from either visual or verbal illustrations.
5. Apply appropriate prep/cooking/holding/presentation options when presented with a list of vegetables.
6. Define the Scoville Heat Unit.
7. Recognize purchasing and storage requirements for vegetables, both fresh and preserved.
8. Explain how acid/alkali reactions affect vegetables.
9. Recognize basic cooking methods.

KNOWLEDGE OF CARBOHYDRATES (PART II)

Potatoes, Grains and Pasta

1. Recognize commonly used potato varieties.
2. Recognize basic cooking methods.

3. State purchasing and storage requirements for potatoes and pasta.
4. Label a botanical illustration of a kernel of grain.
5. List methods for grinding grains.
6. Indicate temperature safety requirements when using grains or potatoes in food service.
7. Identify various cuts of pasta.
8. Describe best methods to prepare pasta, both fresh and frozen.
9. Explain steps required to produce fresh pasta.

KNOWLEDGE OF CARBOHYDRATES (PART III)

Fruits

1. Identify a variety of fruits.
2. Discuss requirements for purchasing/storing fresh fruits.
3. Recognize basic cooking methods.
4. List options for prep/presentation of various fruits.
5. Detail ripening stages/requirements of fruits, including the effect on the sensory properties of the fruit.
6. State which parts of a specified fruit are edible.
7. Explain the terms "hybrid," "heirloom" and "variety."
8. List the nutritional benefits of fruits.
9. Explain the term "acidulation" as it applies to fruits.
10. List benefits of various processing methods (canned, frozen, preserved, dried).
11. Explain how storage temperatures affect fruit respiration rate.

KNOWLEDGE OF NUTRITION TRENDS

1. Identify food nutrition trends that affect food service.
2. Discuss consumer concerns as related to the nutritional content of various foods.
3. List six categories of nutrients.
4. Describe interplay of various nutrients as it relates to function.
5. Explain the different parts of a nutritional label.

KNOWLEDGE OF DAIRY PRODUCTS (PART I)

Milk and Milk Products (concentrated milk products, cream, cultured dairy products, butter, margarine)

1. Differentiate attributes of various concentrated milk products.
2. State safe storage requirements for different dairy products.
3. Contrast butter and margarine, both in composition and application in cooking.
4. List a variety of mammals that produce milk used for human consumption.

Processing Techniques

1. Discuss the various processing techniques for milk.
2. Explain the steps needed to produce most common cultured dairy products.
3. Describe the characteristics of a variety of butters.

Cheeses (Fresh or Unripened, Soft, Semi-soft, Firm, Hard, Processed)

1. Identify various cheeses.
2. Describe production process for fresh, soft, semi-soft, firm, hard and processed cheese.
3. State which types of cheese fit various culinary applications.

4. Recognize cheese terminology appearing on labels.
5. Describe requirements for storing cheeses.

KNOWLEDGE OF DAIRY PRODUCTS (PART II)

Egg Products/Substitutes

1. Identify the parts of an egg.
2. Explain purchase, safe storage and handling requirements for eggs.
3. Describe differences between eggs from various fowl.
4. List steps required to whip egg whites.
5. Define nutritional content of eggs.
6. List reasons for using egg substitutes.
7. Indicate specific properties of two types of egg substitutes.
8. Recognize basic cooking methods.

KNOWLEDGE OF FATS & OILS

Hydrogenation, Saturation, Refining, Rendering of Fats

1. Define rendering as it applies to fats.
2. Describe the chemistry principles behind hydrogenation of fats.
3. Describe the following terms used to classify fats: saturated, monounsaturated, polyunsaturated, and trans.
4. Discuss how dietary fats may affect the heart.

Processing, Quality, Functionality

1. List appropriate cooking oils used in basic cooking methods.
2. Define the following terms: melt, smoke and flash points.
3. Match various fats to their melt, smoke and flash points.
4. Explain the following: sautéing, stir frying, deep frying and pan frying.
5. State safety requirements when cooking with oils.
6. Briefly explain what happens when fats break down.
7. Explain the changes to viscosity and opacity when oils transition from refrigeration to room temperature
8. State considerations regarding cost and flavor of oils in culinary usage.
9. Explain sensory results of "rancidity."
10. Define labeling terminology for blended oils.
11. Explain how hydrogenation can affect the various physical properties of oil.

KNOWLEDGE OF GENERAL NUTRITION (PART I)

Enrichment (esp. grain products)

1. List the two vitamins often used to enrich dairy products.

Essential Nutrients (Carbohydrates, Lipids, Proteins, Vitamins, Minerals, Water, & Phytochemicals)

2. Define: calorie, carbohydrate, lipids and protein.
3. Calculate fat, carbohydrate and protein calories.
4. Name three energy components of essential nutrients.
5. Specify the function, source and technique for nutrient retention of the various vitamins.
6. Specify the function and source of various minerals.

7. Describe the body's need and use of water.
8. Explain the value of phytochemicals as related to disease prevention and the healthy maintenance of the human body.
9. Define the terms flavonoids and antioxidants.

KNOWLEDGE OF GENERAL NUTRITION (PART II)

Healthful Eating (health recommendations, ingredient substitutions and alternatives)

1. Define "ingredient substitution" as related to diet.
2. Explain the difference between ingredient "substitution" and "alternative."
3. Apply the terms "reduce," "replace" and "eliminate" when modifying recipe ingredients for nutritional needs.
4. Describe appropriate use of the various sugar, salt and fat substitutes available in the marketplace.

Nutritional Labeling (consumer concerns about nutrition)

1. Describe how nutrient requirements are established.
2. Interpret nutritional labels on packaging.

KNOWLEDGE OF PROTEINS (PART I)

Meat (Beef, Veal, Lamb, Pork, Game)

1. Match cuts of meat to the various animal sources.
2. Recognize basic cooking methods for meat.
3. Review the composition of different cuts of meat.
4. Describe the benefits of marination in preparation of meats.
5. Describe common methods for smoking meats.

Meat Composition & Butchering (primal, sub primal, fabricated cuts)

1. Identify structure and muscle composition of various meats.
2. Describe the primal, sub-primal and fabricated cuts of meat.
3. Describe various aging methods for meat. 4) Recognize purchasing/storage requirements for meats.
4. State safe serving temperatures for all meats.
5. Explain the Maillard reaction.

Poultry (Chicken, Duck, Goose, Guinea, Pigeon, Turkey, Game)

1. Identify the various classes of poultry.
2. Recognize various cooking methods for poultry.
3. Describe how poultry age affects the choice of cooking method.
4. Describe the benefits of marination in preparation of poultry and game.

Identification & Butchering

1. Identify structure and muscle composition of poultry and game.
2. Label the various cuts of poultry/game.
3. Recognize purchasing/storage requirements for poultry and game.
4. List various procedures to prepare poultry and game for cooking.
5. Recognize various cooking methods for poultry and game.
6. List safe serving temperatures for all poultry and game.

Liver, Gizzards, Hearts, Neck, Foie Gras

1. Identify various organ meats.

2. Recognize various cooking methods for organ meats.

KNOWLEDGE OF PROTEINS (PART II)

Fish and Shellfish

1. Identify shellfish, fish, mollusk and crustacean categories.
2. Recognize proper purchasing, storage and food safety requirements for shellfish, fish, mollusks and crustaceans.
3. State nutritional aspects of various shellfish, fish, mollusks and crustaceans.
4. Recognize various cooking methods for various shellfish, fish, mollusks and crustaceans.

Identification & Fabrication

1. Describe common fabrication methods for shellfish and fish.

KNOWLEDGE OF PROTEINS (PART III)

Plant Proteins (including legumes, soy/soy products, meat analogs, nuts, seeds, nutritional yeast)

1. Explain the range of vegetarian diets.
2. Discuss various motivations for supporting a vegetarian diet.
3. Substitute plant proteins for animal proteins to create balanced diet plan.
4. Describe properties of soybean-based proteins.
5. Recognize cooking methods for soybean-based proteins.
6. Describe the relationship of plant materials and flavorings/herbs & spices to create analogous foods.
7. List vegetarian substitutes for dairy/meat products.
8. Identify a variety of nuts.

KNOWLEDGE OF FLAVOR BUILDING IN THE KITCHEN (PART I)

Top, Mid, Base Notes and construction of flavor systems

1. Explain the psychology of taste and smell in humans.
2. Discuss factors affecting perception of flavors.
3. Match type of aroma/flavor with listing of foods with such characteristics.
4. Explain the concept of top, mid and base notes.
5. Describe what other factors can affect flavors.

Basic Tastes (sweet, salty, bitter, sour, and Umami)

1. Recognize what can be added/subtracted from a basic taste profile (sweet, salty, etc.) to enhance perception of taste.
2. Define the basic taste sensations by describing how they are derived, how to enhance them, and how tastes are perceived in various foods.

Flavor Perception

1. Discuss what human factors compromise perception of taste.
2. Describe what environmental factors affect perception of taste.
3. Describe the physiology of how humans experience taste and smell.

KNOWLEDGE OF FLAVOR BUILDING IN THE KITCHEN (PART II)

Oil and Spice Extracts

1. Recognize a variety of herbs, spices, oils, vinegars, wines and other flavorings.

2. State proper storage conditions for flavoring agents.
3. Know the properties of culinary salts available.
4. Describe the taste profiles of culinary oils.
5. Explain the difference between emulsions and extracts.
6. Recognize the source of essential oils
7. Recognize proper storage for essential oils, extracts, etc.

Wine, Beers, Liquors

1. Define the following terms: beer, wine, brandies, liquors and liqueurs.
2. Explain the wine making process.
3. Describe the difference between sparkling and fortified wines.
4. Discuss grape varieties.
5. Recognize labeling requirements for imported wines of various regions.
6. Describe process for evaluating wines.
7. List some guidelines to assist customers to match wine and beer with food.
8. State challenges possible when using wine as a flavoring.
9. Describe characteristics of different types of beer.
10. Identify the basic categories of liquors.
11. Characterize the distillation process of major liquors.

~ CULINARY ARTS & MANAGEMENT ~

KNOWLEDGE OF CULINARY KITCHEN FUNDAMENTALS

1. Identify the chef stations of the kitchen brigade and their responsibilities.
2. Describe how the modern kitchen brigade differs from the classic brigade system.
3. Describe the various work sections and their stations in the modern kitchen.
4. Define the term "Mise en Place" and be able to name examples.

KNOWLEDGE OF CULINARY USES AND APPLICATIONS OF PRODUCTS

1. Identify which cooking methods are suited for specific foods.
2. Classify the following reaction temperatures for different types of fat: melting point, smoke point and flash point.

KNOWLEDGE OF KITCHEN TOOLS AND EQUIPMENT KNIVES

1. Identify the parts of a knife and various knife shapes.
2. Describe knife sharpening techniques and equipment.

Measuring and Portioning Equipment

1. Recognize measuring and portioning equipment and describe its uses.
2. List measuring utensils (spoons, cups, scales)
3. Discuss conversions between different measuring equipment (i.e., volume to weight).
4. Identify standard portion scoop capacities.

Common Cookware, Processing Equipment and Heavy Equipment

1. Identify common cookware, processing equipment, heavy equipment, and buffet equipment.
2. Describe materials used in cookware and the advantages/disadvantages of each.
3. Describe the factors that should be considered when selecting tools & equipment.

4. Describe new technology cooking: silicon bake-ware, induction.

Safety Equipment

1. Identify the following safety equipment elements, how they work and why they are necessary in the kitchen: fire extinguishers, ventilation, first aid and protective gear.

KNOWLEDGE OF PRINCIPLES OF COOKING (PART I)

Heat Transfer

1. Describe the following principles of heat transfer: conduction, convection and radiation.

Effects of Heat

1. Explain the following effects of heat: coagulation, gelatinization, caramelization and browning.

Dry Heat Cooking: broiling, grilling, roasting, sautéing, stir-frying, pan frying, deep frying

1. Describe each dry heat cooking procedure.
2. Recognize the related terminology and explain when each technique would be used.
3. State which type of equipment would typically be used for each procedure.
4. Define Poêléing and basting.
5. Describe what carryover cooking is and why it is important.
6. Recognize the various methods of deep frying.
7. Describe the safety hazards of cooking with hot oil, including the role of acrolein.
8. Explain factors that can damage fryer fats and name indicators that the fat needs to be changed.

KNOWLEDGE OF PRINCIPLES OF COOKING (PART II)

Moist Heat Cooking: poaching, simmering, boiling, steaming

1. Describe each moist heat cooking procedure.
2. Recognize the related terminology and explain when each technique would be used.
3. State which type of equipment would typically be used for each procedure.
4. Recognize and explain the differences associated with liquid temperature and liquid condition, and how each affects the following moist heat cooking techniques: poaching, simmering, boiling and steaming.

Combination Cooking: braising, stewing

1. Describe each combination cooking procedure.
2. Recognize the related terminology and explain when each technique would be used.
3. State which type of equipment would typically be used for each procedure.

KNOWLEDGE OF PRINCIPLES OF COOKING (PART III)

Breading/Batters

1. Identify the types of breading and batters and how they are used.
2. Explain how to make bread crumbs and the standard breading procedure, including associated safety concerns.
3. Define "meal" as it relates to the breading/battering process.

Blanching and Parboiling

1. Define blanching, parboiling and par cooking and describe why they are important.

Ice Baths

1. Explain the purposes of using an ice bath. 2) Identify the process of shocking and why it is used.

KNOWLEDGE OF REGIONAL & WORLD CUISINES

1. Identify typical flavoring ingredients and cooking methods that are fundamental to various world cuisines.
2. Define the following: global cuisine, national cuisine, regional cuisine, and ethnic cuisine.

KNOWLEDGE OF TRADITIONAL STOCKS, SAUCES & SOUPS (PART I)**Stocks**

1. Identify stock terminology: white, brown, fish, fumet, court bouillon and fond.
2. Identify the ratios of the following stock components: bones, mirepoix, seasonings and water.
3. Identify the components and uses of various bones and how they relate to making stock.
4. Identify the steps in making the various types of stocks.
5. Describe the method for safely cooling and handling stocks.
6. Explain the following key terms associated with stock making: sweat, deglaze, degrease, caramelize, matignon, remouillage, nage and glaze.
7. Describe how to troubleshoot common problems in stock making.

KNOWLEDGE OF TRADITIONAL STOCKS, SAUCES & SOUPS (PART II)**Sauces**

1. List the mother / leading sauces, their ingredients.
2. Recognize how small/compound sauces are created
3. Define the following contemporary sauces: purees, salsas, relish, compound butters, coulis, vegetable juice sauces, flavored oils and pan sauces.
4. Describe the process to make a mother sauce.
5. Define "gastrique", "clarify" and the various types of butter sauces.
6. Recognize the following sauce thickening agents, their purpose and benefits or disadvantages: roux, cornstarch, arrowroot, beurre manié, liaison, emulsification, tempering and slurry.
7. Describe the proportions of roux to liquid for light, medium and heavy sauces.
8. Describe the process for holding emulsified butter sauces, and state the proper, related temperatures.
9. Recognize the following sauce finishing techniques: reduction, straining and monté au beurre.
10. Describe the following sauce qualities and typical uses: Béchamel, Velouté, Espagnole, Tomato, Hollandaise, butter sauces, pan gravy, coulis, salsa/relish and flavored oils.
11. Discuss how to troubleshoot common problems in sauce making.

KNOWLEDGE OF TRADITIONAL STOCKS, SAUCES & SOUPS (PART III)

Soups

1. Identify the classifications of soups and their components: clear, consommé, cream, puree, bisques, chowders and cold soups.
2. Describe the method used to produce the various types of soups.
3. Discuss the types of thickening agents used for the various types of soups.
4. Understand the function of soup garnishes and the appropriate garnish for each type of soup.
5. Describe the classic garnishes of classic consommés.

KNOWLEDGE OF BAKING & PASTRY (PART I)

Ingredient Composition & Structure

1. Describe the composition of wheat kernels.
2. Describe the process of milling flour.
3. Describe the difference between soft and hard flours.
4. Explain the process of aging or bleaching flour.
5. Explain and describe gluten and its function in baked goods.
6. Describe different protein contents of flour and the different usages of each.
7. List and describe the different usages of sugars as they relate to baked goods.
8. List and describe the usages of liquid sweeteners and their functions in baked goods.
9. Describe different cooked sugar syrup stages, their make-up and usages.
10. Describe and list the different fats used in baking.
11. Describe the difference between powdered gelatin and sheet gelatin. Why and how each is used.
12. Describe the difference between extracts and emulsions.

Ingredient Functionality

1. Describe the composition and different usages of baking powder and baking soda.
2. Recognize commonly used acids used in conjunction with baking soda.
3. List the function of sugars and or other sweeteners on baked goods.
4. List and describe the functions of fats in baked goods.
5. Describe the composition of eggs.
6. Describe proper storage of eggs.
7. Describe and list common methods of determining the quality of eggs.
8. Describe how salt affects baked products.
9. List different types of leavening agents.

KNOWLEDGE OF BAKING & PASTRY (PART II)

Mixing Methods

1. Define the mixing methods and applications: biscuit, muffin, creaming, beating, blending, cutting, folding, kneading, sifting, stirring and whipping.

Applications

1. Describe the function of fermentation.
2. Describe the proper temperatures when using yeasts.
3. List and describe different types of yeasts.
4. List and describe the 10 stages of production for yeast breads.

5. Identify and explain the procedure for preparing rolled-in dough.
6. Describe and list the differences between lean and rich doughs.
7. Describe the difference between flaky and mealy doughs.
8. Describe the process of blind baking.
9. Describe various pie fillings such as cream, fruit, custard and chiffon.
10. Describe common methods of making meringues such as common, Swiss and Italian.
11. Describe various types of cookies such as drop, icebox, bar, cut-out, rolled, pressed and wafer.
12. Describe how formula ingredients, size, shape and baking affect the texture of cookies.
13. Describe how formula ingredients, mixing method affect the texture of cakes.
14. Describe various types of cakes such as high-ratio, genoise, angel, chiffon and butter cakes.
15. Describe how altitude affects cakes and how to adjust formulas.
16. Describe methods for determining when cakes are done.
17. List and describe various types of frosting such as butter-cream, foam, fudge, fondant, glaze, royal icing, and ganache.
18. Describe the difference between a stirred custard and a baked custard.
19. List the classifications of pastry dough and describe characteristics after baking.

Formula Calculations- Baker's %

1. Recognize and be able to apply Baker's percent.

KNOWLEDGE OF PRODUCT PRESENTATION

1. Explain the following aspects of food preparation for proper plate presentation: cutting and molding.
2. Indicate how to properly choose plates for presenting food with regard to sizes and shapes, and colors and patterns.
3. Recognize how to arrange food on plates for the best presentation with regard to shapes, colors, textures and arrangements.
4. Explain how to decorate plates through dusting, herbs/greens and sauces.

KNOWLEDGE OF INGREDIENT SOURCING

Internal management

1. Define FIFO.
2. Explain the issues that can control/affect food costs.
3. Define parstock.

Storage

1. Describe storage procedures for the various ingredients in the kitchen.

KNOWLEDGE OF RECIPE DEVELOPMENT AND FORMULA RATIOS

Recipe Yield

1. Calculate recipe yield.
2. Explain how to convert portion size.
3. Define common abbreviations for measurements and common equivalents.
4. Describe how to calculate recipe cost, unit cost, food cost percent and selling price.

5. Define conversion factor, A.P. (as purchased), E.P. (edible portion), overhead costs and inventory.

Standardized recipes

1. Recognize the difference between the definitions for "recipe" and "standardized recipe."

KNOWLEDGE OF WEIGHT & MEASUREMENT CONVERSIONS

1. Describe the difference of weight versus volume.
2. Explain how to convert from Celsius to Fahrenheit and from Fahrenheit to Celsius degrees.
3. Explain how to convert from the US and metric measurement systems.
4. Discuss the process of using a balance scale.

~ MICROBIOLOGY, FOOD SAFETY, QUALITY ASSURANCE & REGULATIONS ~

KNOWLEDGE OF FOOD CHEMISTRY AND MICROBIOLOGY

1. Describe different types of bacteria.
2. Define putrefactives and explain how "pathogenic" and "reproduction time phases" relate to the term.
3. List and describe different types of intoxications and infections.
4. Describe viruses and their forms, and how they differ from bacteria.

KNOWLEDGE OF FOOD SAFETY AND SANITATION (PART I)

Contaminants: Biological, Chemical, Physical

1. Describe terms biological hazard, chemical hazard and physical hazard.
2. List and describe the names, forms, common sources and prevention of different types of bacterial illnesses.
3. Describe and list several types of potentially hazardous foods.
4. Identify chemical contaminants.
5. Describe how to prevent chemical contamination.
6. Describe common pest management programs.

KNOWLEDGE OF FOOD SAFETY AND SANITATION (PART II)

KNOWLEDGE OF HACCP

1. Define HACCP.
2. List and describe HACCP systems.
3. Explain "HACCP flow" as it relates to recipes.
4. List and describe the following different aspects of the "time and temperature" principle:
 - a. Danger zone
 - b. "Hot Foods Hot/Cold Foods Cold"
 - c. Temperature in order to kill bacteria
 - d. Lag and log phase
 - e. Thawing foods
 - f. Reheating or cooling foods
 - g. Recommended internal temperatures of final cooked stage

- h. pH and its affects
- i. Aerobic atmosphere
- j. Anaerobic atmosphere
- k. Facultative atmosphere

Preventing Food Borne Illness

1. Describe cross contamination and state its causes and effects.
2. Describe proper hand washing procedures.
3. Describe the difference between "clean" and "sanitary" and how they relate to ware washing.
4. Describe and list "safe worker practices" related to working in a kitchen.
5. Define parasites and describe how the following parasites affect people and food: Trichinosis, Anisakiasis and Cyclospora.

KNOWLEDGE OF GOVERNMENT FOOD REGULATIONS

1. List the criteria for food to be labeled organic or to display the USDA organic seal.
2. Identify the U.S. government agency responsible for general nutrition guidelines.
3. Identify various acronyms (USDA, FDA, etc) for the various federal government groups responsible for health recommendations/food safety guidelines
4. Name the federal agency which regulates authorized health claims (e.g. low fat, lean, good source).
5. Indicate specific requirements for a vegetable to be labeled "organic."
6. Differentiate the various federal health organizations that publish recommended dietary needs.
7. Describe the need for USDA pasteurization guidelines for eggs.
8. List the enrichment nutrients, permissible by USDA standards, to be added to flour.
9. Define the acronyms EAR, RDA, UL and AL as they relate to nutrition.
10. Define NSF and the standards requirements
11. Describe the US grading system for the following food items: fresh fruits, milk, eggs, meat and poultry.

FOOD SCIENCE

Note: 90% of CRC exam questions come from FOOD SCIENCE and 10% come from CULINARY ARTS. In addition to these learning outcomes, please reference the most recent editions of *Elementary Food Science* (Ernest R. Vieira), *Understanding Food Science and Technology* (Peter S. Murano) and *On Cooking: a Textbook of Culinary Fundamentals* (Sarah R. Labensky, Alan M. Hause).

~ APPLICATIONS ~

KNOWLEDGE OF ALLERGENS

1. Discuss the distinction between a food allergy and a food intolerance.
2. List the top 8 commonly recognized food allergens as listed by the FDA. [Note: On Cooking does not separately list fin fish or tree nuts.]
3. Recognize substances which can cause food intolerances and trigger reactions.

KNOWLEDGE OF CARBOHYDRATES

1. Identify important food sugars, the chemical reactions they participate in, and their functional properties.
2. Identify various sources of gums, their differences and functional properties in food processing.

Vegetables and Fruits

1. Botanically classify fruits vs. vegetables.
2. Describe different approaches to ripening commercial fruit.
3. Describe standard methods of storing, and processing for fruit and vegetables.

KNOWLEDGE OF COMMERCIAL FLAVORINGS

1. Define commercial flavor terms as they relate to applications.
2. State the significance of the Maillard reactions.
3. Explain the purpose of encapsulation with respect to the flavor industry.

KNOWLEDGE OF DAIRY & MILK PRODUCTS

1. Explain how the Standards of Identity for milk products relate to compositional differences.
2. Name sources in milk and methods of limiting bacterial contamination.

Processing Techniques

1. Describe the manufacturing procedures in preparing ice cream.
2. Describe the processing of fluid milk to include pasteurization and different UHT processes.

Egg Products/Substitutes

1. Explain the process of pasteurization of egg product in the prevention of salmonellosis.
2. Describe how egg processing involves separation, mixing, pasteurization, cooling, freezing or drying.

KNOWLEDGE OF FATS & OILS (LIPIDS)

1. State the important functional properties of food lipids, including aeration, crystallization, heat transfer, and mouth feel.
2. Identify the origin of fats and oils and examples in each source.

Hydrogenation, Saturation, Refining & Rendering

1. Distinguish between the classes of lipid molecules and the chemical differences of fatty acids.
2. Discuss the chemical reactions that lipids undergo and the functionality of these reactions.
3. Describe the chemical and physical tests used on fats and oils.
4. Identify the difference between cis and trans fat configuration.

Processing, Quality & Functionality

1. Discuss the basic production and refining methods for fats and oils.
2. Describe the functionality of lipids in emulsions.

KNOWLEDGE OF NUTRITION TRENDS AND GENERAL NUTRITION

1. Explain the concept of nutrient density.
2. Explain how the digestion, absorption and transport of the various nutrients are accomplished.
3. Explain the information in the food composition tables.
4. State the nutritional value of alternative sweeteners and fat replacers.
5. Explain how to read a food label.

Essential Nutrients

1. Explain difference between micro and macro nutrients
2. Define healthy nutrition and describe ways to achieve it.
3. Calculate the energy value of any food.
4. Define bioavailability and name factors that affect it.
5. Identify the nutrients considered essential for the human body.
6. Discuss the functions of the important nutrients in human nutrition.

KNOWLEDGE OF PROTEINS

1. Describe the structure of food proteins and list their functional properties.
2. Describe the structure of muscle tissue.
3. Relate collagen content of meat to meat tenderness.
4. Describe the functional properties of protein (e.g. foaming and gelation, etc.)
5. Explain the chemical basis for red meat color.

KNOWLEDGE OF FUNCTIONAL INGREDIENTS

1. Recognize the potential for protein hydrolysates to act as functional ingredients.
2. Discuss the functional properties of common food additives, including acidulants, alkalies, buffers, etc.
3. Explain the function and benefits of food starches in food systems.

Colors

1. List the certified food colorants and examples of those exempt from certification.
2. Discuss the advantages and disadvantages of natural and artificial food colorants in product development.

Preservatives

1. State the legal definition of a food additive.
2. Explain the purpose of the various types of food additives.
3. Describe the purpose of chemical preservatives.
4. List and define the various chemicals used in food preservation.

Antioxidants

1. Explain antioxidants.
2. Discuss the functionality of antioxidants.
3. Classify various ingredients as natural or artificial antioxidants.

Leavening Agents

1. Describe chemical and biological leavening and their functionality in baked products.

Acidulants, Buffers & pH Adjusting Ingredients

1. Define: oxidation, reduction, oxidizing agent, reducing agent.

2. Describe related chemical and functional properties of water.
3. Describe related chemical and functional properties of food acids.
4. Distinguish features of food systems such as emulsions, foams, gels and solutions.
5. Explain food acidity in terms of pH and titratable acidity.
6. Explain how acidulants, buffers and pH adjusting ingredients affect food enzymatic reactions.

~ MICROBIOLOGY, FOOD SAFETY, QUALITY ASSURANCE &
REGULATIONS ~

KNOWLEDGE OF FOOD CHEMISTRY AND MICROBIOLOGY (PART I)

Cell Basics

1. Identify the parts of both animal and plant cells.

Basic Chemical Matter

1. Define: elements, compounds, mixture, symbols and chemical bonds.
2. Identify the elements of the Periodic Table that are important to food science.
3. Explain chemical equations and their components (including reactants, products and symbols).
4. Define: solution, solvent, solute, homogeneous matter, food system, food colloids, emulsion, foam, gel and sol.

KNOWLEDGE OF FOOD CHEMISTRY AND MICROBIOLOGY (PART II)

Enzymatic Reactions

1. Define enzymes.
2. Discuss the following enzymes: proteolytic, oxidizing, fat-splitting, and decomposing carbohydrates.
3. Discuss the application of enzymes in food processing.
4. Understand how enzymes can affect food products.
5. Explain how enzymes work, including the term “active site.”
6. Explain enzymatic hydrolysis.
7. Understand enzymatic fermentation, oxidation-reduction and polymerization.

Non Enzymatic Reactions

1. Define the following non-enzymatic terms: addition, oxidation-reduction, condensation and hydrolysis.

Functional Groups

1. Be able to define the following functional groups and recognize their chemical structures: alcohol, aldehyde, amino, carboxylic acid, ester, ketone, methyl, phosphate, sulfhydryl and ionic.

KNOWLEDGE OF FOOD CHEMISTRY AND MICROBIOLOGY (PART III)

Properties of Water

1. Explain the functional properties of water.
2. Recognize the molecular structure of water.
3. Explain why the structure of water affects its physical characteristics and electrostatic attraction.

4. Define the terms solubility, hydrophilic, hydration, amphiphilic, micelles and non-covalent interactions, and explain why they are important to water.
5. Explain water activity and how moisture, free water, absorbed water and bound water are related to water activity.
6. Understand how to calculate water activity and relative humidity.
7. Explain how water can be a vehicle for heat transfer.
8. Define the terms plasticizer, and Tg (glass transition temperature).

KNOWLEDGE OF FOOD SAFETY AND SANITATION (PART I)

Process Lethality

1. Define process lethality.
2. Describe how to determine a process time and a lethal process.
3. Define what a unit of lethality is.
4. Recognize the basic calculation of process lethality.

Thermal Death Curves

1. Discuss the concept of death curves.
2. Define D, F, Fo and z values.
3. Explain the importance of death curves in manufacturing.

KNOWLEDGE OF FOOD SAFETY AND SANITATION (PART II)

Contaminants

1. Define the terms: safety, hazard and risk.
2. Name an example of a biological, chemical, physical, or microbiological contaminant.

HACCP

1. Describe purpose of HACCP.
2. State the definition of HACCP.
3. List seven principals of HACCP.
4. Recognize a critical control point.

Food Borne Illness

1. Recognize difference between food infection vs. food intoxication.
2. List the four major food borne pathogenic microorganisms.
3. Identify foods associated with specific food borne pathogenic microorganisms.
4. Explain the six factors that affect microbial growth, including temperature, pH and water activity.
5. Discuss the sources that contribute to the microbial flora of foods.
6. Describe the microorganism associated with meats, seafood, fruit and vegetables and dairy products.
7. Explain how food spoilage occurs.
8. Discuss how microbial sampling can be used to verify food quality.
9. Discuss the following attributes of microbes: structure, shape, size, reproduction and motility.

KNOWLEDGE OF FOOD TESTING

Analytical

1. Explain water activity, pH, brix, moisture testing, and acid testing, as they are used to prevent bacteria outgrowth.

Organoleptic

1. Indicate signs of food spoilage.
2. Identify visual signs of pathogenic spoilage.

Micro Testing

1. Identify how microbiology labs test for pathogenic and spoilage bacteria.
2. Recognize sampling, cultures, and microscopic methods (TPC, APC, Coliform indicator organisms).

KNOWLEDGE OF GOVERNMENT FOOD REGULATIONS (PART I)

Governmental Agencies

1. Identify government agencies and their primary responsibilities.
2. Define what GMPs are and who publishes them.
3. Recognize Dept. of Commerce and which bureau it holds.

NLEA

1. Define what the NLEA law is.
2. Recognize parts of nutritional labeling (serving size, nutrients, reference values, conversion guide, % daily values).
3. Define what a nutrient "claim" is.
4. Define what a "health" claim is.

Labeling of Flavors

1. Describe the difference between natural, WONF (with other natural flavors), type, Natural and Artificial (N&A), and artificial.
2. Recognize the four classes of flavors: oil soluble, water soluble, water dispersible and water-oil soluble.

KNOWLEDGE OF GOVERNMENT FOOD REGULATIONS (PART II)

Code of Federal Regulations

1. Identify the Code of Federal Regulation.
2. Describe what Title 21 specifically covers.
3. Explain the Food, Drug and Cosmetic Act.
4. Identify other acts (Federal Poultry, Federal Trade, Infant Formula Act 1980, Nutritional Labeling and Education Act).

Grading and Inspection

1. Define the Federal Grade Standards of Quality and recognize who administers them.
2. Describe the difference between inspection and grading.
3. Recognize how consumers use these grades.
4. Differentiate between products that are inspected by USDA vs FDA.

Standard of Identity

1. Describe the Standard of Identity of dairy products, such as ice cream, yogurt, cheese, butter, whey, buttermilk and sour cream.

KNOWLEDGE OF GOVERNMENT FOOD REGULATIONS (PART III)

Allergen Regulations

1. List the top 8 commonly recognized food allergens as listed by the FDA. [Note: On Cooking does not separately list finfish or tree nuts.]
2. Recognize the legal way to label an allergen on a food label.

Organic Regulations

1. Identify who regulates the organic industry (USDA).
2. Recognize organic certification procedures.
3. Name laws related to organic manufacturing.
4. Differentiate between "made with organic ingredients" and "organic".
5. Define standards of organic products.

KNOWLEDGE OF PRODUCT SHELF LIFE (PART I)

Determination of Food Safety and Quality

1. Define the term "Quality of Food."
2. Identify equipment used to measure sensory qualities (appearance, texture, and flavor).
3. Define a quality control department and its general functions.
4. Define TQC (total quality control).

Shelf Life Testing Procedures & Recommendations

1. Define "shelf life of a food" as it relates to safety and quality.
2. Identify what MAQ stands for.
3. Explain how one can determine shelf life of a product?
4. Recognize time/temperature indicator as it relates to quality and shelf life.

KNOWLEDGE OF PRODUCT SHELF LIFE (PART II)

Packaging Technology

1. List some current packaging technologies.
2. List general requirements of a food package.
3. List types of "assaults" that packaging prevent against.
4. Recognize how product quality is protected by packaging and how it is protected from light, heat, chemicals, bugs, rodents and oxygen.
5. Discuss how packaging prolongs shelf life.
6. Define aseptic packaging.

Preservation Methods

1. List all the preservation method categories: thermal, drying, low temperature and food additives.
2. Indicate how each preservation method inhibits outgrowth of bacteria.
3. Explain difference between sterilization, commercially sterile, pasteurization, blanching, hot fill and the different types of microorganisms each inhibits.
4. Explain drying methods.
5. Explain low temperature methods.
6. Explain the function of the most common food additives for preservation.

KNOWLEDGE OF PRODUCT SHELF LIFE (PART III)**Discoloration Due to Oxidation & Temperature Abuse**

1. Describe negative effects of temperature, oxygen and light on food quality and shelf life over a period of time.

Flavor Loss Over Time

1. Identify factors that can contribute to flavor loss and the creation of off flavors.
2. Define oxidized flavor.
3. Identify a food additive that can help prevent flavor loss over time.

Yeast, Mold, Spoilage Prevention

1. Describe how yeast and mold contamination occur.
2. List food associated with specific types of mold/yeast/spoilage organisms.
3. Explain how to prevent food spoilage and extend shelf life.

KNOWLEDGE OF PRODUCT SHELF LIFE (PART IV)**Dating Procedures**

1. Recognize why products are "dated".
2. Explain what a date tag tells consumers. Distribution, Shipping & Storage
3. List environmental (extrinsic) factors that affect food quality/shelf life.
4. Explain how to protect food during distribution, shipping and storage.

Minimum Shelf Life & Minimum Aging

1. Define MAQ (minimum acceptable quality).
2. Recognize how soon a product's deterioration can be detected (this is what minimum shelf life requirements are based on).
3. Review how shelf life can also relate to time needed to obtain optimal quality.

~ PROCESSING, MANUFACTURING & ENGINEERING ~

KNOWLEDGE AND APPLICATION OF HEAT EXCHANGE / HEAT TRANSFER

1. Discuss the reasoning for D-value.
2. Explain retort.
3. Review heat transfer and thermal processing techniques and be able to discuss the differences and application.
4. Identify the steps for heat transfer technologies and thermal processes e.g. convection, conduction, radiation and irradiation/microwave etc.
5. Describe IQF technology.
6. Describe sun drying, drum drying, spray drying, and freeze-drying techniques.

KNOWLEDGE OF PACKAGING

1. Discuss packaging selection criteria for modified atmosphere packaging, vacuum packaging and aseptic packaging.
2. Review the most critical material properties of plastics and understand how and why to apply to packaging selection.
3. Discuss the barrier property differences between metal cans, flexible pouches, glass and edible films.

KNOWLEDGE OF WEIGHT & MEASUREMENT CONVERSIONS

1. Translate weight and volumetric measurements from US to metric.
2. Review formulation structure such as % weight, scale-up from batch to full-scale, converting to standardized recipe.
3. Describe the method or calculations for converting degrees F to degrees C.

KNOWLEDGE OF FOOD PROCESSING

1. Classify and describe different ways to process food.
2. Identify methods for drying and be able to discuss the process for each.
3. Explain the reasons for using a particular type of drying method.
4. Describe the effects of drying on food product and its quality.
5. Describe freezing methods and why you would use a particular method.
6. Identify the methods for preparing food for freezing.
7. Recognize the effects of freezing on food quality.
8. Explain the process and purpose of milk pasteurization.
9. Describe what an extruder is and the types of food products produced.
10. Identify the three tools to measure texture and control quality during processing.

~ FOOD PRODUCT DEVELOPMENT ~

KNOWLEDGE OF EQUIPMENT & SELECTION

1. Review basic types of manufacturing equipment to produce a range of food products and explain differences and similarities.

Understanding of the Product Development Process

1. Define the stages of product development and recognize the key aspects of each stage.
2. Define the appropriate types of sensory tests required for each stage.

APPENDIX E

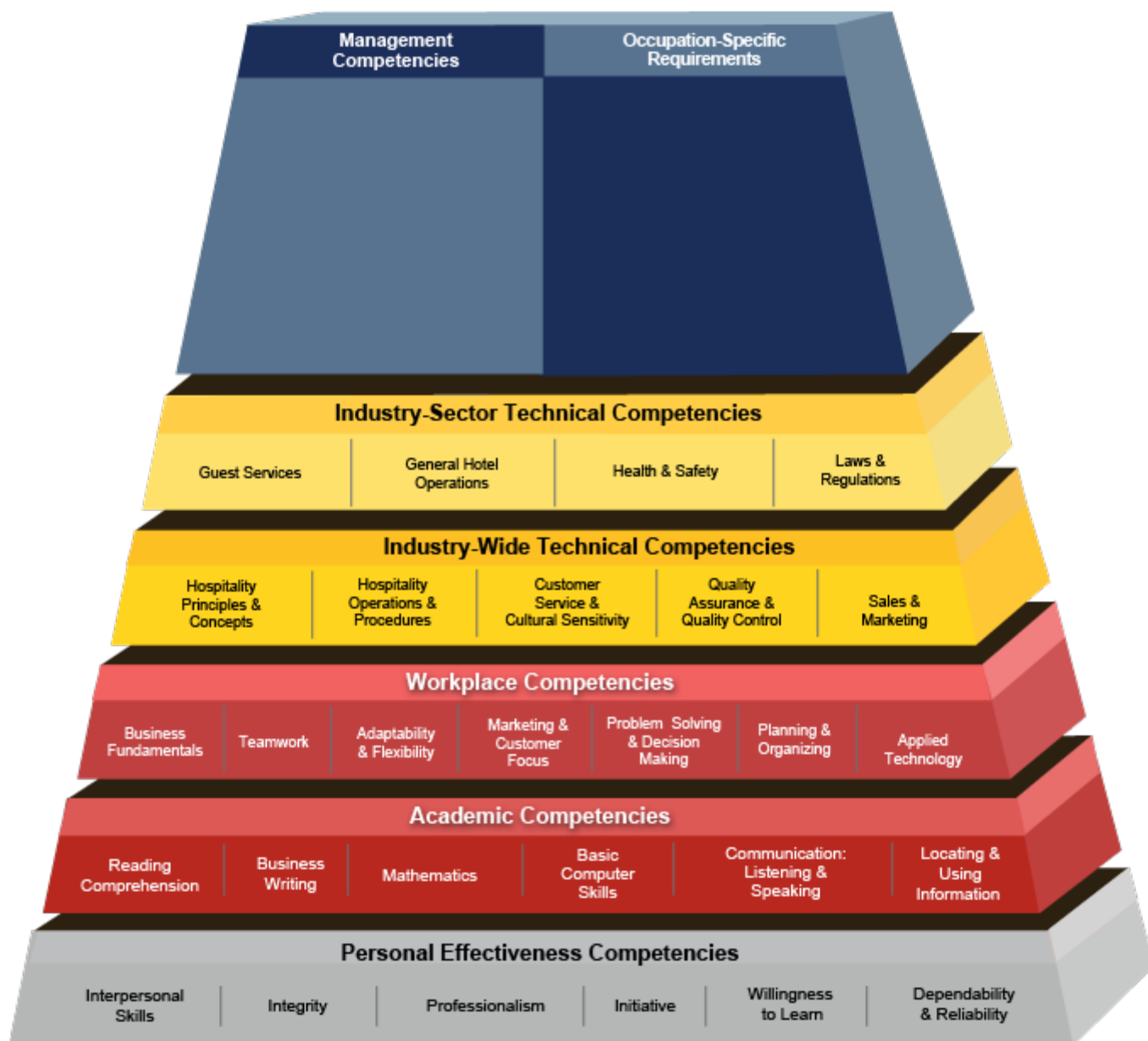
HOSPITALITY / HOTEL AND LODGING COMPETENCY MODEL

Framework of Competencies by the Hospitality Industry

Hotel & Lodging

Retrieved Oct 1, 2012 from

<http://www.careeronestop.org/competencymodel/pyramid.aspx?hsp=Y>



TOP-LEVEL SUMMARY OF COMPETENCY MODEL FRAMEWORK

Tier 1: Personal Effectiveness

Interpersonal Skills
Integrity
Professionalism
Initiative
Willingness to Learn
Dependability & Reliability

Tier 2: Academic Competencies

Reading Comprehension
Business Writing
Mathematics
Basic Computer Skills
Communication: Listening and Speaking
Locating & Using Information

Tier 3: Workplace Competencies

Business Fundamentals
Teamwork
Adaptability & Flexibility
Marketing & Customer Focus
Problem Solving/Decision Making
Planning and Organizing
Applied Technology

Tier 4: Industry-wide Technical Competencies

Hospitality Principles & Concepts
Hospitality Operations & Procedures
Customer Service & Cultural Sensitivity
Quality Assurance & Quality Control
Sales & Marketing

Tier 5: Industry-Sector Competencies

Guest Services
General Hotel Operations
Health & Safety
Laws & Regulations

Tier 1: Personal Effectiveness

Personal Effectiveness
<p>1. Interpersonal Skills: Display skills to work with people.</p> <ul style="list-style-type: none"> ▪ Demonstrate concern for others ▪ Use good manners and show cooperation ▪ Use interpersonal skills to build effective working relationships ▪ Work with diverse people by being flexible and open-minded ▪ Negotiate with others to resolve conflicts and settle disputes ▪ Demonstrate social perceptiveness by being aware of others' reactions and understanding why they react as they do ▪ Maintain open communication with others and recognize and accurately interpret the verbal and non-verbal behaviors of others; base actions appropriately ▪ Respect diversity by demonstrating respect for, listening to, and considering the opinions, perspectives, customs, and individual differences of others
<p>2. Integrity: Display accepted social and work behaviors.</p> <ul style="list-style-type: none"> ▪ Behave ethically, even in the face of opposition; encourage others to behave accordingly ▪ Act fairly and treat others with honesty, fairness and respect ▪ Take responsibility for one's decisions and actions and for those of one's group, team, or department ▪ Attempt to learn from one's mistakes
<p>3. Professionalism: Maintain a professional appearance and uphold ethical standards.</p> <ul style="list-style-type: none"> ▪ Demonstrate self-control by maintaining composure and dealing calmly and effectively with stressful situations ▪ Maintain a professional appearance by dressing appropriately for the job, maintaining personal hygiene, and using appropriate language when speaking with supervisor, co-workers, and customers ▪ Remain free from substance abuse ▪ Maintain positive attitude by taking pride in one's work and the work of the organization ▪ Avoid aggressive behavior
<p>4. Initiative: Demonstrate a willingness to work. Take on new responsibility.</p> <ul style="list-style-type: none"> ▪ Work independently; develop own ways of doing things; perform effectively even with minimal direction, support, or approval and without direct supervision ▪ Pursue work with energy, drive, and a strong accomplishment orientation; persist and expend extra effort to accomplish tasks even when conditions are difficult or deadlines are tight; persist at a task or problem despite interruptions, obstacles, or setbacks ▪ Go beyond the routine demands of the job; take initiative in seeking out new work challenges and increasing the variety and scope of one's job ▪ Seek opportunities to influence events and originate action ▪ Strive to exceed standards and expectations; exhibit confidence in capabilities and an expectation to succeed in future activities
<p>5. Willingness to Learn: Understand the importance of learning new information for both current and future problem solving and decision making.</p>

- Employ skills to promote personal learning and self-development
- Seek feedback from multiple sources about how to develop and improve; modify behavior for improvement
- Keep up-to-date technically applying new knowledge on the job
- Develop personal and professional goals
- Take steps to develop and maintain knowledge, skills, and expertise necessary to achieve positive results
- Participate fully in relevant training programs and actively pursue other opportunities to develop knowledge and skills
- Treat unexpected circumstances as opportunities to learn
- Anticipate changes in work demands and search for and participate in assignments or training that address these changing demands
- Take charge of personal career development by identifying occupational interests, strengths, options and opportunities; make insightful career planning decisions based on integration and consideration of others' feedback, and seek out additional training to pursue career goals

6. Dependability & Reliability: Displaying responsible behaviors at work.

- Be responsible in fulfilling work duties
- Behave consistently and predictably; be reliable, responsible and dependable in fulfilling obligations; diligently follow through on commitments and consistently meet deadlines
- Demonstrate regular and punctual attendance; rarely be late for meetings or appointments
- Diligently check work to ensure that all essential details have been considered; notice errors or inconsistencies that others have missed, and take prompt, thorough action to correct errors
- Follow written and verbal directions; comply with organizational rules, policies, and procedures

Tier 2: Foundation Academic Competencies

Academic Competencies

1. Reading Comprehension: Read and understand procedures, policies, instructions, emergency directives, training materials, newsletters, marketing promotions, and customer letters.

- Locate, understand, and interpret written information in documents
- Speak and understand English or required language
- Understand written sentences in work related materials
- Integrate what is learned from written materials with prior knowledge
- Apply what is learned from the written material to follow instructions and complete tasks

2. Business Writing: Use standard business English to write messages to co-workers and customers, reports to managers and associates, and letters to customers.

- Create documents to communicate thoughts, ideas, information, messages, and other written information, which may contain technical material, in a logical, organized, and

<p>coherent manner</p> <ul style="list-style-type: none"> ▪ Develop ideas well with supporting information and examples ▪ Use standard syntax and sentence structure; correct spelling, punctuation, and capitalization; and appropriate grammar ▪ Write in a manner appropriate for business using appropriate tone and word choice
<p>3. Mathematics: Use mathematics to calculate rates, taxes, and other fees and make conversions between currencies or units of measure.</p>
<ul style="list-style-type: none"> ▪ Read and write numbers ▪ Add, subtract, multiply, and divide with whole numbers, fractions, decimals, and percents ▪ Calculate averages, ratios, proportions and rates ▪ Convert decimals to fractions; convert fractions to percents ▪ Perform basic math computations accurately ▪ Translate practical problems into useful mathematical expressions ▪ Calculate staff time needed to cover a shift, figuring in breaks and hours worked per week ▪ Calculate time to complete the timesheet
<p>4. Basic Computer Skills: Use a personal computer and related applications to convey and retrieve information.</p>
<p>Navigation and File Management</p> <ul style="list-style-type: none"> ▪ Use scroll bars, a mouse, dialog boxes, and touch screen to work within a computer's operating system ▪ Access and switch between applications and files of interest <p>Internet and E-mail</p> <ul style="list-style-type: none"> ▪ Open and configure standard browsers ▪ Use searches, hypertext references, and transfer protocols ▪ Send and retrieve electronic mail (e-mail) <p>Intranet</p> <ul style="list-style-type: none"> • Follow login and password protocols ▪ Use company database to search for customer account information, product/service information, and availability of product/service ▪ Complete e-learning training modules
<p>5. Communication: Listen and speak so others understand. Communicate in spoken English well enough to be understood by supervisors, co-workers, and customers.</p>
<ul style="list-style-type: none"> ▪ Give full attention to what other people are saying, taking time to understand the points being made; ask questions as appropriate, and do not interrupt at inappropriate times ▪ Speak clearly, in precise language and in a logical organized and coherent manner ▪ Use correct grammar ▪ Effectively use eye-contact and non-verbal expression ▪ Communicate clearly and concisely to co-workers, customers, and those whose primary language is not English ▪ Utilize tactful language and communication to dispel misunderstandings or difficult

<p>situations</p> <ul style="list-style-type: none"> ▪ Make a request of a guest/customer without confrontation ▪ Give directions to a frenzied, stressed, upset guest/customer without insult or conflict
<p>6. Locating & Using Information: Know how to find and identify essential information (information gathering).</p>
<ul style="list-style-type: none"> ▪ Maintain knowledge of floor diagrams of the establishment ▪ Locate information regarding services offered by the company ▪ Use tracking procedures for services ▪ Assist the guest regardless of whether inquiries concern in-house or off-premises attractions, facilities, services, or activities ▪ Know how to provide concise and accurate directions ▪ Make reservations and obtains tickets for flights, the theater, or special events. Organize special functions such as VIP cocktail receptions, secretarial services

Tier 3: Workplace Competencies

Workplace Competencies
<p>1. Business Fundamentals: General knowledge of business and management principles.</p>
<p>Economic/Business/Financial Principles</p> <ul style="list-style-type: none"> ▪ Understand fundamental economic concepts ▪ Understand the environments in which businesses function ▪ Identify economic trends and indicators to measure economic conditions ▪ Knowledge of the industry at large, including market trends in the industry and the company's position in the market ▪ Knowledge of suppliers' practice, dependability, and flexibility ▪ Knowledge of sources of information about new and/or competitors' products and services
<p>Business Acumen</p> <ul style="list-style-type: none"> ▪ Understand and have an appreciation of what it takes for a business to be profitable ▪ Understand the organizations mission and functions recognizing one's role in the functioning of the company ▪ Consider the relative costs and benefits of potential actions to choose the most appropriate one
<p>Business Ethics</p> <ul style="list-style-type: none"> • Act in the best interests of the company, co-workers, community, and the environment ▪ Comply with the spirit as well as the letter of applicable laws ▪ Make proper use of company property, minimizing loss and waste ▪ Maintain privacy and confidentiality of company information, as well as that of customers and co-workers ▪ Adhere to company policies and regulations to foster trust ▪ Practice honesty with regard to company time and property

2. Teamwork: Apply interpersonal skills to collaborate with staff to help meet customer needs and expectations, arrange schedules, and complete work assignments.

- Work as part of a team to achieve company goals
- Show loyalty to the team and lead, influence, motivate, and persuade others to achieve company goals
- Develop constructive and cooperative working relationships with others; show sensitivity to the thoughts and opinions of others; respond appropriately to positive and negative feedback
- Work the assigned schedule and take responsibility for completing one's assigned tasks
- Employ leadership skills to facilitate workflow
- Communicate with incoming staff to facilitate shift transition
- Observe and coach others for improved performance; assist with training new employees
- Assist others who have less experience or have heavy workloads

3. Adaptability/Flexibility: Be open to change (positive or negative) and to considerable variety in the workplace.

- Be open to considering new ways of doing things
- Actively seek out and carefully consider the merits of new approaches to work
- Willingly embrace new approaches when appropriate and discard approaches that are no longer working
- Take effective action when necessary without having to have all the necessary facts in hand
- Change gears in response to unpredictable or unexpected events
- Effectively change plans, goals, actions, or priorities to deal with changing situations

4. Marketing and Customer Focus: Actively look for ways to identify market demands and meet the customer or client need.

Know the customer

- Understand internal and external customers
- Demonstrate a desire to understand customer needs
- Understand customer needs
- Ask questions as appropriate
- Address customer comments, questions, concerns, and objections with direct, accurate, and timely responses
- Evaluate customer satisfaction

Marketing

- Demonstrate an understanding of market trends, company's position in the market place, defined market segments
- Understand position of product/service in relation to market demand
- Uphold the company and product brand through building and maintaining customer relations

5. Problem Solving & Decision Making: Apply problem-solving and critical-thinking skills to help grow the business and/or to resolve workplace conflict.

Identify the problem

- Recognize the existence of a problem
- Define the problem
- Communicate problems to appropriate personnel

Analyze the problem

- Identify potential causes of the problem
- Recall previously learned information that is relevant to the problem
- Generate a number of different approaches to problems
- Evaluate the relative merits of the various solutions

Choose and implement a solution

- Exercise good judgment
- Decisively choose the best solution after contemplating available approaches to the problem
- Choose an effective solution without assistance when appropriate
- Make difficult decisions even in highly ambiguous or ill-defined situations
- Develop a realistic approach for implementing the chosen solution
- Observe and evaluate the outcomes of implementing the solution to assess the need for alternative approaches and to identify lessons learned

6. Planning & Organizing: Plan and prioritize work to manage time effectively and accomplish assigned tasks.

- Manage time effectively
- Approach work in a methodical manner
- Plan and schedule tasks so that work is completed on time
- Keep track of details to ensure work is performed accurately and completely
- Prioritize various competing tasks
- Perform tasks quickly and efficiently according to their urgency
- Find new ways of organizing work area or planning work to accomplish work more efficiently
- Demonstrate the ability to perform more than one activity at a time

7. Applied Technology: Develop capacities to operate and troubleshoot electrical, electronic, and mechanical equipment.

- Use electric and electronic equipment such as cash registers, printers, lighting
- Use a telephone or other device to convey and receive information
- Operate mechanical and electrical products and displays
- Use appropriate methods and instructions to ensure equipment is used safely and without damage to the equipment.

Tier 4—Industry-Wide Technical Competencies

<p>1. <u>Hospitality Principles & Concepts</u> - Knowledge of the principles and concepts related to the hospitality industry.</p>
<p>Industry Characteristics</p> <ul style="list-style-type: none"> ▪ Exhibit knowledge of industry features and characteristics including basic types of hotels: commercial, resort, residential, extended-stay, and casino ▪ Identify the various departments in a hotel/lodging operation facility (“front of the house” vs. “back of the house” operations) ▪ Identify areas of concentration in the food service industry ▪ Understand industry terminology such as “no-show,” “overbooking,” and “spoilage” ▪ Demonstrate awareness of industry-related factors such as impact of economy on business or seasonal fluctuations ▪ Compare/contrast different organizational structures including independently owned, chain affiliated, and corporations <p>Industry Developments</p> <ul style="list-style-type: none"> ▪ Demonstrate awareness of emerging industry concepts and principles such as economic shifts or developing security policies ▪ Adapt current practices to incorporate advances in the industry, such as changes in customer mix (families, business travelers, etc.) or preferences, changes in types of guest accommodations offered ▪ Upgrade services provided to include technological advances (e.g., Internet access)
<p>2. <u>Hospitality Operations and Procedures</u> - Perform activities associated with setting up, monitoring, controlling and improving hospitality services to meet industry requirements; demonstrate understanding of the operations performed within the hospitality industry.</p>
<p>Service Procedures</p> <ul style="list-style-type: none"> ▪ Offer and provide services appropriate to guests requirements ▪ Read procedural or company manuals and/or other forms of information to determine and carry out service processes or requirements ▪ Set up and monitor equipment or materials involved in the service process ▪ Adjust procedures based on industry or market changes such as environmental concerns (“going green” and energy and resource conservation) or changes in customer focus <p>Operation Procedures</p> <ul style="list-style-type: none"> ▪ Has basic knowledge of, operate, or coordinate operation of equipment and/or machinery involved in the satisfactory provision of services to guests, such as audiovisual equipment, Internet connections, beverage service, ice machines, etc. ▪ Understand varying shifts and variable schedules due to extended hours of service

<p>3. Customer Service & Cultural Sensitivity - Listen to customer needs and provide personalized assistance to meet those needs. Identify the components of cultural diversity to understand their impact on the different areas of the hospitality industry.</p>
<p>Service Performance</p> <ul style="list-style-type: none"> ▪ Maintain a customer service orientation ▪ Assess customer needs in order to provide personalized customer care ▪ Meet customer's service expectations and industry standards for service ▪ Use customer comments to guide customer satisfaction policies and improve customer service <p>Customer Assistance</p> <ul style="list-style-type: none"> ▪ Initiate customer contact ▪ Educate the customer regarding products and/or services through telephone, email and/or face-to-face interactions ▪ Respond to customer inquires and resolve customer complaints ▪ Ensure that appropriate actions are taken to assist customer ▪ Refer unresolved customer concerns to appropriate entities for further action <p>Cultural Sensitivity</p> <ul style="list-style-type: none"> ▪ Positively interact and foster relationships with people of different backgrounds ▪ Understand cultural differences in communication styles ▪ Show sensitivity toward others' beliefs at all times ▪ Demonstrate fairness and respect for different cultures, religions, genders, and ages
<p>4. Quality Assurance & Quality Control - Ensure materials, processes, services, and products meet quality specifications and customer expectations before, during, and after guests' visit.</p>
<p>Quality Assurance</p> <ul style="list-style-type: none"> ▪ Ensure that a service meets specified requirements and customer expectations ▪ Guarantee customer satisfaction ▪ Anticipate outcomes to prevent or minimize customer inconvenience <p>Quality Control</p> <ul style="list-style-type: none"> ▪ Identify quality standards for service ▪ Monitor service to review quality ▪ Ensure that service conforms to the established set of quality standards within the hospitality industry and the company or establishment ▪ Determine if a service meets customer/client requirements ▪ Report quality failures to appropriate individuals for corrective action
<p>5. Sales & Marketing - Promote and sell industry services.</p>
<p>Service Information</p> <ul style="list-style-type: none"> ▪ Demonstrate knowledge of hotel or lodging and restaurant services ▪ Understand promotion and selling strategies, such as marketing of restaurant services, spa services, or other services offered by the company or provided on the

premises

Service Promotion/Sale

- Identify and pursue prospective customers and appropriate customer groups
- Monitor customer preferences to determine focus of sales efforts and services that satisfy customer needs
- Emphasize and promote features in marketing or sales
- Direct and coordinate activities involving sales and services
- Gain customers' commitment to buy services
- Demonstrate an ability to close the sale

Sales Assistance

- Assist in the selection of services based on the match between customer needs and product or service specifications
- Inform customers regarding service contracts, offered services, estimated cost, delivery of services, and any other information regarding the purchase of services
- Resolve customer complaints regarding sales or service

Tier 5—Industry-Sector Competencies

1. **Guest Services** - Understand procedures related to proper contact with guests upon arrival and departure, and demonstrate knowledge of area/region including area attractions.

Greeting

- Meet and greet customers according to established standards (e.g., 10/5 Rule - acknowledge guest at 10 feet away and make verbal contact at 5 feet away).

Check In/Check Out

- Knowledge of procedures involving transactions relating to guest arrival, stay, and departure.
- Determine method of payment and process payment transactions
- Register and assign rooms to guests; issue room keys
- Receive and transmit messages to guests
- Follow policies for securing cash/bank drawer

Guest Assistance

- Understand facility guidelines related to ensuring customer satisfaction by assisting customers including, luggage and item delivery, room maintenance, basic customer inquiries, etc.

Public Relations

- Demonstrate ability to handle customer requests and complaints
- Ensure requests and complaints are dealt with promptly and to the satisfaction of the customer

<p>Information</p> <ul style="list-style-type: none"> ▪ Knowledge of hotel services, and dining recommendations (both in-house and out-of-house), and customer reservations for local events ▪ Knowledge of sources of entertainment and area attractions for tourists and guests, and how to apply that knowledge to assist in organizing guests' visits ▪ Use information to provide vacation guidance to customers ▪ Recognizes and recommends appropriate travel methods for guests including air, rail, sea, car and other modes of transportation.
<p>2. General Hotel Operations - Understand the functional areas of hotel operation and the organization structure, hotel services offered, and role in the functioning of the hotel.</p>
<p>Room Maintenance</p> <ul style="list-style-type: none"> ▪ Ensure timely cleaning of guest rooms including changes of linens, restocking of toiletries and other room amenities ▪ Note any needed repairs to materials or equipment (telephone, radio, television) and notify appropriate individual(s) ▪ Follow proper and safe cleaning procedures, interpret room status reports and complete room assignment sheets <p>General Facilities Maintenance</p> <ul style="list-style-type: none"> ▪ Provide general routine and preventative hotel maintenance, including grounds and recreational facilities. Respond to service requests, track maintenance scheduling, and maintain service & maintenance reports. <p>Event Planning and Management</p> <ul style="list-style-type: none"> ▪ Knowledge of procedures for banquets and major corporate functions, including conference arrangement, setup, service, and clean up function
<p>3. Health & Safety - Knowledge of regulations governing hotel and motel safety.</p>
<p>Guest Safety</p> <ul style="list-style-type: none"> ▪ Knowledge of facility guidelines to ensure the physical safety of customers ▪ Maintain a clean and safe environment ▪ Be aware of evacuation routes, fire extinguisher location and use, and safety manuals ▪ Recommend tourist attractions and accommodations that will be safe for all family members ▪ Outline basic first aid and CPR procedures <p>Security Procedures</p> <ul style="list-style-type: none"> ▪ Knowledge of company health, safety and security standards ▪ Knowledge of procedures for both customers and employees in emergency situations ▪ Provide security by identifying activities that are suspicious and carry out loss prevention safe guards.

<p>Hazardous Materials Safety</p> <ul style="list-style-type: none"> ▪ Understand and appropriately use chemicals and equipment ▪ Ensure safe handling of chemicals and equipment at all times
<p>4. Laws & Regulations - Knowledge of relevant local, state and federal laws and regulations that relate to the provision of lodging</p>
<p>Knowledge of applicable laws and regulations, including:</p> <ul style="list-style-type: none"> ▪ Procedures for protection of guests and their goods ▪ Innkeeper rights and obligations ▪ Relevant health codes ▪ OSHA health and safety regulations for employees

APPENDIX F

INSTITUTIONAL REVIEW BOARD EXEMPT LETTER

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 9/28/2011

To: Michael Cheng
1501 State St
Marshall, MN 56258

CC: Dr. Robert Bosselman
31 MacKay

From: Office for Responsible Research

Title: A Competency Model for Research Chefs: Evaluation of the Research Chefs Association's Bachelor of Science in Culinology Core Competencies

IRB ID: 11-366

Study Review Date: 9/28/2011

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b).

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

APPENDIX G
ORIGINAL SURVEY INSTRUMENT

EVALUATION OF THE RESEARCH CHEFS ASSOCIATION'S BACHELOR OF SCIENCE IN CULINOLOGY® CORE COMPETENCIES

Introduction

The purpose of this study is to evaluate the effectiveness of the RCA's Bachelor of Science in Culinology® core competencies in preparing graduates of Culinology® programs for entry-level positions in food product development. This survey will take no more than twenty (20) minutes to complete. Your assistance in completing this survey questionnaire will allow us to evaluate the graduates' self-assessment of these competencies in relation to their preparedness for employment in their current position. This questionnaire will require you to answer questions pertaining only to the required knowledge and competencies of the RCA's Bachelor of Science in Culinology® core competencies, not your particular skills.

In addition to your participation in this research project, I am asking you to provide the contact information of your present employer in order to also investigate their perceptions as to the importance of the RCA required knowledge and competencies. I plan to survey all employers of Culinology® graduates, so I can investigate the relationship between perspectives of the graduates and employers in order to better align what is taught in the program with the needs of the food product development industry. Please identify only your supervisor's name, email address, company name, address, and work phone number of your place of employment. I will follow up by contacting your supervisor to survey him/her about these Culinology® competencies.

In appreciation of your time and effort for completing this survey, you will also be asked to volunteer your name and email address to be entered into a drawing for one of the following at the completion of the survey. Names and emails will be kept separate from the rest of your survey submission.

- One complimentary registration to the 2012 Research Chefs Association Annual Conference and Culinology® Expo in San Antonio, March 21 – 24, 2012.
- Twenty five Starbucks gift card, valued at \$10 each.

Employer's name:

Phone:

Company name:

Company Address:

Supervisor's email:

Part I: Demographic Data

- 1) Are you a graduate from a Research Chefs Association (RCA)-approved Culinology® degree program? *(check one)*
 - Yes
 - No *(end survey at this point)*

- 2) Which year did you graduate from a RCA-approved Culinology® degree program?
 - 2002
 - 2003
 - 2004
 - 2005
 - 2006
 - 2007
 - 2008
 - 2009
 - 2010
 - 2011

- 3) Which institution did you graduate from?
 - Cal Poly Pomona
 - Clemson University
 - CSU – Fresno
 - Dominican University
 - Rutgers University
 - Southwest Minnesota State University
 - University of Cincinnati
 - University of Nebraska-Lincoln
 - University of Massachusetts – Amherst

- 4) Are you currently employed in the food industry developing food and/or beverage products? *(check one)*
 - Yes
 - No *(Briefly explain why you are no longer working in product development in the food industry) [end survey at this point]*

- 5) What is your current or most recent position in food product development?

- 6) Including this year, how long have you held your current position in this company?
 - Less than 1 year
 - 1 – 2 years
 - 2 – 5 years
 - More than 5 years

- 7) Including this year, how long have you worked in food product development?
- Less than 1 year
 - 1 – 2 years
 - 2 – 5 years
 - More than 5 years
- 8) What product category do you presently work in? (*Check all that apply*)
- Baked goods
 - Beverages
 - Confectionary products
 - Dairy products
 - Fruits and vegetables
 - Further-process & packaged foods & specialties
 - Grain products/milling
 - Meat/poultry/seafood
 - Snacks
 - Value-added ingredients/powder mixes
 - Other _____
- 9) I am: (*check one*)
- Male
 - Female
- 10) My age is: _____

Part II: Competencies for Culinologists

Competencies refer to the knowledge, skills, and abilities required to effectively perform the required functions of a position successfully. **Core competencies** are clusters of competency statements that address specific knowledge, skills, and abilities – e.g. knowledge of food chemistry analysis, knife skills, or ability to design experiments to solve research questions.

For each of the core competencies below, a description of the expected knowledge, skills and abilities is provided. Please read the competency statements and rate:

- The **importance** of the core competency in the day-to-day responsibilities of a culinologist, on a scale of 1 – 5 (1=not important, 3=moderately important, 5=very important)
- The **frequency** with which the core competency is used, on a scale of 1 – 5 (1=less than once a month, 3=more than once a month but less than once a week, 5=almost daily)

Core Competencies

1. Culinary Arts
2. Baking, Pastry and Confectionary Arts
3. Food Chemistry Analysis and Function of Ingredients
4. Food Safety and Quality
5. Food Processing and Manufacturing
6. Nutrition
7. Business of Product Development
8. Food Policy Analysis and Regulations
9. Sensory Evaluation
10. Research Methodologies and Experimental Design

CORE COMPETENCY 1: CULINARY ARTS

The culinary arts core competency was developed using the American Culinary Federation's Required (ACF) Knowledge and Competencies for a certified culinarian. The complete list of ACF's competencies includes 12 core competencies, covering everything from basic baking to dining room service to sanitation and safety. For this core competency, only the competencies related to food preparation were included in the RCA's Bachelor of Science in Culinology® Core Competencies.

This core competency addresses the following content areas:

- Basic understanding and application of principles and processes in cooking
- Equipment identification as related to food preparation in commercial kitchens
- Knife skills
- Identification and use of culinary ingredients, such as proteins, fruits, vegetables, dairy products, herbs and spices
- Ability to prepare various menus from different international and regional cuisines
- Food presentation from an aesthetic viewpoint
- Menu development, including menu planning and costing
- Knowledge of culinary history
- Knowledge of various foodservice operations, including front-of-the-house and back-of-the-house operations
- Knowledge of beverages, including basic production of wines, presentation, and service
- Ability to apply flavor layering and balance
- Knowledge and application of Garde manger and butchery skills, including preparation of appetizers, forcemeats, salads and salad dressings, and fabrication of meat, poultry, and seafood.

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content areas within the culinary arts core competency that you believe is less important than the others?

- Yes
- No

If Yes, please indicate below.

How frequently do you use this core competency?

- 1
(less than once a month)
- 2
- 3
(more than once a month but less than once a week)
- 4
- 5
(almost daily)

Is there one or more content areas within the culinary arts core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No

If Yes, please indicate below.

CORE COMPETENCY 2: BAKING, PASTRY AND CONFECTIONARY ARTS

The baking, pastry and confectionary arts core competency was developed using the American Culinary Federation's Required (ACF) Knowledge and Competencies for a certified culinarian. The full list of ACF's competencies includes 12 core competencies, covering everything from basic baking to dining room service to sanitation and safety. For this core competency, only the competencies related to baking were included in the RCA's Bachelor of Science in Culinary® Core Competencies.

This core competency addresses the following content areas:

- Basic understanding and application of principles and processes in baking
- Equipment identification as related to baking in commercial kitchens
- Ability to identify and use various ingredients in commercial bakery
- Ability to demonstrate comprehension of formulas and mixing methods
- Food presentation from an aesthetic viewpoint

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within the baking, pastry and confectionary arts core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the baking, pastry and confectionary arts core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No
-

If Yes, please indicate below.

CORE COMPETENCY 3: FOOD CHEMISTRY ANALYSIS & FUNCTION OF INGREDIENTS

The food chemistry analysis & function of ingredients core competency was developed following the Institute of Food Technologists' (IFT) Education Standards for approved undergraduate food science programs. IFT's food chemistry and analysis core competency was modified to include comprehension of ingredient functionality for the RCA.

This core competency addresses the following content areas:

- Structure and properties of food components, including water, carbohydrates, protein, lipids, other nutrients and food additives
- Knowledge of flavors as related to chemical reactions during food preparation, processing, and storage
- Ability to explain and utilize the appropriate ingredient functionality to any given food application or process
- Demonstrated knowledge of food chemistry processes to control changes occurring during processing, storage and utilization
- Ability to demonstrate common laboratory techniques used in basic and applied food chemistry
- Knowledge of the basic principles, methods, and techniques of qualitative and quantitative physical, chemical, and biological analyses of food and food ingredients

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within food chemistry analysis & function of ingredients core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the food chemistry analysis & function of ingredients core competency that you use substantially less frequently (less than once a year) than the others?

Yes

No

If Yes, please indicate below.

CORE COMPETENCY 4: FOOD SAFETY AND QUALITY

The food safety and quality core competency was developed following the Institute of Food Technologists' (IFT) Education Standards for approved undergraduate food science programs. IFT's food safety and microbiology core competency was modified to include coverage of all aspects of quality assurance practices in the food industry for the RCA.

This core competency addresses the following content areas:

- Skill in basic sanitation practices such as ServSafe and HACCP
- Knowledge of pathogenic and spoilage microorganisms control in foods
- Knowledge of the use of microorganisms in food production
- Knowledge of food safety and security (GMP, SOP, HAACP & CARVER-Shock)

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within the food safety and quality core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the food safety and quality core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No

If Yes, please indicate below.

CORE COMPETENCY 5: FOOD PROCESSING AND MANUFACTURING

The food processing and manufacturing core competency was developed following the Institute of Food Technologists' (IFT) Education Standards for approved undergraduate food science programs. IFT's food processing and manufacturing core competency provided the baseline for the development of this core competency for the RCA, but food engineering principles were excluded due to the lack of foundational courses in physics in the curriculum.

This core competency addresses the following content areas:

- Ability to apply the principles of large scale production systems and scale up
- Knowledge of the principles of food processing and packaging technologies
- Knowledge of quality control and assurance in food processing
- Knowledge of basic unit operations
- Ability to apply principles of food preservation to extend shelf life

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within the food processing and manufacturing core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the food processing and manufacturing core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No

If Yes, please indicate below.

CORE COMPETENCY 6: NUTRITION

Nutrition was identified as a core competency for RCA's Bachelor of Science in Culinary® by McMeen (2005).

This core competency addresses the following content areas:

- Knowledge of theory and application of basic nutrition principles
- Knowledge of health issues and trends
- Knowledge of functional applications as related to nutritional composition during formulation and processing
- Knowledge of laws and evaluation systems

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within the nutrition core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the nutrition core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No

If Yes, please indicate below.

CORE COMPETENCY 7: BUSINESS OF PRODUCT DEVELOPMENT

The business of product development core competency was developed to ensure that graduates of the RCA's Bachelor of Science in Culinary® degree programs possess the requisite skills necessary to succeed as food product developers.

This core competency addresses the following content areas:

- Ability to read, understand, and interpret market trends and data
- Knowledge and ability to apply the food product development process from ideation to market roll out
- Skills in the development of the culinary "Gold Standard"

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within the business of product development core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the business of product development core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No

If Yes, please indicate below.

CORE COMPETENCY 8: FOOD POLICY ANALYSIS AND REGULATIONS

The food policy analysis and regulations core competency is included in the RCA's Bachelor of Science in Culinology® core competencies to ensure that graduates were able to identify the multiplicity of food laws and regulations pertaining to food manufacturing.

This core competency addresses the following content areas:

- FDA, USDA, and ATF food regulations
- Food and beverage labeling requirements
- Food additives, nutraceuticals, and dietary supplements
- ISO 9000 requirements
- Legal aspects involved in intellectual property preservation
- Knowledge of multicultural competency such as halal and kosher requirements
- Knowledge of OSHA systems as related to factory inspections

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within the food policy analysis and regulations core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the food policy analysis and regulations core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No

If Yes, please indicate below.

CORE COMPETENCY 9: SENSORY EVALUATION

This core competency addresses the principles and techniques of sensory evaluation, including the fundamentals of sensory perception through food appearance, texture, aroma, flavor and physiology of sensory receptors.

This core competency addresses the following content areas:

- Knowledge of the basic physiology and function of the senses
- Ability to describe common sensory terminology
- Ability to explain the role of sensory analysis in the product development process
- Ability to apply the appropriate affective, discrimination, and descriptive methods used in sensory evaluation
- Skills in distinguishing by sensory evaluation the gustatory sensations of bitter, sour, salty, sweet, and umami

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within the sensory evaluation core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the sensory evaluation core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No

If Yes, please indicate below.

CORE COMPETENCY 10: RESEARCH METHODOLOGIES AND EXPERIMENTAL DESIGN

The research methodologies and experimental design core competency ensures that graduates of the RCA's Bachelor of Science in Culinary[®] degree programs are knowledgeable in basic experimental design methods.

This core competency addresses the following content areas:

- Knowledge of quantitative and qualitative methods used in research
- Ability to utilize basic statistical methods to display and interpret statistical data
- Ability to apply the scientific method in the design of experiments in food product development

How important is this core competency in your day-to-day responsibilities as a culinologist?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(not important)		(moderately important)		(very important)

Is there one or more content area within the research methodologies and experimental design core competency that you believe is less important than the others?

- Yes
 No

If Yes, please indicate below.

How frequently do you use this core competency?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5
(less than once a month)		(more than once a month but less than once a week)		(almost daily)

Is there one or more content areas within the research methodologies and experimental design core competency that you use substantially less frequently (less than once a year) than the others?

- Yes
 No

If Yes, please indicate below.

Part III: Additional Information

- 10) Are there any other competencies that you believe are critical for a culinologist to have/possess that was not already listed above? If yes, please list them below.

- 11) Additional comments regarding the RCA's Bachelor of Science in Culinology® Core Competencies:

OPTIONAL DRAWING

Thank you for your assistance in completing this survey. Your time and effort are very much appreciated. If you wish to be entered into a drawing for one of the following, enter your name and email below. One entry per person. Names and emails will be kept separate from the rest of your survey submission.

- One Complimentary registration to the 2012 Research Chefs Association Annual Conference and Culinology® Expo in San Antonio, March 21 – 24, 2012.
- Twenty five Starbucks gift card, valued at \$10 each.

APPENDIX H

DRAFT INSTRUMENT FEEDBACK FORM

Review Panel Member:

(Name and Title)

RCA Bachelor of Science in Culinary® Core Competencies

Survey Feedback Form

Please rate the survey on the following scale of 1 – 5.
(1 = Poor, 2 = Below Average, 3 = Average, 4 = Above Average, 5 = Excellent)

- | | | | | | |
|---|---|---|---|---|---|
| 1. How clear is the survey instrument? | 1 | 2 | 3 | 4 | 5 |
| 2. How concise is the survey instrument? | 1 | 2 | 3 | 4 | 5 |
| 3. How accurate is the survey instrument? | 1 | 2 | 3 | 4 | 5 |

Comments:

APPENDIX I
INTERVIEW PROTOCOLS

INTERVIEW PROTOCOL FOR GRADUATES

Interview guide for culinologists

- 1) What is your current position title?
- 2) What are the reasons why there is a difference between Importance and Frequency of Use for 7 of the 10 competencies? (Baking, Food Chemistry, Food Processing, Nutrition, Business of PD, Food Policy, and Research Methodologies)
- 3) What influenced your rating of importance for each of those 7 competencies?
- 4) What influenced your rating of Frequency of Use for each of those 7 competencies?
- 5) Of the ten competencies, do you think your university's curriculum covered each of the competencies to sufficiently prepare you for employment after graduation? Why or Why not?
- 6) The results from the survey indicate that employers value culinary arts highly, and it had the highest rating for importance. However, the graduates had a different perception, and food safety had the highest rating for importance. Culinary arts ranked as the eighth highest rating for importance among the 10 competencies. Why do you think there is a difference?

INTERVIEW SCRIPT

EVALUATION OF THE RCA'S BACHELOR OF SCIENCE IN CULINOLOGY® CORE COMPETENCIES

Introduction

The main focus of our interview today is to **understand more about your perceptions of the RCA's core competencies for Culinology® degree programs**. I have sent you the complete list of the competencies in an earlier email. Have you received it, and have you had a chance to review it? If not, I can email you another copy prior to our interview for reference.

You are considered **the expert** at your work so there are no wrong answers to any of my questions. Your opinion on these core competencies and their relevance to your job will help my research. I am interested in finding out whether you think the **ten core competencies** identified by the RCA as necessary for a Culinology® degree is important, and used in your particular position. Your participation is strictly voluntary, and all collected data will be kept confidential.

This interview will take approximately 1 hour from start to finish. During this interview, it is important that your responses be completely honest and open. Please do not let our prior interactions or professional communications influence your responses. I am seeking your honest opinion about these competencies.

I will also be audio-recording our conversation so that I can ensure the accuracy of the results. Your confidentiality will be maintained at all times, and there will be no references made to you or your organization in the final report. All interview notes and recording will be kept only for the minimum amount of time that is required per established guidelines.

Any questions before we begin?

Interview Questions

Warm-up Questions

1. How long have you been at your present position?
2. What is your current position title?
3. Are you currently, or have you in the past, been a member of the Research Chefs Association?

Research Questions

4. Please tell me what you know about the RCA's Culinology® degree core competencies.

5. The results from the questionnaire indicated that the important competencies are not always done the most frequently. For instance, in the Baking competency, the mean for Importance was 3.33 but the mean for Frequency was 2.69. In other words, on a scale of 1 – 5, Baking was rated as moderately important, however, it was used less than once a week. Why do you think that is?
 - a. There are seven competencies altogether that were like this. They are Baking, Food Chemistry, Food Processing, Nutrition, Business of Product Development, Food Policy and Research Methodologies. In your opinion, why do you think these seven competencies were rated as more important, but not used on a daily basis?
6. What influenced your rating of Importance for each of those seven competencies?
 - b. Do you think (your current job position, your education, your previous internship, your academic advisor, the order of appearance of the competencies in the questionnaire) influenced the rating of Importance?
7. What influenced your rating of Frequency of Use for each of those seven competencies?
 - c. Do you think (your current job position, your education, your previous internship, your academic advisor, the order of appearance of the competencies in the questionnaire) influenced your rating of Frequency of Use?
8. These next set of questions have to do with your perceptions of whether you think your university's Culinology® curriculum sufficiently prepared you for employment after graduation.
 - a) Do you think your university sufficiently covered the topics as listed in the Food Chemistry Analysis and Functions of Ingredients competency? How did you come to this assessment?
 - b) Food Safety and Quality?
 - c) Food Processing and Manufacturing?
 - d) Culinary Arts?
 - e) Baking, Pastry, and Confectionary Arts?
 - f) Nutrition?
 - g) Business of Product Development?
 - h) Food Policy Analysis and Regulations?
 - i) Sensory Evaluation?

- j) Research Methods and Experimental Design?
9. The results from the questionnaire indicated that employers rated culinary arts highly for importance, at 4.9 out of 5. What is your opinion about this result? Why/why not?
- d. On the other hand, graduates rated culinary arts at 3.7 out of 5 for importance. Why do you think there is a difference between the employers' and the graduates' perception?
10. The results also indicated that graduates rated Food Safety as having the highest mean for importance, at 4.5 out of 5. Out of all ten competencies, Food Safety was rated the highest. Why do you think that is the case?

Wrap-up Questions

11. What additional thoughts or comments would you like to share regarding this topic?
12. You will be receiving a copy of the interview responses, and I will be asking you to verify that I have captured the interview content accurately. Would you be willing to review it for accuracy?

Thank you for your time and feedback today. If you would like a copy of the findings, I am happy to send you an electronic copy of the final report. If you have any questions or concerns regarding this interview, you may contact me at 507-401-6676 or Michael.cheng@smsu.edu.

INTERVIEW PROTOCOL FOR EMPLOYERS

Interview guide for employers

- 1) What is your current position title?
- 2) What influenced your rating of importance for each of those 10 competencies?
- 3) Of the ten competencies, do you the curriculum covered each of the competencies to sufficiently prepare graduates for employment after graduation? Why or Why not?
- 4) The results from the survey indicate that employers value culinary arts highly, and it had the highest rating for importance. However, the graduates had a different perception, and food safety had the highest rating for importance. Culinary arts ranked as the eighth highest rating for importance among the 10 competencies. Why do you think there is a difference?

INTERVIEW SCRIPT

EVALUATION OF THE RCA'S BACHELOR OF SCIENCE IN CULINOLOGY® CORE COMPETENCIES

Introduction

The main focus of our interview today is to **understand more about your perceptions of the RCA's core competencies for Culinology® degree programs**. I have sent you the complete list of the competencies in an earlier email. Have you received it, and have you had a chance to review it? If not, I can email you another copy prior to our interview for reference.

You are considered **the expert** at your work so there are no wrong answers to any of my questions. Your opinion on these core competencies and their relevance to your job will help my research. I am interested in finding out whether you think the **ten core competencies** identified by the RCA as necessary for a Culinology® degree is important, and used by your employees who are culinologists. Your participation is strictly voluntary, and all collected data will be kept confidential.

This interview will take approximately 1 hour from start to finish. During this interview, it is important that your responses be completely honest and open. Please do not let our prior interactions or professional communications influence your responses. I am seeking your honest opinion about these competencies.

I will also be audio-recording our conversation so that I can ensure the accuracy of the results. Your confidentiality will be maintained at all times, and there will be no references made to you or your organization in the final report. All interview notes and recording will be kept only for the minimum amount of time that is required per established guidelines.

Any questions before we begin?

Interview Questions

Warm-up Questions

1. How long have you been at your present position?
2. What is your current position title?
3. Are you currently, or have you in the past, been a member of the Research Chefs Association?

Research Questions

4. Please tell me what you know about the RCA's Culinology® degree core competencies.

5. What influenced your rating of Importance for each of those seven competencies?
 - e. Do you think (your current job position, your education, your previous internship, your academic advisor, the order of appearance of the competencies in the questionnaire) influenced the rating of Importance?
6. These next set of questions have to do with your perceptions of whether you think the BS in Culinology® curriculum sufficiently prepared graduates for employment after graduation.
 - a. What is your assessment of the Food Chemistry Analysis and Functions of Ingredients competency in helping prepare graduates for employment? How did you come to this assessment?
 - b. Food Safety and Quality?
 - c. Food Processing and Manufacturing?
 - d. Culinary Arts?
 - e. Baking, Pastry, and Confectionary Arts?
 - f. Nutrition?
 - g. Business of Product Development?
 - h. Food Policy Analysis and Regulations?
 - i. Sensory Evaluation?
 - j. Research Methods and Experimental Design?
7. The results from the questionnaire indicated that employers rated culinary arts highly for importance, at 4.9 out of 5. What is your opinion about this result? Why/why not?
 - a. On the other hand, graduates rated culinary arts at 3.7 out of 5 for importance. Why do you think there is a difference between the employers' and the graduates' perception?

Wrap-up Questions

8. What additional thoughts or comments would you like to share regarding this topic?
9. You will be receiving a copy of the interview responses, and I will be asking you to verify that I have captured the interview content accurately. Would you be willing to review it for accuracy?

Thank you for your time and feedback today. If you would like a copy of the findings, I am happy to send you an electronic copy of the final report. If you have any questions or concerns regarding this interview, you may contact me at 507-401-6676 or Michael.cheng@smsu.edu.

APPENDIX J
IDENTIFIED THEMES FROM INTERVIEWS

THEMES IDENTIFIED

Theme: Culinology® degree program competencies

- C1: All competencies are important
- C2: Competencies are important as background knowledge for the job
- C72: Competencies need to be further defined
- C73: Emphasis in school is different than emphasis in workplace
- C74: Workplace competencies driven by customer needs and wants
- C75: Workplace competencies driven by bottom line

Theme: Rating of importance influencers

- C4: Rating of importance influenced by current position
- C5: Rating of importance influenced by self
- C6: Rating of importance influenced by daily use of competency on the job
- C7: Rating of importance influenced by experience

Theme: Frequency of use influencers

- C8: Frequency of use influenced by current position
- C9: Frequency of use influenced by daily usage

Theme: Food chemistry competency

- C10: Food chemistry is very important to know
- C11: Food chemistry is covered well in lecture but needs more hands on taught
- C92: Ignorance of food chemistry leads to product/corporate failure
- C93: Key during cross functional teamwork

Theme: Food processing competency

- C12: Food processing is important to know
- C13: Food processing not taught adequately in lecture
- C14: Food processing is covered in detail during lecture but no applications taught
- C15: Food processing knowledge is fundamental to the job

Theme: Food safety competency

- C16: Food safety is important
- C19: Food safety knowledge very important to employers
- C80: Emphasized in culinary arts section
- C81: Not emphasized in the science
- C82: Downplayed/assumed by industry
- C83: Students see it as scary and critical
- C84: Employers see it as managed and controlled

Theme: Culinary skills competency

- C20: Culinary skills is core to the culinologist's role
- C21: Culinary skills is important
- C24: Culinary skills was emphasized

C28: Culinary skills must be emphasized

C77: Faculty/staff were not able to integrate the culinary with food science

Theme: Baking competency

C29: Baking knowledge is necessary

C30: Only baseline baking knowledge is needed

C31: Knowledge of concepts taught in baking is transferable, i.e. ratios, percentages

C32: Not enough emphasis placed on baking in school

C33: Background knowledge of baking helps with non-baking product development

Theme: Nutrition competency

C34: Nutrition knowledge is good to have

C35: Nutrition knowledge is required

C36: Nutrition is overemphasized and over-detailed

C94: increasing in importance

Theme: Business of product development competency

C38: Business of PD is important to know

C39: Business of PD is not taught in-depth

C40: Need more in-depth knowledge about business acumen of product development

C41: Need more knowledge about commercialization

C42: Economics and marketing courses should be required

C78: Lacking competency leads to limitations in future jobs

Theme: Food policy competency

C45: Food policy knowledge is required

C79: Knowledge of workplace application can be obtained on the job

Theme: Sensory evaluation competency

C49: Sensory competency was covered very well in curriculum

C50: Depth of knowledge of sensory evaluation techniques is dependent on size of company

Theme: Research methodologies competency

C51: Need more hands on research and development activities in school

C53: Knowledge of experimental design is crucial

C54: Research methodologies was sufficiently covered

Theme: Employers' perception of culinary arts competency

C26: Culinary skills importance influenced by own background

C55: Importance of culinary arts by employers is valid

C56: Culinary arts proficiency results in shorter product development time

C57: Application of culinary skills on the job varies

C58: All culinologists should be competent in culinary arts

Theme: Graduates' perception of food safety competency

C59: Food safety competence is important because of potential risks associated with it

Theme: The role of the Culinology® graduate

C62: Need to communicate to the public the role of the culinologist

C63: Employers are interested in the culinary competence of the culinologist

C66: Culinologists are jack-of-all-trades

C67: Educate food manufacturers on the importance of the culinologist

C68: Difference between what employers value vs graduates due to lack of communication

C69: Culinology® graduates are hired into entry level positions with food science responsibilities

Theme: Education

C70: Culinary arts and food science needs to be better align within curriculum

C76: That which was delivered in courses was learned/delivered accurately

C91: Broad and general knowledge is necessary

Disparity between student and industry

C85: Students do not see the entire picture

C86: Students lack work experience

C87: Classes are delivered as if all classes were equally important

C88: Schools are not prepared for differential emphasis

C89: Employers are considering bottom-line issues

APPENDIX K
RESEARCH CHEFS ASSOCIATION CORE COMPETENCIES FOR THE PRACTICING
CULINOLOGIST SURVEY RESULTS

Rank Order	Group	Knowledge Competency
1	Culinary Arts	Knowledge of Principles of Cooking (i.e. heat transfer, cooking methods, breading/batters, etc.)
2	Culinary Arts	Knowledge of Culinary Uses and Applications of Products
3	Mb/FS/QA/Reg	Knowledge of Food Sanitation, including prevention of foodborne illnesses, HACCP, etc.
4	Culinary Arts	Knowledge of Culinary Fundamentals and Production Systems
5	Proc/Mfg/Engr	Knowledge of Recipe Development and Formula Ratios (e.g. percent vs. per batch, yield, etc.)
6	Application	Knowledge of Flavor Building in the Kitchen (i.e. fond, stock, cooking method, seasoning, etc.)
7	R Fd Pdt Devel	Knowledge of Formula Development
8	Application	Knowledge of Proteins (meat, poultry, eggs, seafood, plant proteins)
9	R Fd Pdt Devel	Understanding of the Product Development Process (e.g. ideation through production startup, including...
10	Proc/Mfg/Engr	Knowledge of Weigh & Measurement Conversions
11	Culinary Arts	Knowledge of Kitchen Tools and Equipment, including how to use and apply
12	Chem/Sci/IngrFnc	Knowledge of Fats and Oils (processing, quality, functionality, nutrition)
13	Culinary Arts	Knowledge of Traditional Stocks and Sauces
14	Application	Knowledge of Carbohydrates (including vegetables, fruits, cereals, grains)
15	Application	Knowledge of Current Nutrition Trends
16	Business	Knowledge of Current and Projected Food Trends
17	Application	Knowledge of General Nutrition (essential nutrients, food pyramid, micro & macro nutrients)
18	Chem/Sci/IngrFnc	Knowledge of Functional Ingredients (i.e. acidulants, buffers, pH adjusting ingredients, enzymes, ...)
19	Proc/Mfg/Engr	Ability to "Convert" from Lat to Plant (i.e. effects of scale up on finished product)
20	R Fd Pdt Devel	Knowledge of Product Presentation, including planning and physical details
21	Mb/FS/QA/Reg	Knowledge of Product Shelf Life (e.g. preservation methods, packaging technologies, effects of temperature....)
22	R Fd Pdt Devel	Knowledge of Appropriate Documentation (e.g. lab book, specs, process documentation, etc.)
23	Mb/FS/QA/Reg	Knowledge of Food Safety & OSHA Systems and Laws
24	Culinary Arts	Knowledge of Regional & World Cuisines, including preparation, spicing & presentation, and cultural....
25	R Fd Pdt Devel	Knowledge of Ingredient Sourcing, including how choices affect purchasing (e.g. seasonality, cost-...)
26	Application	Knowledge of Allergens
27	Mb/FS/QA/Reg	Knowledge of Food Chemistry and Microbiology (i.e. process lethality validation, contaminants - biological....)
28	Culinary Arts	Knowledge of End-user Skills (i.e. cooks in national chains)
29	Proc/Mfg/Engr	Knowledge of Heat Exchange/Heat Transfer (i.e. how it works/effect on the product)
30	Application	Application of Nutrition Knowledge (labels, recipes, healthy eating recommendations)

Rank Order	Group	Knowledge Competency
31	Culinary Arts	Knowledge of Commercial Equipment
32	Application	Knowledge of Top, Mid & Base Notes and Construction of Flavor Systems
33	Application	knowledge of Commercial Flavorings (i.e. process flavors, compound flavors, HVPs, yeast extracts,
34	Application	Knowledge of Dairy Products
35	Mb/FS/QA/Reg	Knowledge of Quality Issues and Troubleshooting (i.e. mold/yeast/microbial issues, effects of abuse...
36	R Fd Pdt Devel	Knowledge of Equipment & Selection, as part of product/process development
37	Proc/Mfg/Engr	Knowledge of Large-Scale Production Systems (e.g. technologies affecting products, large scale prod...
38	R Fd Pdt Devel	Understanding Follow-Through, including production start-up and customer support
39	Chem/Sci/IngrFnc	Knowledge of New Technologies (i.e. fat substitutes, carbohydrate reduction technologies, etc.)
40	Mb/FS/QA/Reg	Knowledge of Government Food Regulations, including FDA, USDA, NLEA, CFR, etc.
41	Business	Knowledge of Competitive Products and Competitive Product Analysis
42	Culinary Arts	Knowledge of Commercial Kitchen Responsibilities and Pressures
43	Mb/FS/QA/Reg	Knowledge of Quality Assurance Systems (i.e. process control, lot traceability & recall, etc.)

APPENDIX L
RESEARCH CHEFS ASSOCIATION GUIDE TO DEVELOPING AN APPROVED
CULINOLOGY[®] DEGREE PROGRAM



RCA Guide to Developing an Approved Culinology® Degree Program
(Revised May 19, 2010)

Contents:

1. Background Information
2. Benefits for RCA Education Partners
3. Criteria for obtaining Culinology® Program Approval from the Research chefs Association
 - Approval Process Objectives
 - Education Standards: Administrative and Physical
 - Culinology® Program Standards
 - Annual Reporting
4. Requirements for Culinology® Degree Program Proposals
5. Approval Process
6. Trademark License Agreement

Background Information

Research Chefs Association (RCA) is the leading professional community for food research and development. RCA is the premier source of culinary and technical information for the food industry and is committed to the advancement of Culinology® –the integration of the culinary arts and food science. Founded in 1996, the RCA has rapidly grown to over 2,400 members, including chefs, food scientists, technologists, writers, nutritionists, academicians, researchers, consultants, sales and marketing professionals, suppliers, co-packers, distributors and students.

Vision

Culinology® will become the universally recognized integration of culinary arts with food science and technology, and its practitioners will define the future of food.

Mission

Communicate and enhance the value of Culinology® by supporting education, development, and recognition of its community of practitioners.

The Research Chefs Association has defined Culinology® as the blending of culinary arts and food science. The new professional who epitomizes this discipline will be someone who combines the passion, skills and creative talent to prepare and present innovative new food products, together with the scientific and technical knowledge required to provide safe, affordable, healthy and delicious food products commercially. This artist/scientist, the Culinology® professional, will define the future of food. A Culinology® program prepares students for careers in areas such as menu and food product development, food processing, and corporate chain restaurant product development.

Benefits for RCA Education Partners

- Positioning of Partner institution as a respected resource for a new educational market.
- Strategic alliance with the leading R&D food association in the US and Canada.
- Curriculum and course outcomes provided by RCA Headquarters.
- Marketing support from RCA Headquarters, including exposure in *CULINOLOGY*® magazine, *Culinology*® *Currents*® newsletter, www.Culinology.org, the *RCA Insider*, press releases, and at major food conventions at the RCA booth.
- Affiliation with RCA educational partners and programs.
- Enhanced opportunities for students and faculty through scholarships, Culinology® Poster Presentations, the Student Culinology® Competition, and participation on RCA committees.
- Discounted booth space at the RCA Culinology® Expo.
- Protection of the trademarked term: Culinology®.

CRITERIA FOR OBTAINING CULINOLOGY PROGRAM APPROVAL FROM THE RESEARCH CHEFS ASSOCIATION

Approval Process Objectives

Specific objectives of the approval process for Culinology® programs are:

1. To provide public assurance that RCA-approved Culinology® programs foster rigorous culinary and scientific training.
2. To provide public assurance that Culinology® programs foster development of professional skills for students.
3. To provide assistance for establishing excellence and evaluating the effectiveness of the academic preparation of students in Culinology® programs.
4. To provide guidance to Culinology® programs for continued improvement and enhancement of the academic program.
5. To promote high educational standards for Culinology® programs.
6. To ensure that the policy and decision making processes in Culinology® programs reflect the needs of the profession, the associated industries and the public.
7. To disseminate information between and among programs that will stimulate improvement of Culinology® programs and related activities.

Education Standards: Administrative and Physical

Organization and Budget. An independent administrative unit ideally a separate organized department with an identifiable budget adequate to sustain a quality academic program will preferably administer the instructional program.

Faculty. The faculty will be of a size and competence commensurate with the diversity of courses deemed necessary to meet the desired competencies. While it is not practical to include the entire faculty in a single administrative unit, the college or university administration must define a faculty with the qualifications outlined below to perform the necessary functions of supervising, teaching, and guiding the program. The fields of faculty specialization must be distributed over the sub-disciplines required for the food science and culinary courses. In general, courses will be taught by faculty whose graduate training or recent experience has involved specialization in the area of the course.

Qualifications of Culinology® Faculty

Culinology® faculty are individuals who through a combination of education and work experience are able to integrate the blending of culinary arts and food science and technology. A minimum Culinology® faculty of two, in addition to faculty from other departments of the institution, is recommended to adequately assist students in learning the skills and competencies outlined in these standards. Culinology® faculty are required to be RCA members.

Qualifications of Culinary Arts Faculty:

It is required that faculty members should have at a minimum a combination of 5 years of culinary arts education and work experience. It is recommended that faculty members have earned an American Culinary Federation (ACF) certification at the Certified Executive Chef or above level. Culinary Arts faculty are recommended to be RCA members.

Qualifications of Food Science Faculty:

It is recommended that faculty members should have, at minimum, an earned master's degree, but a doctorate is preferred; some may have extensive professional experience in lieu of a doctoral degree. Faculty can be established scholars with demonstrated potential for becoming world leaders in the following research areas: chemical engineering, biological engineering, food engineering, food science, biochemistry, or nutrition. They should have a strong commitment to conducting interdisciplinary research and the ability to develop a stimulating research environment, which will attract excellent graduate students. Food Science faculty are recommended to be RCA members.

Facilities. Teaching laboratories for Food Science will have up-to-date and adequate facilities and equipment to conduct chemical, engineering, processing, and microbiological exercises. Pilot-plant facilities will be available to teach principles of unit operations and unit processes involved in food science. Similarly, teaching facilities for Culinary Arts will have at least a dedicated teaching kitchen for production, charcuterie, and demonstration. In some facilities, these teaching kitchens may also function as bake shops and pastry kitchens. An experiential learning component must be available for culinary arts students to learn ala Carte production and service skills. The institution must also have a gourmet restaurant open to the public and supported by a full production kitchen.

If these teaching facilities are not available, the institution must provide evidence of joint partnerships with other institutions or existing organizations to provide faculty and students access to these facilities. Library facilities will support, encourage, and stimulate independent study and research by both students and faculty.

Culinology® Program Standards

Culinology® programs should teach the dynamics of artistically and scientifically prepared food, with the ultimate objective of improving the overall quality, nutrition and manufacturing of the foods we eat. In order to accomplish this, Culinology® programs must provide evidence of course work which teaches the learning outcomes for a B.S. in Culinology® (see attached), and includes at a minimum a 300 contact hour internship in culinary arts and a 300 contact hour internship in food science, research and development, or manufacturing.

The Curriculum shall consist of the following components:

- The program must be offered at institutions accredited by the Higher Learning Commission.

- The degree awarded must include culinary arts, food and nutrition science and practical externship components, which blend “hands on” experience in culinary arts and research.

For a Culinology® Transfer degree

1. Coursework must be consistent with the Research Chefs Association mission and with the goals and objectives outlined by the Education Committee.
2. Institutions awarding associates degrees in culinary arts must be accredited by the American Culinary Federation Accrediting Commission, or provide written assurance that the associate degree curriculum achieves a standard equal or greater to the ACF criteria.
3. It is recommended that the majority of the courses completed at the associate’s level be culinary arts.

For a baccalaureate degree

1. Coursework must be consistent with the Research Chefs Association mission and with the goals and objectives outlined by the Education Committee.
2. The courses completed at the baccalaureate level should include up-to-date core knowledge competencies.

Annual Reporting

Once approved, RCA Culinology® degree programs must maintain approval annually through an annual reporting process which gathers enrollment statistics and data on faculty. The purpose of annual reporting is to ensure that Culinology® degree programs continue to foster rigorous culinary and scientific training and the development of professional skills for students.

Requirements for Culinology® Degree Program Proposals

Applying schools, including those pursuing Culinology® transfer degree programs, are required to submit the following documents / information to:

Tim Kline
 Director of Education & Certification
 Research Chefs Association
 1100 Johnson Ferry Road, Suite 300
 Atlanta, GA 30342
tkline@kellencompany.com
 Tel: 678-303-3017

1. A letter of institutional support for a Culinology® degree program or Culinology® concentration from the Department Chair or College Dean with stated commitment to the following:
 - a. An annual report to the RCA, due by January 31.
 - b. Ongoing collaboration between Culinology® transfer degree partners (*if applicable*).
 - c. Promotion of RCA student membership and support of Culinology® club activities.
2. Advisory committee, *if applicable*
3. Description of Organization and Budget (p. 2 of Guide)
4. Faculty curriculum vitae (p. 2 of Guide)
5. Identification of two Culinology® faculty members, who are RCA members, and their qualifications (p. 2 of Guide)
6. Description of teaching and laboratory facilities (p. 3 of Guide)
7. Proposed plan of study, and course descriptions and syllabi from courses which teach the up-to-date learning outcomes for a Culinology® program of study. Please indicate which courses in the Culinology® degree curriculum integrate culinary arts with food science.
8. The learning outcomes for a Culinology® program of study organized according to courses.
9. A five-year plan for building enrolment indicating annual growth targets.
10. In the case of Culinology® transfer degree programs, a signed articulation agreement.
11. An application fee of \$500, due upon submission of proposal for staff review.
12. A signed licensing agreement related to use of the trademark CULINOLOGY® (Appendix A Trademark License Agreement).

Approval Process

The approval process on average takes one calendar quarter and involves the following steps:

1. Contact RCA in advance of submitting a proposal, so that the Higher Education Subcommittee may assign a mentor as a resource to guide proposal development.
2. Once finalized, submit \$500 application fee and proposal to staff (Tim Kline tkline@kellencompany.com) for review.
3. The Higher Education Subcommittee meets to review and generate follow-up questions and feedback, which are then discussed with university representatives.
4. Once all information has been gathered, a reply letter with Subcommittee recommendations is sent to the applying university. Note: n the event Subcommittee recommendations have not been implemented within 60 days, the application will expire and 50% of the application fee will be refunded. In the event that an application is ultimately denied, the applicant would receive a 50% application fee refund.
5. Upon written assurances that RCA recommendations have been implemented, the Higher Education Subcommittee's recommendation for approval is submitted to the Education Committee for their ratification.
6. The RCA Executive Committee meets to confirm Education Committee ratification.
7. Confirmation of approval/denial is related to the applying university.

TRADEMARK LICENSE AGREEMENT

THIS TRADEMARK LICENSE AGREEMENT (“Agreement”) is entered into and effective as of _____ (“Effective Date”), by and between **Research Chefs Association**, a Missouri non-profit organization, located at 1100 Johnson Ferry Road, Suite 300, Atlanta, Georgia, USA 30342 (“RCA”) and _____ [NAME], a _____ [CORPORATE ENTITY STATUS] located at _____ [ADDRESS] (“Licensee”) (collectively, the “Parties”).

WHEREAS, RCA is the owner of and has used the trademark CULINOLOGY, whether or not registered, (the “Mark”) in connection with providing association services, trade show services, educational services, informational services, and related products and services for the food industry;

WHEREAS, Licensee desires to use the Mark in connection with providing CULINOLOGY courses and degree programs _____ (the “Services”) in the United States,(the “Territory”); and

WHEREAS, the Parties mutually desire to formally set forth the terms and conditions under which Licensee shall be permitted to use the Mark.

NOW, THEREFORE, in consideration of good and valuable consideration including the mutual promises and covenants set forth herein, the adequacy and sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Grant of License. RCA hereby grants to Licensee during the Term of this Agreement a non-exclusive, non-transferable license to use the Mark in the Territory on and in connection with the Services. Licensee acknowledges the retention by RCA of all rights and privileges not expressly granted by this Agreement. Licensee also acknowledges that RCA reserves and has the right to, in its sole discretion, use the Mark on and in connection with the Services in the Territory. The license granted hereunder shall not include a license to use any trademark owned by RCA other than the Mark.

2. Ownership of Marks. Licensee acknowledges the exclusive ownership of the Mark by RCA, agrees that it will do nothing inconsistent with that ownership, and agrees that all use of the Mark by it shall inure exclusively to the benefit of RCA. Licensee agrees that it will not at any time, including after expiration or termination of this Agreement, do or acquiesce in anything, or aid or assist any other party in doing anything, that may in any way infringe upon, harm, dilute, challenge or otherwise adversely affect the rights of RCA in and to the Mark, including attacking the title of RCA to the Mark or attacking the validity of the Mark. Nothing in this Agreement shall give Licensee any right, title, or interest in the Mark other than the right to use the Mark as provided herein during the Term of this Agreement. Licensee agrees that it does not have and shall not have as a result of the license granted herein any right to register, aid, or permit others to register the Mark either alone or in

combination with any other word, symbol, slogan, sign, device, or design, either during the Term of this Agreement or after its expiration or termination.

3. Quality Control. Licensee shall use its best efforts, skill, and diligence to ensure that the Services offered under the Mark are rendered in accordance with the standards, specifications, and instructions approved by RCA, are of a quality, form and nature that is substantially equivalent to the same or similar goods or services offered by RCA just prior to the Effective Date, and are of a good standard of quality. RCA has the sole right to control and approve the actual quality of the Services offered by Licensee in connection with the Mark. In that regard, Licensee agrees to cooperate with RCA to permit reasonable inspection of its operations, premises, finished products, printed materials, advertising, and all other matters related to the Mark or the quality of the Services. Licensee also agrees upon request to furnish RCA with samples of advertising and promotional materials related to the Services offered under the Mark. RCA hereby acknowledges that it has approved the current quality of the Services that are offered under the Mark by Licensee. Licensee shall comply with all applicable laws and regulations and obtain all appropriate government approvals pertaining to the offering of the Services covered by this Agreement.

4. Form of Use. RCA has the sole right to control and approve the manner and form in which the Mark is to be used and Licensee agrees to use the Mark only in the manner and form approved by RCA. To facilitate such approval, Licensee agrees at RCA's request to send RCA samples, photographs, and/or finalized layouts of advertising and promotional materials, course books, and the like related to its proposed uses of the Mark and shall refrain from such use until approval is given by RCA. RCA's approval shall not be unreasonably withheld and shall be deemed given if no objection is made within thirty (30) days of RCA's receipt of the proposed use. Licensee agrees to promptly and fully follow all directions and instructions of RCA concerning its use of the Mark.

5. Markings. Licensee agrees that it shall undertake what is required to safeguard and protect RCA's rights in the Mark and the goodwill associated therewith and agrees that it will not do anything, directly, or indirectly, or by omission, to diminish the value of the Mark or to impair or injure RCA's rights therein. Licensee agrees that all uses of the Mark on approved Services offered by it shall be accompanied by a marking inscription which conforms in substance to the following:

“CULINOLOGY is a trademark of Research Chefs Association. It is licensed to _____ and is used in accordance with the standards, specifications and express permission of Research Chefs Association.”

Licensee agrees to add any other markings reasonably requested by RCA and to change the above marking if requested by RCA.

6. Term. This Agreement shall be effective, unless earlier terminated, for as long as Licensee uses the Mark in connection with the Services; provided, however, that

RCA may terminate this Agreement without cause upon three (3) months' written notice to Licensee.

7. Termination. In the event Licensee breaches this Agreement and such breach is not cured within thirty (30) days of receipt by Licensee of written notice of such breach, RCA may terminate the Agreement without further notice. This Agreement shall be immediately terminated upon the following circumstances: (a) upon Licensee's cessation of use of the Mark; or (b) in the event Licensee becomes unable to pay its debts in the ordinary course of trade or is bankrupt or insolvent.

8. Effect of Termination. Upon expiration or termination of this Agreement for any reason, all of Licensee's rights hereunder with respect to its use of the Mark shall immediately cease and Licensee shall not have the right to use the Mark, or permit others to do so. Licensee agrees that, upon expiration or termination of this Agreement for any reason, it will immediately discontinue use of the Mark and will remove all indications of the Mark from its premises, advertising and promotional material, course books, and the like. Licensee shall not thereafter use the Mark or any other marks or words or combinations that so nearly resemble the Mark as to be likely to deceive or cause confusion, unless specific written permission to do so shall be given by RCA.

9. Infringement Proceeding. Licensee agrees to promptly notify RCA of the appearance of any unauthorized use of the Mark by others that comes to the attention of Licensee. RCA reserves the exclusive right, in its sole discretion, to assert claims of infringement and to institute proceedings for infringement of the Mark either in its own name or at its option jointly with Licensee, and Licensee agrees to render such assistance in connection therewith as RCA may require.

10. Disclaimer; Indemnification. RCA makes no representations or warranties concerning the ownership, validity, or availability of the Mark, and use thereof by Licensee is at its own risk. Licensee shall be fully responsible for and shall defend, indemnify and hold RCA harmless from and against any losses, claims, demands, actions, damages, costs, suits and proceedings by or against RCA that may arise, or be made, brought or recovered by any party, by reason or on account of Licensee's offering of the Services or arising out of Licensee's improper or unauthorized use of the Mark. This provision shall survive the expiration or termination of this Agreement and shall remain in full force and effect.

11. Warranty. Licensee acknowledges that RCA undertakes no obligations and makes no warranties that in the rendering of the Services, the use of the Mark, or the exercise of any other rights granted to Licensee under this Agreement, Licensee will be free of liability for infringement of the rights of third parties and that every such obligation or warranty is hereby excluded.

12. Waiver and Modification. No future waiver, alteration, amendment, modification, or other change of any of the terms and conditions of this Agreement, whether oral, through the Parties' course of performance, course of dealing or course of conduct, or

manifested in any other way, shall be binding or effective unless agreed to in writing and signed by authorized representatives of the Parties. Any such written waiver shall be effective only in the specific instance and for the purpose given. It is the express intention of the Parties that such requirement for written waivers, alterations, amendments, modifications, or other changes be strictly enforced, notwithstanding judicial precedent or statutory provisions to the contrary.

13. Further Assurances. Licensee agrees that it will promptly execute and deliver all documents and do all things that are reasonably requested by RCA to facilitate compliance with applicable laws, regulations, conventions and treaties of the Territory. Licensee agrees to enter into any formal license or registered or permitted user agreement and to execute or procure execution of any other document at any time and without further consideration from RCA which may be necessary to preserve the validity of the Mark, or applications or registrations thereof, or the rights of RCA therein.

14. Notice. Any notice required to be given under this Agreement shall be sent by overnight mail or by facsimile to the other party to the relevant address set forth below. Any notice mailed via overnight mail shall be deemed to have been received by the addressee on the next business day following the date of mailing. Any notice sent by facsimile shall be deemed to have been received by the addressee on the same business day as the day on which such facsimile is sent or the next business day in the case of a facsimile sent after 4:00 p.m., so long as a transmission verification is received by the sender and the recipient does not notify the sender that the notice was not received in legible form. The relevant addresses are:

If to Research Chefs Association: Research Chefs Association
Executive Director
1100 Johnson Ferry Road
Suite 300
Atlanta, Georgia 30342
USA
Facsimile: (404) 252-0774

With a copy to: Stephen T. Olson
Harness, Dickey & Pierce, P.L.C.
5445 Corporate Drive, Suite 200
Troy, Michigan 48098
USA
Facsimile: (248) 641-0270

If to Licensee: _____

With a copy to: _____

Each Party shall promptly give notice to the other of any change in name or address to which notices to it are to be sent.

15. Assignment and Sublicense. This Agreement is personal to Licensee and no rights granted to it hereunder may be sold, transferred, pledged, assigned, sublicensed, or otherwise conveyed or disposed of by it in any way to any third party, including by operation of law, without the prior written approval of RCA and any purported sale, transfer, pledge, assignment, sublicense or disposition by Licensee shall be void. This Agreement is freely transferrable by RCA.

16. Successors and Assigns. This Agreement shall be binding upon, and inure to the benefit of, the Parties and their permitted successors and assigns.

17. Entire Agreement. This Agreement constitutes the entire agreement between the Parties with respect to the subject matter hereof and supersedes and replaces any prior representations, statements, promises, communications or agreements of any kind between the Parties, whether oral, written, or implied.

18. Severability. In the event that any provision or any portion of any provision of this Agreement shall be held invalid or unenforceable for any reason, the remaining provisions of this Agreement and the remaining portion of any provision held invalid or unenforceable shall nevertheless remain in full force and effect.

19. Governing Law. This Agreement shall be governed by and shall be construed, interpreted and enforced in accordance with the laws of the State of Michigan, without regard to the conflict of laws provisions of that State.

20. Counterparts. This Agreement may be executed in two counterparts, each of which, when executed, shall be deemed an original and such counterparts together shall constitute a single instrument.

IN WITNESS WHEREOF, this Agreement is effective as of the Effective Date.

RESEARCH CHEFS ASSOCIATION

APPENDIX M

UNIVERSITY OF CINCINNATI CURRICULUM, 2004

BACHELOR OF APPLIED SCIENCE – CULINARY ARTS AND SCIENCE [CUL]

Term	Course No.	Course Name	Cr.Hrs.	
<i>Pre-Junior Year</i>				
AUT/	32CHEM330	Fundamentals of Food Science	4	
WIN	32CUL330	Advanced Asian Cookery	3	
	32ENGL387	Food and Film	3	
	32MATH161	Math for Culinary Science I	<u>3</u>	13
CO-OP				
SPR/	32CHEM331	Fundamentals of Food Chemistry I	4	
SUM	32CUL332	Classical French Cookery	3	
	32CUL333	Computer Use in Food Management	3	
	32SOSC342	The World of Tea	3	
	32MATH162	Math for Culinary Science II	<u>3</u>	16
CO-OP				

<i>Junior Year</i>				
AUT/	32CHEM332	Fundamentals of Food Chemistry II	4	
WIN	32CUL334	American Ethnic Cuisines	3	
	32CUL335	Advanced Cake and Pastry	3	
	32POL325	Politics and Food	3	
	32CUL331	Setting the Stage – Banq & Catering	<u>3</u>	16
CO-OP				
SPR/	32CHEM333	Food Safety and Preservation	4	
SUM	32CUL336	Advanced Bakeshop	3	
	32CUL337	Advanced Seafood	3	
	32CUL338	Mktg & Merch. Food	3	
	32ENGL340	Food And Art	<u>3</u>	16
CO-OP				

<i>Senior Year</i>				
AUT	32CHEM420	Food Processing	4	
	32CUL401	The Art of Plated Foods	3	
	32CUL402	Food Culture	3	
	32CUL403	Food Management	3	
	32CUL/CHEM	Culinary Arts/Science Elective	<u>3</u>	16
WIN	32CHEM421	Food Form./Ingr Functionality	4	
	32CUL404	Creating Foods	3	
	32CUL405	Culinary Demonstration	3	
	32CHEM422	Senior Project I	<u>3</u>	13
SPR	32CHEM424	Nutrition – Food Trends	4	
	32CUL406	Discovering Wine	3	
	32COMM341	Managerial Communications	3	
	32CHEM423	Senior Project II	<u>4</u>	14
				TOTAL 104

Course Titles, Credits, Descriptions*
[v.5/04]

Food Science

32CHEM330 Fundamentals of Food Science, 4cr.

An introductory course in basic chemistry to support an understanding of the properties and reactions of foods.

32CHEM331 Fundamentals of Food Chemistry I, 4cr.

An introductory course in carbohydrates and lipids, including an understanding of ingredient functionalities in food preparation and on final product characteristics. *Prerequisite:* 32CHEM330

32CHEM332 Fundamentals of Food Chemistry II, 4cr.

A continuation of Fundamentals of Food Chemistry I with emphasis upon proteins and food additives. *Prerequisite:* 32CHEM331

32CHEM333 Food Safety and Preservation, 4cr.

An introduction to chemical and microbial food safety issues, including the roles of environmental factors, the principles and methods of food preservation, and government regulations. *Prerequisite:* 32CHEM332

32CHEM420 Food Processing, 4cr.

A comprehensive overview of food products and the principles of food processing and engineering, including canning, dehydration, refrigeration, freezing, and food packaging. *Prerequisite:* 32CHEM332

32CHEM421 Food Formulation/Ingredient Functionality, 4cr.

An overview of food formulation practices and principles from prototype to finished product, including how new product ideas are derived from food trend, consumer learning, and market analysis. *Prerequisite:* 32CHEM420

32CHEM422 Senior Project I, 3cr.

A capstone experience requiring students to define a problem or creative need in the food industry, to develop a Project Plan to solve the problem or meet the creative need, and to present the Project Plan in writing and through an oral presentation, including both theoretical and practical/hands-on applications. *Prerequisite:* 32CHEM420

32CHEM423 Senior Project II, 4cr.

A continuation of Senior Project I wherein students execute their Project Plans, and provide a written Final Report and oral presentation of results. *Prerequisite:* 32CHEM422

32CHEM424 Nutrition, 4cr.

An introductory course in nutrition and consumer science to support an understanding of the properties and reactions of foods, and their nutritional values. *Prerequisite:* 32CHEM421

Advanced Culinary Arts

32CUL330 Advanced Asian Cookery, 3cr.

Students will prepare authentic Asian foods and discuss through lecture the cultures, history, traditions, and symbolisms behind the ethnic cuisine. The course consists of lectures, demonstrations, and hands-on production. Students will be introduced to traditional techniques and will experiment with numerous Asian ingredients and spices.

32CUL331 Setting the Stage-Banquet and Catering, 3cr.

In-depth analyses pertaining to on premise banquet operations, off-premise catering, and an overview of global event planning.

32CUL332 Classical French Cookery, 3cr.

Following the path of the Grand Chefs of France such as Carème, Escoffier, and Bocuse, the student will study and practice the regional cuisines of France.

32CUL333 Computer Use In Food Management, 3cr.

Utilizing desktop publishing fundamentals, the student will focus on ways to produce brochures, banners, menus, and documents that include the use of digital photography for the restaurant industry.

32CUL334 American Ethnic Cuisines, 3cr.

Following the historical immigration of the new Americans, the course will explore the evolution of American Regional Cooking. The student will research the fundamentals of American regional cooking including Cajun, Creole, South Western, Texmex, California Spa Cuisine, New England, and San Francisco Asiatic Cooking.

32CUL335 Advanced Cake & Pastry, 3cr.

Using the skills the student has learned this course will give a more in-depth look into the art of pastry, including plated desserts, decorating cakes, pastry for retail and buffet production.

32CUL336 Advanced Bakeshop, 3cr.

The student will hone their basic bakeshop skills to produce advanced artisan breads, cookies, breakfast pastries, event, and novelty cake items.

32CUL337 Advanced Seafood Cookery, 3cr.

Expanding the students basic knowledge of fish and seafood, the student will practice more advanced seafood preparations utilizing various species of fish, shellfish, crustaceans and mollusks.

32CUL338 Marketing and Merchandising Food and Food Product, 3cr.

An introduction to the theory and practice of the basic structure of distribution; of the fundamentals of marketing: consumer research, product planning, advertising and promotion, distribution channels, physical distribution, and the forces impacting management of food channels and institutions.

32CUL401 The Art of Plated Foods, 3cr.

The student will work on the challenge of food presentation, focusing on the aesthetics of plating food and modern trends in the restaurant business.

32CUL403 Food Culture, 3cr.

In-depth discussion and review of the history of food. Lectures pertaining to prehistory and early civilizations thru the 21st century relating to culture, Dietetics, traditions, and innovations in the food industry will be addressed.

32CUL404 Creating Foods, 3cr.

Mastering the learned culinary basic methods and experimenting with flavors and foods to produce unique and personalized dishes. Focusing on education of the palate and proper marrying of flavors to produce symmetry of the plate.

32CUL405 Culinary Demonstration, 3cr.

The course will focus on recipe and press release writing skills, professionalism within the industry and media presentations. Within the course, the student will be required to perform a 30-minute culinary lecture and demonstration to their peers.

32CUL406 Discovering Wine, 3cr.

Examining the gastronomic principles involved with storing, handling, serving, and pairing wine with foods.

English, Humanities, Social Sciences32COMM341 Managerial Communications, 3cr.

A study of process of communication focusing on the purpose of communicating and the best strategy for accomplishing that purpose in national and international settings.

32SOSC342 The World of Tea, 3cr.

This course examines the role tea plays in various cultures. The history, technology, biochemistry, and traditions provide a lens through which to examine its role in society from 2700 B.C. to the 21st century.

32POL325 Politics and Food, 3cr.

This course examines the ways in which food companies use political processes to obtain government and professional support. It examines the American diet, marketing strategies of the food industry, and its use (and misuse) of the political system.

32ENGL340 Biographies of Eminent Chefs, 3cr.

This course examines the biographies of chefs such as Georges-Auguste Escoffier who have made significant contributions to the culinary science field.

32ENGL387 Food and Film, 3cr.

Using a cultural studies approach, this course examines what food, as depicted in film, tells us about our communities and ourselves.

Mathematics

32MATH161 Math for Culinary Science I, 3 cr.

This is an introductory course designed to provide proficiency in and an understanding of the mathematical concepts required to successfully complete the coursework for a career in the culinary field. It includes an overview of topics such as: ratios and proportions, measurement systems, dimensional analysis, exponents and scientific notation, algebraic manipulations, equation solving, basic logarithms, and reading and interpreting graphs, charts and tables. Special emphasis will be placed on the development of critical thinking skills necessary to make decisions about how and when to apply the mathematical concepts.

32MATH162 Math for Culinary Science II, 3 cr.

This course will be a continuation of Math for Culinary Science I. An emphasis will be placed on applications and problem solving using the skills obtained from part one of the course. Students will also be required to work on group projects. Topics will include data collection, spreadsheets, curve fitting, systems of equations, basic geometry, and interpreting statistical and probabilistic information.

****Course Titles, Credits, and Descriptions are subject to approval by the UC/CAS Curriculum Committee; they may change.***

APPENDIX N

UNIVERSITY OF NEBRASKA-LINCOLN'S CURRICULUM, 2004

890. Workshop in Improving Curriculum and Instruction (1-3 cr each per sem, max 15) (UNL) Prereq: 6 hrs education, 12 hrs family and consumer sciences including some work in specific areas.

- A. Related Art
- B. Family Economics/Consumer Education
- D. Food and Nutrition
- E. Housing and Furnishings
- G. Human Development and the Family
- J. Home Management
- K. Textiles and Clothing

897. Supervised Educational Experiences in Family and Consumer Sciences (1-6 cr) (UNL) Prereq: Permission. *Actual and simulated education experiences in family and consumer sciences. P/N only.*

897A. Practicum in Early Childhood Education (3 cr) (UNL) Lec 3, lab 24. Prereq: FACS 270 and 270L with grades of C or better; or permission. *P/N only.*

899. Masters Thesis (6-10 cr) (UNL)

Refer to the Graduate Bulletin for 900-level courses.

Department of Nutrition and Health Sciences

Chair: Associate Professor Marilyn Schnepf
Professors: Betts, Boeckner, Driskell, Johnson, Sime
Associate Professors: Albrecht, Carr, Hamouz,
Housh, Lewis, Martin, Pohlman, Scheer, Schmidt,
Stanek-Krogstand
Assistant Professors: Callahan, Jones, Zempleni
Extension Assistant Professor: Koszewski
Senior Lecturer: Benes
Lecturers: Rudy, Young

There are six options in the Department of Nutrition and Health Sciences. The dietetics option; the nutrition science option; the restaurant and foodservice administration option; the dietetics/journalism and mass communications option; nutrition, fitness and health promotion option; and the culinology™ (culinary science) option are offered on the Lincoln campus.

Acceptance of Grades

Only grades of C or above will count toward graduation requirements for department (NUTR) classes.

Graduate Study

Advanced degrees of master of science in nutrition and health sciences and master of science and doctor of philosophy degrees are offered in the interdepartmental nutrition program as well as in human resources and family sciences. For details see the *Graduate Studies Bulletin*.

I. Dietetics (Didactic Program in Dietetics)

The dietetics option is designed for students who wish to become practitioners in clinical, community, and foodservice areas of nutrition. The University of Nebraska Didactic Program in Dietetics is currently granted approval status by the Commission on Accreditation for Dietetics Education of the American Dietetic Association, 120 South Riverside Plaza, Suite 2000, Chicago, IL 60606-6995, 312/899-0040. Upon graduation all students will receive a verification statement indicating completion of program requirements.

The Department of Nutrition and Health Sciences will provide a Verification Statement of a student meeting Didactic Program in Dietetics (DPD) requirements based on the program in effect in the undergraduate bulletin the student is using for graduation requirements if the student is continuously enrolled and graduates within five years. If the student cannot finish their studies within this five-year time period, they must comply with the didactic program reflected in the undergraduate bulletin currently in effect. The Department of Nutrition and Health Sciences will not accept course work to meet DPD requirements from any university/college outside the University of Nebraska system in which a grade of D-, D, or D+ was earned.

In order to receive a Verification Statement of a student meeting Didactic Program in Dietetics requirements, a minimum of 15 credits from 300- or 400-level courses must be completed at the University of Nebraska-Lincoln. Nine of the 15 credit hours must come from three of the following classes: NUTR 450 Medical Nutrition Therapy I, NUTR 452 & 452L Medical Nutrition Therapy II and Lab, NUTR 455 Advanced Nutrition, or NUTR 473 Organization and Administration of Foodservice.

Following graduation, an accredited/approved supervised practice is required before students are eligible to take the registration examination. Registered dietitians are employed by hospitals, community agencies, and various government or private organizations. The minimum of 128 credit hours required for graduation is to be met as follows:

	Hours
Comprehensive Education	36-39
A. Communications	6
COMM 109 Fund of Human Comm or COMM 209 Public Speaking (3 cr); and ENGL 101 Comp & Lit I or 102 Comp & Lit II or 150 Comp I or 151 Comp II or JGEN 200 Tech Comm I or 300 Tech Comm II (3 cr)	
B. Mathematics and Statistics	3-6
MATH 101 or higher, trigonometry or calculus (3 cr) (<i>Math requirement waived if placed above MATH 101 on Math Placement Exam</i>); and STAT 218 Intro to Statistics or EDPS 459 Statistical Methods (3 cr)	
C. Human Behavior, Culture and Social Organization	10
NUTR 100 Healthy Lifestyles (3 cr) PSYC 181 Intro to Psychology (4 cr) <i>Select 3 hrs from Essential Studies list section C.</i>	
D. Science and Technology	4
BIOS 101/101L General Biology (4 cr)	
E. Historical Studies	3
<i>Select from Essential Studies list section E.</i>	
F. Humanities	3
<i>Select from Essential Studies list section F.</i>	
G. Arts	3
<i>Select from Essential Studies list section G.</i>	
H. Race, Ethnicity and Gender	3
NUTR 253 Cultural Aspects of Food & Nutrition (3 cr)	
I. Information, Discovery, and Retrieval	1
LIBR 110 Intro to Library Research (1 cr)	
Human Sciences Core	6
FACS 120 or 160 or 280 (3 cr) NUTR 402 Facts & Fiction in Fitness & Food (3 cr)	
Professional Requirements	56-59
<i>Only grades of C or above will count toward graduation requirements for NUTR courses.</i>	
Nutritional Science and Dietetics	34-35
NUTR 150 Foundations in Nutrition & Health Promotion (1 cr) NUTR 151 Intro to Nutrition (3 cr) NUTR 250 Human Nutrition & Metabolism (3 cr)	

NUTR 244 Scientific Principles of Food
Prep (3 cr)
NUTR 245 Scientific Principles of Food
Prep Lab (1 cr)
NUTR 344 Food & Nutrition for Healthy
Living (3 cr)
NUTR 356 Nutrition Education in the
Community (3 cr)
NUTR 370 Food Production Mngt (3 cr)
NUTR 371 Applied Food Production Lab
(1 cr)
NUTR 450 Medical Nutrition Therapy I
(3 cr)
NUTR 452 Medical Nutrition Therapy II
(3 cr)
NUTR 452L Medical Nutrition Therapy II
Lab (1 cr)
NUTR 453 Communication Strategies for
the Dietetic Professional (2 cr)
NUTR 455 Advanced Nutrition (3 cr)
NUTR 457 Classroom & Outreach Experi-
ences in Food & Nutrition (1 cr) or
NUTR 454 Peer Nutrition Education (2 cr)
or NUTR 498 Research Experiences (1 cr)
NUTR 470 Cost Control for Foodservice (2 cr)
NUTR 473 Organization & Administration
of Foodservice (3 cr)
NUTR 490 Professional Preparation for
Careers in Dietetics (1 cr)

Supporting Sciences

CHEM 109 General Chemistry I (4 cr)	22-24
CHEM 110 General Chemistry II (4 cr)	
CHEM 251 Organic Chemistry and CHEM 253 Organic Chemistry Lab (4 cr)	
BIOC 321 and 321L Elements of Biochemistry & Lab or 431 Biochemistry I (3-4 cr)	
BIOS 111 The Biology of Microorganisms or 312 Fund of Microbiology and 314 Microbiology Lab (4 cr) or NUTR 372 Food Safety & Sanitation (3 cr)	
BIOS 213 & 213L Human Physiology & Lab or ASCI 240 Anatomy & Physiology of Domestic Animals (4 cr)	
Electives	18-24
<i>Select IS courses as needed.</i>	
	Total 128

2. Culinary Science

The culinology™ (Culinology™) option is the emerging discipline of the culinary arts, nutrition and the science of food. Culinology™ is becoming a recognized and valued discipline that will significantly impact food research and development in the global market. Culinologists are skilled chefs who are creating a new generation of exciting, high-quality convenience food products. The food industry needs—and rewards—people who understand and can apply the principles of this specialty. The minimum of 128 hours required for graduation is to be met as follows:

	Hours
Comprehensive Education	35-39
A. Communications	6
COMM 109 Fund of Human Comm or 209 Public Speaking (3 cr); and ENGL 101 Comp & Lit I or 102 Comp & Lit II or 150 Comp I or 151 Comp II or JGEN 200 Tech Comm I or 300 Tech Comm II (3 cr)	
B. Mathematics and Statistics	3-6
MATH 101 or higher, trigonometry or calculus (3 cr) STAT 218 Intro to Statistics (3 cr)	
C. Human Behavior, Culture, and Social Organization	9-10
ECON 210 Intro to Economics or ECON 211 and 212 Principles of Macro- and Microeconomics (6 cr); and PSYC 181 Intro to Psychology (4 cr)	
D. Science and Technology	4
CHEM 109 General Chemistry (4 cr)	
E. Historical Studies	3
<i>Select from Essential Studies list section E.</i>	

F Humanities.....	3
<i>Select from Essential Studies list section F</i>	
G.Arts.....	3
<i>Select from Essential Studies list section G.</i>	
H. Race, Ethnicity and Gender.....	3
NUTR 253 Cultural Aspects of Food & Nutrition (3 cr)	
I. Information, Discovery, and Retrieval.....	1
LIBR 110 Intro to Library Research (1 cr)	
Human Sciences Core	6
FACS 120 or 160 or 280 (3 cr)	
NUTR 402 Facts & Fiction in Fitness & Food (3 cr)	
Professional Requirements	80-81
<i>Only grades of C or above will count toward graduation requirements for NUTR courses</i>	
Nutritional Science and Dietetics.....	22
NUTR 151 Intro to Nutrition (3 cr)	
NUTR 244 Scientific Principles of Food Preparation (3 cr)	
NUTR 245 Scientific Principles of Food Preparation Lab (1 cr)	
NUTR 344 Food & Nutrition for Healthy Living (3 cr)	
NUTR 371 Applied Food Production Lab (1 cr)	
NUTR 372 Food Safety & Sanitation (3 cr)	
NUTR 374 Menu & Service Mgt (2 cr)	
NUTR 441 Functional Properties of Foods (3 cr) or 448 Food Chemistry (3 cr)	
NUTR 445 Experimental Foods (3 cr)	
NUTR 498 Research Experiences (3 cr)	
Food Science and Technology	8-10
FDST 203 Food Composition (2 cr) or 205 Food Composition & Analysis (4 cr)	
FDST 403 Food Quality Assurance (3 cr)	
FDST 460 Concepts of Product Development (3 cr)	
Supporting Sciences	8
CHEM 110 General Chemistry II (4 cr)	
CHEM 251 Organic Chem and 253 Organic Chem Lab (4 cr)	
Professional Supporting Courses.....	34
MRKT 341 Marketing (3 cr)	
Sensory Science Elective (3 cr)	
Processing Electives (6 cr)	
<i>Select from:</i>	
ASCI 210 Animal Products (3 cr)	
ASCI 410 Processed Meats (3 cr)	
FDST 412 Cereal Technology (3 cr)	
FDST 418 Eggs & Egg Products (3 cr)	
FDST 420 Fruit & Vegetable Technology (3 cr)	
FDST 429 Dairy Technology (3 cr)	
FDST 455 Microbiology of Fermented Foods (3 cr)	
Culinary Electives—Area of Concentration (22 cr)	
Electives	2-6
<i>Select IS courses as needed.</i>	
Total 128	

3. Restaurant and Foodservice Administration

This option prepares students for managerial and administrative positions in the restaurant and foodservice industries. Career opportunities can be found in hotels, restaurants, fast food restaurants, private clubs, health care, corporations, and the armed forces. A practicum is required. The minimum of 128 credit hours required for graduation is to be met as follows.

Comprehensive Education.....	Hours
41-43	
A. Communications	6
COMM 109 Fund of Human Comm or 209 Public Speaking (3 cr); and	
ENGL 101 Comp & Lit I or 102 Comp & Lit II or 150 Comp I or 151 Comp II or JGEN 200 Tech Comm I or 300 Tech Comm II (3 cr)	
B. Mathematics and Statistics	6
<i>Select from Essential Studies List Section B (3 cr); and</i>	

STAT 218 Intro to Statistics or EDPS 459 Statistical Methods or ECON 215 Statistics (3 cr)	
C. Human Behavior, Culture, and Social Organization	8-10
ECON 210 Intro to Economics or ECON 211 and 212 Principles of Macro- and Microeconomics (5-6 cr); and	
PSYC 181 Intro to Psychology or SOCI 101 Intro to Sociology (3-4 cr)	
D. Science and Technology	8
CHEM 105 Chemistry & the Citizen I and CHEM 106 Chemistry & the Citizen II (8 cr) or	
CHEM 109 General Chemistry I and CHEM 110 General Chemistry II (8 cr)	
E. Historical Studies.....	3
<i>Select from Essential Studies list section E.</i>	
F Humanities.....	3
PHIL 220 Elements of Ethics or ALEC 388 Ethics in Agric & Natural Resources or PHIL 213 Medical Ethics or UHON 395 Business Ethics (3 cr)	
G.Arts.....	3
<i>Select from Essential Studies list section G.</i>	
H. Race Ethnicity and Gender	3
<i>Select one of the following:</i>	
COMM 211 Intercultural Communication (3 cr)	
COMM 380 Gender & Communications (3 cr)	
NUTR 253 Cultural Aspects of Food & Nutrition (3 cr)	
SOCI 200 Women in Contemporary Society (3 cr)	
SOCI 217 Nationality & Race Relations (3 cr)	
SOCI 218 Chicanos in American Society (3 cr)	
Information, Discovery and Retrieval	1
LIBR 110 Intro to Library Research (1 cr)	
Human Sciences Core	9
FACS 120 or 160 or 280 (3 cr)	
NUTR 402 Facts & Fiction in Fitness & Food (3 cr)	
Professional Requirements	67-72
<i>Only grades of C or above will count toward graduation requirements for NUTR courses.</i>	
Nutritional Science and Dietetics.....	35
NUTR 151 Intro to Nutrition (3 cr)	
NUTR 171 Intro to Restaurant/Foodservice Management (1 cr)	
NUTR 244 Scientific Principles of Food Preparation (3 cr)	
NUTR 245 Scientific Principles of Food Preparation Lab (1 cr)	
NUTR 370 Food Production Mngt (3 cr)	
NUTR 371 Applied Food Production Lab (1 cr)	
NUTR 372 Food Safety & Sanitation (3 cr)	
NUTR 374 Menu & Service Management (2 cr)	
NUTR 457 Classroom & Outreach Experiences in Food & Nutrition (1 cr) or NUTR 498 Research Experiences (1 cr)	
NUTR 470 Cost Control for Foodservice (2 cr)	
NUTR 473 Organization & Admin of Foodservice (3 cr)	
NUTR 474 Food and Beverage Mgt (4 cr)	
NUTR 476 Practicum in Foodservice Management (6 cr)	
NUTR 477 Foodservice Facility Planning & Design (2 cr)	
NUTR 497 Restaurant & Foodservice Mgt Study Tour (1 cr)	
Accounting	6
ACCT 201 Introductory Accounting or 306 Survey of Accounting (3 cr)	
ACCT 371 Legal Environment (3 cr)	
Marketing.....	3
MRKT 341 Marketing (3 cr)	
Finance.....	3
FINA 361 Finance (3 cr)	
Management	12
MNGT 320 Principles of Mgt (3 cr)	
MNGT 360 Managing Behavior in Organizations or 361 Personnel/Human Resource Mgt (3 cr)	

Electives from Business Administration (6 cr)	
<i>Select from management, marketing, accounting, entrepreneurship, management information systems, finance or economics</i>	
Communication/Leadership Electives	6
<i>Select 6 hours from the following:</i>	
Any communications course (except COMM 109 or 209 or 211 or 380); and/or	
ALEC 102 Interpersonal Skills for Agricultural Leadership (3 cr); and/or	
ALEC 202 Leadership Development of Agriculture and/or MNGT 467 Leadership in Organizations (3 cr)	
Electives	2-9
<i>Select IS courses as needed.</i>	
Total 128	

4. Nutrition Science (Pre-Professional)

The nutrition science option is designed for students who wish to combine an emphasis in nutrition with a strong science background. This major provides an appropriate vehicle for premedical, pre dental, nursing, physical therapy, and laboratory technology majors who may be able to obtain a degree in nutrition and simultaneously meet entrance requirements for a professional program. It is also a suitable avenue for students interested in nutrition research and graduate study since it provides an opportunity to emphasize the basic sciences. NOTE: The admission requirements for pre-professional programs vary and may change from year to year. Admission to professional programs are competitive. Students need to be aware of not only specific course requirements but also entrance exams, admission deadlines, research and volunteer opportunities, and other activities that enhance the application. In order to receive the most timely information on requirements and preparation, students should visit the Arts and Sciences Advising Center, 107 Oldfather Hall, 472-4190. The minimum of 128 credit hours required for graduation is to be met as follows.

Comprehensive Education.....	Hours
39	
A. Communications.....	6
COMM 109 Fund of Human Comm or ALEC 102 Interpersonal Skills (3 cr); and	
ENGL 101 Comp & Lit I or 102 Comp & Lit II or 150 Comp I or 151 Comp II or JGEN 200 Tech Comm I or 300 Tech Comm II (3 cr)	
B. Mathematics and Statistics	6
STAT 218 Intro to Statistics or EDPS 459 Statistical Methods (3 cr); and	
MATH 101 or higher, trigonometry or calculus (3 cr)	
C. Human Behavior, Culture, and Social Organization	10
PSYC 181 Intro to Psychology (4 cr); and	
<i>Select 6 hrs from Essential Studies list section C (3 hrs must be Integrative Studies).</i>	
D. Science and Technology	4
CHEM 109 General Chemistry I or 113 Fundamental CHEM I (4 cr)	
E. Historical Studies.....	3
<i>Select from Essential Studies list section E.</i>	
F Humanities.....	3
<i>Select from Essential Studies list section F (selection must be Integrative Studies).</i>	
G. Arts	3
<i>Select from Essential Studies list section G.</i>	
H. Race, Ethnicity and Gender	3
NUTR 253 Cultural Aspects of Food & Nutrition or COMM 211 Intercultural Comm or SOCI 200 Women in Contemporary Society or 217 Nationality & Race Relations (3 cr)	

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