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A survey of registered dietitians' perceptions of constructivist and behaviorist instructional approaches and delivery methods in accredited dietetics programs

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A Survey of Registered Dietitians' Perceptions of Constructivist and Behaviorist

Instructional Approaches and Delivery Methods in Accredited Dietetics Programs

By

Martha A. Smith

Dissertation

Submitted to the Department of Leadership and Counseling

Eastern Michigan University

in partial fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

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Abstract

This purpose of this research study was to test learning theories and models of teaching (constructivist vs. behaviorist) used in dietetic education programs. Additionally, the focus of accreditation for dietetics education is the quality and integrity of a program regardless of its instructional delivery method. Therefore, this study examined the variations between on-line and on-campus delivery methods.

Research questions that guided this study included:

> *1) To what extent do educators use constructivist or behaviorist theoretical approaches during instructional delivery?*

> *2) What are the differences in learning between on-line education and on-campus delivery methods?*

> *3) As far as constructivist and behaviorist teaching methods impact learning, is there an interaction between instructional style and delivery method?*

> *4) How do constructivist and behaviorist teaching methods impact learning (as measured by RD exam score, GPA, and perceived level of knowledge and skills) to work as an entry level dietitian)?*

A 106-item survey was developed by the author and adapted from previously developed instruments including the Teaching Belief Survey and the Constructivist Learning Environment Survey. Multiple interaction effects were found, indicating that constructivist and behaviorist teaching strategies and learning environments are not mutually exclusive nor is either one considered to be superior to the other.

Descriptive statistics such as means and percentages were used to compare response distributions. Factor analysis was performed and the value of Cronbach's alpha for all of the components was calculated. Paired sample *t*-tests, Pearson product-moment correlation coefficients were used to compare on-line and on-campus responses. Multiple linear regressions and path analysis were also used as part of the data analysis process.

This study met the outcome measures of obtaining GPA and addressed knowledge and skills to determine competence to work as an entry level dietitian. The findings in this study showed that both constructivist and behaviorist teaching strategies and classroom environment had an effect on GPA and perception of knowledge.

Considering the need for well educated dietitians, there is a tremendous need for research that tests effectiveness of particular educational approaches in dietetic programs. The American Dietetic Association (ADA) claims that completion of an accredited program and passage of the National Registration Examination ensures a competent entry level dietitian. Professional competence of entry level dietetic practitioners included criteria of (a) reported undergraduate grade point average (GPA) from the institution of higher education attended, and (b) the graduates' self-perception of competence. Future research is indicated for and should be encouraged and expanded in order to strengthen future outcomes of dietetic education across the country.

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Chapter 1

Introduction and Background

Problem Statement

The healthcare industry is experiencing an acute shortage of skilled professionals, creating a strong demand for health educational programs. The federal government's Bureau of Labor Statistics (BLS) has projected that 7 of the 20 fastest growing occupations are healthcare related. These occupations will also generate 3 million new jobs between 2006 and 2016, more than any other industry (Bureau of Labor Statistics, 2008). Demand for healthcare services is surging, driven in large part by an aging population, longer life spans, and changes in the healthcare profession through managed care.

One specific healthcare profession shortage includes Registered Dietitians (RDs). An RD is a trained food and nutrition professional, translating the science of nutrition into practical solutions for healthy living (Van Horn, 2008). RDs assist with prevention and treatment of illnesses by promoting healthy eating habits. They recommend dietary modifications, such as the use of more fiber for constipation or the reduction of salt intake for those who have high blood pressure. Career opportunities for RDs include areas in nutritional-based research, schools, managed food service systems, consultant dietetics, clinical facilities, and long term care establishments (Bureau of Labor Statistics, 2008).

The need for RDs is important since Americans' sedentary lifestyle and food habits have resulted in higher obesity rates and health problems. The BLS projects employment of RDs to increase 9% during the 2006-2016 decade as a result of an increasing emphasis

on disease prevention through improved dietary habits (Bureau of Labor Statistics, 2008). BLS also reports that public interest in nutrition and increased emphasis on health education will demand more dietetic professionals (Bureau of Labor Statistics, 2008).

Higher education institutions play a key role in meeting increased employment demands by educating and training many of the skilled professionals in the health sciences fields. Employers often complain that many college graduates are not prepared for the workplace due to lack of new skill sets that are necessary for successful employment and continuous career development (Schray, 2006). In response to these complaints, the Commission on Accreditation for Dietetics Education (CADE) established minimum requirements of foundation knowledge, skills, and competencies for institutions to train entry level dietitians (Shafer & Knous, 2001; Skipper & Lewis, 2005). CADE establishes and enforces eligibility requirements and accreditation standards that ensure the quality and continued improvement of dietetics education programs (American Dietetic Association, 2008). Subsequent research has shown that graduates of programs that comply with these competency standards are professionally prepared to enter the workforce (Karp and Lawrence, 1999). However, accreditation agency periodic reviews focus on process more than bottom-line results for learning.

An entry level dietetics education program is based on knowledge, skills, and competencies necessary to provide dietetic services. Dietetic programs should have established outcomes and appropriate measures to assess achievement of goals and program effectiveness. Examples of achievement measures include program completion rates, job placement, graduate school acceptance rates, and the pass rate on the National Registration Examination for Dietitians (RD exam). If the pass rate is less than 80% for

first-time examinees, the program should implement and monitor a plan of action to improve performance.

Justification of Study

Considering the need for well-educated dietitians, there is a tremendous need for research that tests effectiveness of particular educational approaches in dietetic programs. As stated earlier, dietitians are trained nutrition professionals who obtain the RD credential through an extensive regulated educational program. Professional growth and mastery of a discipline begins with the student who, with education and supervised practice experience, is expected to achieve competence as an entry level practitioner (Haessig & La Potin, 2002). Obtaining the RD credential requires completion from one of two kinds of dietetics programs: A Didactic Program in Dietetics (DPD) followed by completion of a Dietetic Internship (DI), or an accredited Coordinated Program in Dietetics (CPD). According to Winterfeldt et al. (2005), a standard dietetics education encompasses two components:

1. Didactic education that provides the *foundation knowledge* and *skills* necessary to function as a professional and on which practitioner competencies can be built, and

2. Supervised practice that provides the *practitioner competencies* essential to perform the specialized functions of a dietitian.

Once the academic and supervised practice experience is complete (either through the DI or the supervised practice component of the CPD), the RD exam can be taken to obtain the RD credential. The RD exam is designed to evaluate a dietitian's ability to perform at entry level. The content domains and topics listed in Appendix H are based on the results of the 2000 Dietetics Practice Audit.

Trends in Dietetic Education Programs

CADE collects data on dietetics education programs, enrollment levels, and

completion rates. The most recent data are from the 593 programs accredited and

approved for entry level education and represent the 2006-2007 academic year (CADE,

2007a). While the overall number of accredited/approved programs remains relatively

constant as new programs open and others close each year, review of the trend data by

program type includes (CADE, 2007a):

1.   Didactic Programs in Dietetics (DPD)

For 2006-2007, 228 baccalaureate and master's degree Didactic Programs in Dietetics
(DPD) revealed enrollments of 13,460 students, an increase of 10% from 2005. There
were 3,898 DPD graduates in 2005-2006, a 12% increase from the previous year.
These graduates are eligible to apply to a CADE-accredited Dietetic Internship.

2.   Supervised Practice Programs (DI or CPD)

In 2006-2007, 53 baccalaureate and master's Coordinated Programs in Dietetics
(CPD) and 257 post-baccalaureate Dietetic Internship Programs (DI) show a 2%
increase from 2005 with an enrollment of 3,806 students. There were 2,829 graduates
in 2006 pointing to a 2% increase from 2005. These graduates are eligible to take the
registration examination for dietitians (RD).

Although the educational programs enrollments have increased, the supply of

dietitians has declined in the last five years (Bureau of Labor Statistics, 2008). Further,

the passage rate on the RD exam has steadily declined since 2001 (CADE, 2006). As

shown in the CADE 2006 reports, low passage rates on the RD exam indicate students

are graduating from CADE accredited programs without all the necessary knowledge to

pass the standardized national test. In 2001, 79% of the eligible candidates (N=3145)

passed the RD exam. By 2005, the national passage rate dropped to an average of 60%

(N=2973; Commission on Dietetic Registration, 2006). Graduates of accredited programs

often take the RD exam numerous times in order to receive the RD credential.

Because of the decrease in passage rates and because one test is not considered a determinant of thorough professional competence, this study has been designed to investigate additional variables to measure achieved competency. Professional competence of entry level practitioners will include criteria of (a) reported undergraduate grade point average (GPA) from the institution of higher education attended, (b) the RD registration examination score, and (c) the graduates' self-perception of competence.

The American Dietetic Association (ADA) claims that completion of an accredited program and passage of the RD exam ensures a competent entry level dietitian. Petrillo (2003) defines the term *competent* as the "point where the individual has acquired enough understanding, skill and appropriate values to continue professional development independently." Roth & Bowen (1995) assert that sound professional education and performance must include the capacity to make professional judgments in a variety of contexts to receive continuous feedback from the environment, and to adjust performance accordingly.

The ADA and CADE have made significant procedural changes in educational requirements. For example, Rogers & Fish (2006) conducted an audit to provide information for the development and validation of the National Registration Examination for the RD credential. Other surveys have been used to update and revise the standards for accreditation of dietetics education programs with a focus on continuous quality improvement and assessment of program learning outcomes (Bruening et al., 2002; Peterson et al., 2008). For the dietetics profession, entry level competence is documented as 46 competencies, divided into eight areas: communication, physical and biological

sciences, social sciences, research, food, nutrition, management, and health care systems (CADE, 2006).

In 2003, a Dietetics Education Task Force was assembled to create a new plan for educating and credentialing RDs based on a review of the roles of the RD and future practice needs (Dahl, 2005). The Task Force examined all aspects of the education and credentialing of the RD. They recommended that CADE re-evaluate the current core competencies for professional entry level practice. This would allow more opportunity for CADE-accredited programs to meet future practice needs with emphasis on a specific area of dietetics practice (Dietetics Education Task Force Final Report, 2006).

In 2004, a comprehensive needs assessment was undertaken by the ADA and the Commission on Dietetic Registration (CDR) to better understand the practice and career issues facing dietetics professionals today. The needs assessment would also identify ways in which dietetic professionals might be better served (Rogers, 2005). Methodologically, a stratified probability sample of 12,000 was systematically selected (from a population of 87,573). The sample included key segments of the profession: RDs, non-registered practitioners, and student members. A total of 7,886 usable responses were received from the sample, which is representative of all US dietetics practitioners and student members. This assessment produced the following results:

- The median RD was 45 years old, with 22% under the age of 35 and 17% age 55 or older. The median age of ADA's student members was 27.

- Ninety-eight percent of ADA member practitioners were female and 2% were male. Among ADA student members, 95% were female.

- Data regarding respondent ethnicity were missing for some segments of the database. Based solely on those for whom data were available, 85% of the respondents were White, 5% Asian/Native Hawaiian/Pacific Islander, 3% Black/African American, and 3% Hispanic/Latino.

Purpose and Objectives of Study

The purpose of this study was to determine the impact of two factors on learning from accredited dietetic professional educational programs (refer to the concept map in Appendix A: Effectiveness of Dietetic Education Programs):

1) instructional approaches (constructivist vs. behaviorist learning theories), and

2) instructional delivery method (face to face [on-campus] vs. on-line).

Demographics

The demographics and background characteristics considered important for this study included:

1. Age

2. Race/Ethnicity
   a. Caucasian
   b. African-American
   c. Hispanic
   d. Asian
   e. Multiracial
   f. Native American
   g. Other

3. Gender

4. Graduate from an accredited Coordinated Program in Dietetics (CPD) with a second survey sent to include graduates from a Didactic Program followed by completion of a Dietetic Internship (DI)

5. Public or private university

6. Year of graduation from dietetic program

7. Overall Grade Point Average (GPA) from dietetic program

8. Passage rate (score) and number of attempts to pass RD exam

9. Percentage of on-line courses taken during dietetic program, if applicable.

Significance of the Study

Outcome assessment and demand for increased program accountability are significant from within the dietetics education arena as well as from healthcare institutions that hire dietetics graduates. As discussed earlier, there are many who are concerned that an inordinate number of dietetic programs produce graduates of inferior quality (Pender & de Looy, 2004). Results of this study could be used by a variety of constituents to improve dietetic education programs. For example, professional associations, such as the ADA, may use these data to enhance quality of professionals. This study will also provide data on the learning outcomes of alumni who graduated from dietetic programs based on program adherence to the CADE standards.

Another constituency for which the study might have significance is employers of recent graduates from dietetic professional education programs. The findings could provide employers with data about the extent to which recent graduates report learning in the foundation knowledge, skills, and competencies of their dietetic education programs. Employers could use this information to focus their recruitment efforts towards hiring graduates from the types of programs that result in greater competence in areas of importance.

In terms of education, this research could provide faculty and administrative staff with data about the extent to which recent graduates report learning and competency in both knowledge and specific skills. Faculty and administrators might use the data to examine the courses offered and the content of those courses. Finally, it is postulated that these data could be used for curriculum review and for implementation in future curriculum development.

Research Questions

Research questions that guide this study include:

1) To what extent do educators use constructivist or behaviorist theoretical approaches during instructional delivery?

2) What are the differences in learning between on-line education and on-campus delivery methods?

3) As far as constructivist and behaviorist teaching methods impact learning, is there an interaction between instructional style and delivery method?

4) How do constructivist and behaviorist teaching methods impact learning (as measured by RD exam score, GPA and perceived level of knowledge) and skills to work as an entry level dietitian?

Overview of Research Study

Chapter 1 presented a rationale for the study by reviewing trends in dietetic education programs. An introduction to the study was outlined while the purpose, objectives, and significance of the study were explained in detail. In addition, the research questions and theoretical framework were established. Conceptual and operational terms were defined for use throughout the study.

Chapter 2 will provide an in-depth literature review covering the learning theories of behaviorism and constructivism used for instructional teaching strategies and classroom learning environments. The literature for instructional delivery methods in on-line and on-campus teaching and learning formats will be reviewed in detail. These learning theories and delivery methods specific to dietetic professional education programs as they emerge from the literature review will be presented.

Chapter 3 presents this study's research methodology. This chapter includes a re-statement of the purpose of this research study; a delineation of the research questions; a discussion of the study's research design, including rationale for design selection,

sampling procedure, sample selection process; and the instrumentation validation process.

Chapter 4 presents a detailed statistical analysis and description of the research findings. Descriptive statistics such as means and percentages will be used to compare response distributions. Paired sample *t*-tests, Pearson product-moment correlation coefficients, multiple linear regressions, and structured equation modeling (path analysis) will be part of the data analysis.

Chapter 5 presents an overview of this research study, limitations of the study, review and discussions of the findings and its implications for dietetic professionals' theory, practice and future research.

Definitions of Conceptual and Operational Terms

Key terms are defined here for the purpose of clarification. These definitions may be assumed throughout the study:

Accreditation: The process whereby a private, nongovernmental agency, organization, or association grants public recognition to an institution or specialized program of study that meets certain established qualifications and periodic evaluations; provides a professional judgment as to the quality of the educational institution or program; and encourages continued improvements-thereby protecting the public against professional or occupational incompetence of graduates (American Dietetic Association, 2008).

American Dietetic Association: The American Dietetic Association is the world's largest organization of food and nutrition professionals. ADA is committed to improving the nation's health and advancing the profession of dietetics through research, education and advocacy (American Dietetic Association, 2008).

Behaviorism: Based on observable changes in behavior. Behaviorism focuses on a new behavioral pattern being repeated until it becomes automatic. Learning is achieved through frequent response and immediate reinforcement of appropriate behavior (Sanjaya, 2002).

Cognitivism: Based on the thought process behind the behavior. New information is built on existing structures. Specific strategies are taught to assume that the learner efficiently acquires the information (Sanjaya, 2002).

Commission on Accreditation for Dietetics Education (CADE): The Commission on Accreditation for Dietetics Education is ADA's accrediting agency for education programs preparing students for careers as registered dietitians or dietetics technicians (American Dietetic Association, 2008).

Commission on Dietetic Registration (CDR): The credentialing agency for the *American Dietetic Association,* who identifies knowledgeable and skilled dietetics practitioners (American Dietetic Association, 2008).

Competency: Requisite knowledge, ability, capability, skills, judgment, attitudes, and values; behavior expected of a beginner practitioner; minimum level of performance requiring some degree of speed and accuracy consistent with patient/client well being (American Dietetic Association, 2008).

Constructivism: Constructivism is an approach to teaching based on research about how people learn. Learning is understood as interpretative and under the control of the learner. Constructive teaching is based on the belief that student learn best when they gain knowledge through exploration and active learning (Sanjaya, 2002).

Constructivist Learning Environment Survey (CLES): Survey instrument that provides information about professors' and students' perceptions of their classroom learning environment (Johnson & McClure, 2002). The original version of the CLES developed by Taylor et al. (1993), at Curtin University of Technology in Perth, Australia, focused on students as co-constructors of knowledge. An updated version of the CLES was developed (Taylor et al., 1997) to obtain measures of a critical constructivist learning environment from the students' perception.

Constructivist Critical Voice Scale: Measures the extent in which students believe that it is beneficial to question the professor's pedagogical plans and methods, and to express concerns about the quality of their learning activities.

Constructivist Shared Control Scale: Measures whether students share in the learning process by assisting with goal setting, course objectives, and assessment of learning. Students help with the design and management of learning activities, and assist with determining and applying assessment criteria.

Constructivist Student Negotiation Scale: Measures the degree to which students are able to interact with each other to improve their understanding and assesses the extent to which opportunities exist for building student knowledge.

Constructivist Uncertainty Scale: Involves the extent to which opportunities are provided for students to experience knowledge based on experience and values in the dietetic curriculum and profession.

Coordinated Program in Dietetics: Academic program in a U.S. regionally accredited college or university culminating in a minimum of a Baccalaureate degree. The program provides for the achievement of knowledge and performance requirements for entry level dietitians through integration of didactic instruction with a minimum of 900 hours of supervised practice (American Dietetic Association, 2008).

Core competencies: The set of specific knowledge, abilities, skills, capabilities, judgment, attitudes, and values that entry level practitioners are expected to possess and apply for employment in dietetics (Haessig & La Potin, 2002).

Credentialing process for dietetics practitioners: Registration by the Commission on Dietetic Registration includes 1) completion of minimum academic requirements, 2) completion of supervised practice requirements, 3) passage of the registration examination, and 4) accrual of a specified number of approved continuing professional education hours every five years (American Dietetic Association, 2008).

Didactic Programs in Dietetics (DPD): The DPD provides the required dietetics coursework leading to a bachelor's or graduate degree. Graduates of CADE-accredited/approved programs who are verified by the program director may apply for Dietetic Internships to establish eligibility to write the CDR registration examination for dietitians (American Dietetic Association, 2008).

Entry Level: Term used to specify performance expected of the dietetics practitioner at the beginning of the practice career (American Dietetic Association, 2008).

On-campus instructional delivery method: A field of education that focuses on the pedagogy, technology, and instructional systems design that are effectively incorporated in delivering education to students who are physically "on site" to receive their education.

On-line instructional delivery method: A field of education that focuses on the pedagogy, technology, and instructional systems design that are effectively incorporated in delivering education to students who are not physically "on site" to receive their education. Teachers and students may communicate asynchronously (at times of their own choosing) by exchanging printed or electronic media, or through technology that allows them to communicate in real time (synchronously). On-line education courses for this study will include dietetic programs offering hybrid or blended courses.

Registered Dietitian: Food and nutrition experts who have met the following criteria to earn the RD credential:
- Complete a minimum of a bachelor's degree at a U.S. regionally accredited university or college and course work approved by the Commission on Accreditation for Dietetics Education (CADE) of the American Dietetic Association (ADA).
- Complete a CADE-accredited supervised practice program.
- Pass a national examination administered by the Commission on Dietetic Registration (CDR).
- Complete continuing professional education requirements to maintain registration (American Dietetic Association, 2008).

Student learning outcomes: The anticipated performance or values students are expected to derive form the educational program. The student learning outcomes are based on the "Foundation Knowledge and Skills for Didactic Component of Entry Level Dietitian Education Programs: and/or "Competency Statements for the Supervised Practice Component of Entry Level Dietitian Education Programs (Haessig & La Potin, 2002).

Supervised practice: Planned learning experiences in which knowledge, understanding, and theory are applied to real-life situations; may be augmented by role playing, simulation, or other experiences in which students actually perform tasks (American Dietetic Association, 2008).

Teacher Belief Survey: Instrument created to assess beliefs related to constructivist and behaviorist theories of learning and was originally designed by Woolley et al., 1999.

Chapter 2

Review of Literature

Learning Theories/Instructional Approaches

What are the instructional bases for a constructivist learning setting and how do they differ from classroom instructions based on a behaviorist model? The current American classroom, whether grade school or college level, tends to resemble a one-person show with a captive but often unengaged audience. Classes are usually driven by teachers or professors and depend heavily on textbooks for the structure of the course. There is the assumption that there is a fixed world of knowledge that the student must come to know. In many instances there is little interaction between students. The learner is expected to regurgitate the accepted explanation or methodology transmitted by the teacher.

The teaching method of teacher as sole information-giver to passive students is primarily outdated. In a Berkeley study on undergraduates in a large lecture hall setting (Richardson, 2003), it was found that only 20% of the students retained what the instructor discussed. They were too preoccupied with taking notes to internalize the information. Also, within eight minutes of lecturing, only 15% of the students were paying attention.

The teacher-as-information-giver, with a textbook-guided classroom, has failed to bring about the desired outcome of producing critical-thinking students. According to Mason & Attree (1997), the movement away from knowledge-driven courses toward programs of study that emphasizes skills and develops desired attitudes is grounded in academic and practitioner theory.

Important Behaviorist Theorists

Behaviorists place "an emphasis on producing observable and measurable outcomes in students" (Ertmer & Newby, 1993, p. 56). Behaviorist theorists believe that learning occurs when learners show the correct response to a certain stimulus (Smith & Ragan, 1999).

Ivan Pavlov (1849-1936) introduced the concept of "conditioned reflex" after studying the effect of external stimuli (the ring of a bell) at the same time dogs were given food. Over time the dogs, which before only salivated when they saw and ate their food, would begin to salivate when the bell sounded, even if no food were present. He also found that the conditioned reflex was repressed if the stimulus proved "wrong" too often. If the bell sounds repeatedly and no food appeared, eventually the dog stopped salivating at the sound (Plaud, 2003).

John B. Watson (1878-1958) extrapolated on Pavlov's theory by predicting that human emotional responses could be conditioned (Hill, 1990). Hill asserts that Watson introduced the principles of frequency and recency. The more frequently we have made a response to a specific stimulus, the more likely we are to make that response to that stimulus again, whereas the more recently we have made a given response to a given stimulus, the more likely we are to make it again. Hill (1990) concludes that Watson had a lack of interest in reinforcement as causes of learning and maintained that students learn a connection between a stimulus and a response simply because the two occur together.

Another behaviorist theorist was Edward Thorndike (1874-1949). As a result of studying animal intelligence, he became interested in human psychology and formulated the "law of effect" based on the stimulus-response hypothesis. Thorndike's "law of

effect" stated that a given behavior is learned by trail-and-error and is more likely to occur if its consequences are satisfying (Mergel, 1998).

Robert Gagne (1916-2002) is considered an experimental psychologist who was concerned with learning and instruction. His earlier work is grounded in the behaviorist tradition and his theoretical framework covers all aspects of learning. However, the focus of Gagne's theory is on intellectual skills and applies to the design of instruction in all domains (verbal information, intellectual skills, cognitive strategies, motor skills and attitudes; Gagne & Driscoll, 1988).

B.F. Skinner (1904-1990) was a proponent of operant conditioning and the inventor of the Skinner box for facilitating experimental observations (Good & Brophy, 1990). Skinner's theory dealt with changes in observable behavior, ignoring the possibility of any processes occurring in the mind. Skinner's work differed from that of his predecessors (classical conditioning) in that he studied operant behavior (voluntary behaviors used in operating on the environment).

For various reasons each of the behaviorist theorists has contributed to advances in instructional approaches to classroom learning today.

Behaviorism and Classroom Learning

Behaviorist learning theories have been a dominant force in American education for the last half century. Correspondingly, behaviorist theories have occupied the foundation for many textbooks and standardized tests (Woolley et al., 1999). Arguably, use of behaviorist learning approaches has served as the bases for development of competencies and for demonstrating technical or psychomotor skills (Torre et al., 2006). According to Skinner (1974), behaviorism is rooted in three basic assumptions: observable behavior is

the focus of learning, environment shapes behavior, and reinforcement is central to the learning process. Mestre (1994) argues that "knowing" means observably connecting a response with a stimulus, and "learning" means making and strengthening the connections through reinforcement. In other words, students learn complex processes broken into component pieces and then demonstrate learning with a desired behavior (Mestre, 1994). The behaviorist approach does not take into account the reasoning and thinking aspects of learning.

To date, behaviorist theory still drives much of the practice of science-based education. Most research that is focused on learning is based on Skinner's work from the early thirties (Stage et al., 1998). Behavioral psychologists believe that behavior can change as a result of extrinsic motivators such as incentives, rewards, and punishments. Behaviorists also purport that behavior can be altered through systematic adjustments of stimulus-response reinforcements. Research has demonstrated that behavioral approaches have been effective in modifying animal behavior as well as helping human beings modify their behavior.

In Stage et al. (1998), Skinner concluded that by controlling the environment of mice in a lab, he could "train" them to behave consistently. From this research came theories designed to train humans. According to Ediger (2006), behaviorists believe in

- stating objectives in very precise terms prior to instruction;
- learning activities aligned to achieve the desired ends; and
- assessment to ascertain if each objective has been achieved.

Behavioral instruction hinges on the use of observable, measurable, and controllable objectives. In educational settings, instructors determine what objectives the learner should achieve. The behaviorist learning objectives are met when the learner responds as

intended by the instructor's stimuli. Birzer (2004) asserts that the intellect, feelings, and emotions of a person's inner life are not salient and therefore not measurable. Hence the behaviorist educator would advocate that effective learning is best accomplished by a change in behavior and primarily relying upon behavioral objectives to accomplish effective learning.

Conner (2002) states that behaviorism still dominates formal education despite mounting evidence that it leads to long-term problems and few short-term gains. The behavioral approach to instructional design is teacher-centered. Connor believes an instructor who makes unilateral decisions, regardless of their merits, is in effect saying that the class does not belong to the learners. Behaviorism focuses primarily on the mastery of prerequisite steps before moving to subsequent steps. This learning orientation is aimed at reinforcing what the teacher wants the learner to perform (Torre et al., 2006).

In spite of the many advances made in improving classroom learning methods and environments, there are those who criticize behaviorist approaches to learning.

Criticism of Behaviorist Learning Theories

According to Scheepers (2000), "criticism against behaviorist theoretical approaches includes the following concerns:

- rote learning,
- limited transfer rate of knowledge,
- limited retention unless reinforced,
- limited learning by association. Students are unable to put the pieces together and apply them to other situations,
- problem solving skills are not developed. The learner may find themselves in a situation where the stimulus to the correct response does not occur, therefore the learner cannot respond,
- learner sees much of the learning as irrelevant to everyday life,
- the stimulus is provided by the educator,
- learner is usually externally motivated,
- very little cooperation between learners, and

- learner will adopt the accepted meaning and predetermined interpretations intended by the educator."

Shepard (2000) argues that educators who view learning from a behaviorist perspective create barriers for student learning when they approach instruction and assessment as separate processes. Shepard also asserts that behavioral measurement strategies fail to consider the kinds of assessment activities needed in constructivist learning environments. He further believes that traditional environments of learning are simply a mechanistic process of breaking knowledge into small units for students to absorb and memorize.

Although they are often presented as a dichotomy, Woolley & Woolley (1999) suggest that constructivism and behaviorism may not be mutually exclusive. The authors developed and validated a Teacher Beliefs Survey (TBS) to measure elementary teachers' beliefs about teaching as related to behaviorist and constructivist learning theories. Woolley et al. (2004) concluded that the two learning theory perspectives might impact teachers' beliefs in different ways. For instance, it might be that each perspective impacts teachers' beliefs about different types of learners or learning, or that teachers apply each perspective to different aspects of their teaching.

Important Constructivist Theorists

 Jean Piaget (1896-1980) believed that "the growth of knowledge is a progressive construction of logically embedded structures superseding one another by a process of inclusion of lower less powerful logical means into higher and more powerful ones up to adulthood. Therefore, children's logic and modes of thinking are initially entirely different from those of adults" (Atherton, 2005). According to Atherton, cognitive development consists of a constant effort to adapt to the environment in terms of

assimilation and accommodation. Piaget's theory is similar in nature to Lev Vygotsky's constructivist perspectives of learning.

Lev Vygotsky (1906-1934) was another prominent constructivist theorist. The major theme of Vygotsky's theoretical framework was that social interaction plays a fundamental role in the development of cognition (Driscoll, 2000). Most of Vygotsky's work was done in the context of language learning in children. He is known for his "zone of proximal development which is the gap between a child's potential development and his/her actual development" (Driscoll, 2000).

David Ausubel (1918-present) was most influenced in his work by Piaget's cognitive development theory. According to Ivie (1998), Ausubel's theory focused on how individuals learn large amounts of meaningful material from verbal/textual lessons. His Subsumption Theory is based on the premise that what a learner already knows has the most influence on learning (e.g., meaningful materials). Ausubel emphasizes that the learner must discover information through problem solving (Ivie, 1998).

Jerome Bruner's (1915-present) theoretical framework is that learning is an active process, in which learners construct new ideas or concepts based upon their current and past knowledge, known as discovery learning (Takaya, 2008). The goal of education is to have information structured so the individual can expand and deepen his or her knowledge more efficiently. According to Takaya, to achieve this goal, the concept of a "spiral curriculum" where students continually build upon what they have already learned is essential.

John Dewey (1859-1952) is responsible for creating learning events in which the learner is presented with problematic situations which he or she would be motivated to

solve by learning (Henson, 2003). Henson argues that Dewey used his life to "exert more influence on education and philosophy than any other American" (p. 9). He promoted the idea that instruction needs to be centered around activities that are meaningful to students' experiences and is best known for establishing many characteristics of today's educational system.

In contrast to behaviorist teaching approaches, students who participate in a constructivist learning environment assemble their own meanings of knowledge that depend on the social and cultural context of a learning situation. An alternative is to change the focus in the classroom from teacher-dominated to student-centered, using a constructivist instructional approach.

Constructivism and Classroom Learning

Constructivist views of learning have emerged as alternatives to the traditional behaviorist approaches in education. Although behaviorism continues to influence many aspects of education, including classroom management and instructional objectives, constructivism represents a significant step beyond behaviorism (Brooks & Brooks, 1993). Willison & Taylor (2006) argue that a behaviorist view of learning uses an exclusive metaphor of knowledge transfer that assumes a single teacher explanation can fit all receptive student minds. They also argue that constructivist-inspired curricula reform calls for inclusive pedagogical practices that enable all students to make good sense of their learning experiences.

Constructivism is not new. According to Benjamin (2003), it has been overshadowed by behaviorism (sometimes referred to as "traditional") because of the dominant influence of behaviorist learning theories on American schools in much of the 20th

century. Theories of cognitive learning that emphasize the active role of learners in building and interpreting their own understanding of reality are considered constructivist (Gueldenzopn, 2003; Henry, 2002; Null, 2004; Richardson, 2003; Windschitl, 2002). A constructivist view of learning rests on the assumption that knowledge is constructed by learners as they attempt to make sense of their environments.

Constructivism is one of the most current theories in the psychology of learning literature (Fosnot, 1996). Constructivism is most often associated with the respective psychological and philosophical works of theorists such as Jean Piaget, Jerome Bruner, John Dewey, and Lev Vygotsky. Constructivism comes directly from Piaget, who focuses on the individual and her or her construction of meaning called cognitive constructivism (Green & Gredler, 2002; Maypole & Davies, 2001). According to Green & Gredler (2002), the key role of the teacher in constructivism is to promote analytical or scientific thinking by creating situations where students have to solve problems that challenge their current ways of thinking. Another influential version of constructivism comes from the ideas of Lev Vygotsky who focused on language and social interactions (Green & Gredler, 2002; Maypole & Davies, 2001). Social constructionists hold that the social context of learning is at least as important as what happens in the mind of the individual. Group interaction is crucial and collaborative learning group work and class discussions are critical to student learning (Stage et al., 1998).

Constructivists believe that people are active and do not respond to stimuli as the behaviorists learning theory suggest (Connor, 2002). Constructivists believe that knowledge is formed within the learner by integrating learning activities and experiences into knowledge and beliefs. Because constructivists believe that individuals learn by

creating meaning from experiences, it follows that the learning in this framework is focused on developing meaning, achieving understanding, and assigning significance to experiences (Torre et al., 2006).

Constructivism's emphasis on students' active role in the construction of their own learning is consistent with the popular teaching approach that is referred to as "student-centered learning." Accordingly, learning activity shifts from the teacher and gets directed toward the student. This teaching/learning approach has caused many of the current reforms in education to emphasize classrooms in which the teacher helps students discover meaning. According to Wilson (1995), one definition of a constructivist learning environment is "a place where learners may work together and support each other as they use a variety of tools and information resources in their pursuit of learning goals and problem-solving activities."

Although a constructivist approach has been debated and successfully applied in K-12 education, there is little evidence indicating that these perspectives have been implemented at the postsecondary level (Brooks & Brooks, 1993; Love & Love, 1995). A review of the literature on constructivism in higher education reveals that the approach has been employed as a framework for reconceptualizing the college classroom. This approach emphasizes the importance of active learning and social negotiation (Cobb, 1994). It also emphasizes greater interactions between teacher and student and among students (Dimant & Bearison, 1991). The constructivist teaching/learning approach promotes teaching practices that utilize collaborative and problem-based learning (Thomas & Macgregor, 2005).

Researchers and some educators in particular disciplines have focused more extensively than others on exploring constructivism as perspectives on how college students learn (Gueldenzoph, 2003; Henry, 2002; Lockyer et al., 2004; Maypole & Davies, 2001; Peters, 2000; Taylor et al., 1997; Torre et al., 2006). While research shows a clear need for new instructional strategies based on a constructivist model of learning, much of current teaching methods remain rooted in behaviorist theory and rote methods of learning. A new vision of teaching and learning must be based on instruction that emphasizes engaged learning, in which students create meaning from their own experiences (Stage et al., 1998).

A few studies will be summarized regarding the effectiveness of the constructivist teaching method. For example, in the science classroom, there were studies by Carey et al. (1981) and Caprio (1994). In the field of nursing, studies were conducted by Kuiper (2002), and Peters (2000). Some studies conducted by Henry (2002) and Maypole & Davies (2001) researched constructivism in history classrooms while elementary education studies were conducted by Woolley et al. (1999) and Richardson (2003).

In the Carey et al. 1981 study, the authors explored the nature of student views on scientific inquiry. Grade 7 students were interviewed about their conception of how science is investigated before and after a constructivist style learning unit on a specific topic. After the learning unit, most of the students saw scientific inquiry as being guided by questions and ideas. They also understood the difference between an idea and an experiment.

Another study by Caprio (1994) compared the constructivist approach to a traditional behaviorist lecture-lab format for an anatomy and physiology community college course.

The results showed that better exam grades were obtained by students who were taught by the constructivist methodology. The average exam score for the constructivist group was 69.7% (N = 44). The group taught by the traditional lecture-lab method was 60.8 % (N = 40). This author concluded that students in the constructivist group seemed more confident of their learning and were more independent learners.

In the field of nursing, Kuiper (2002) asked the following research questions:

- What are the effects of self-regulated learning (SRL) prompts on the meta-cognitive processes of new nurse graduates who use reflective journaling during clinical experience?
- Are there changes in meta-cognitive processes of new nurse graduates who use SRL prompts for reflective journaling for 8 weeks of clinical experiences?
- Are there differences in meta-cognitive processes between associate degree and baccalaureate degree nurse graduates who use SRL prompts for reflective journaling after clinical experiences?

Nurses and students observed in educational and practice settings displayed varying degrees of reflection, but it seemed the majority of students used lower levels of reflection and could not demonstrate efforts at validating assumptions or transforming perspectives. Using the constructivist paradigm of social cognitive theory and observing nursing students in situated learning revealed that interpretation of experience, reflection, and self-evaluation impacted cognitive gains and self-regulation strategies. The data from Kuiper's study suggested that nursing education should use constructivist learning with its emphasis on self-reflection and knowledge construction to contribute to the development of critical thinking skills.

Peters (2000) argued that nurse education using constructivist learning theory was more likely to enhance the development of nursing knowledge and nurse practice than traditional behaviorist frameworks, which have limited application for the practice of nursing. Peters (2000) asserts that there are likely to be benefits for nurses in the practice

setting for making the transition from inexperienced to experienced practitioners as a result of undergraduate learning within a constructivist framework.

In 2002, Henry brought constructivism into the history classroom. By blending lectures and probing students to question and respond in class, Henry encouraged historical thinking in his students. Student evaluations of the constructivist-oriented course were very positive, and they liked having a break from the passive, note-taking (behaviorist) approach that had often dominated their history classes.

The purpose of another study in 2001 by Maypole & Davies was to explore community college students' perceptions of the learning experience in an American History course using constructivist theories. The researchers found that students enjoyed the autonomous learning environment, they reported greater understanding of American history by utilizing various constructivist tools, and the students found reflective journals helpful in reviewing what they had learned.

The field of teacher education began to explore the meaning and practice of constructivism. Constructivist learning theory became an important element of the curriculum and it was often presented to the students in a lecture (behaviorist) format. Models of teaching constructively were presented to the students to encourage them in establishing constructivist classrooms once they graduated (Richardson, 2003). Richardson argued that the teacher education classes should be conducted in a constructivist manner to increase the legitimacy of the theory among teacher education students, and to help them develop deeper understandings of the teaching process as an aid in their continued learning.

Woolley et al. (1999) wondered what the impact would be of placing student teachers who learned constructivist learning theory with teachers who practiced behaviorist learning theory. The study included 38 student teachers and 71 teachers in an elementary education program. Although student teachers learn from their supervising teachers, their fundamental beliefs about teaching do not change in one semester. During student teaching, they were introduced to the realities of teaching, including many practices based on behaviorist learning theory, as well as some based on constructivist learning theory (Woolley et al., 1999). As a group, student teachers were observed to be more constructivist and less behaviorist than their supervising teacher. The study suggested that teacher educators should focus on when to use behaviorist and constructivist learning theories rather than proclaiming superiority of one theory to the other.

The Constructivist Learning Environment Survey (CLES; Taylor et al., 1995a, 1995b; Taylor et al., 1997) was developed to enable educators and researchers to measure students' perceptions of the extent to which the classroom learning environment enabled them to reflect on their prior knowledge, develop as autonomous learners, and negotiate their understandings with others students (Taylor et al., 1994). According to Johnson & McClure (2002), the CLES provides valuable information about students' perceptions of their classroom learning environment. The original version of the CLES was developed by Peter Taylor and Barry Fraser at Curtin University of Technology in Perth, Australia (Taylor et al., 1993). The survey focused on students as co-constructors of knowledge and used the instrument in science disciplines within Australian high schools and in other countries (Lucas & Roth, 1996; Roth & Bowen, 1995; Watters & Ginns, 1994).

A new version of the CLES was developed (Taylor et al., 1997) to obtain measures of five key elements of a critical constructivist learning environment from the students' perceptions: (1) the degree of personal relevance in their studies or learning about the world; (2) whether students have shared control over their learning; also known as learning to learn; (3) the degree to which students feel free to express concerns about their learning, called critical voice or learning to speak out, (4) the degree to which students are able to interact with each other to improve their understanding referred to as student negotiation, and (5) the extent to which dietetics is viewed as ever changing or scientific uncertainty (Taylor et al., 1995a; Taylor et al., 1997). Each scale of the new version of the CLES was designed to obtain measures of students' perceptions of the frequency of occurrence of these five key dimensions of a constructivist learning environment. (A modified version of the CLES was used in this study. Refer to Appendix C.)

Criticism of Constructivist Learning Theory

According to Scheepers (2000), "criticism against constructivist theoretical approaches includes the following concerns:

- in situations where conformity is essential divergent thinking and action may cause problems,
- content can be very subjective and fact-avoidant,
- assessment of learner's grasp of material can be difficult to measure,
- learner must have a level of maturity (if learner does not take responsibility for learning, system will fail),
- the learning process is time consuming,
- unpredictable and incidental learning outcomes are often vague,
- invariably, it is difficult to develop problems that will motivate all learners to participate in the learning process,
- learners often have difficulty in assessing which facts are important and relative, and
- intellectual anarchy is often present: inference that each person constructs a unique reality, that is only in the mind of the knower."

Summary of Behaviorist and Constructivist Learning Theories

Clearly, it can be safely assumed that there is a large body of literature on behaviorist and constructivist teaching and learning approaches. Also there is evidence that both teaching and learning approaches have been utilized in research studies. Nonetheless, use of these approaches has not received much attention as applied to dietetic professional education.

Beliefs in the behaviorist approach and in the constructivist approach are not mutually exclusive. One might believe in the behaviorist approach in terms of class management but use constructivist approach in their teaching (Benjamin, 2003). The literature described behaviorist and constructive approaches at both ends of the spectrum and differentiated them clearly. Examples of ineffective constructivist teaching are seldom presented, and examples of exemplary constructivist teaching were often compared with behaviorist teaching. If a teacher considers her-or himself to be a constructivist but is not particularly good, it is suggested that this notion likely exists because the teacher, at root, holds behaviorist beliefs (Cohen, 1990). To understand the unique differences between behaviorism and constructivism, a review by Coghlan (2002) differentiates the two as follows:

Table 1

Differences Between Behaviorism and Constructivism

Behaviorism	Constructivism
Teacher driven	Student driven
Teachers "give" knowledge	Students build (construct) knowledge
Solo	Collaborative
Teacher is expert	Students' knowledge is valid starting point
"Regurgitation" of information; memorization	Analysis, exploration, synthesis of information (higher order thinking skills)
Content based	Process based
Passive	Active
Clear end point	Ongoing
Student primarily work alone	Students primarily work in groups
Strict adherence to fixed curriculum is highly valued	Pursuit of student questions is highly valued

Both behaviorism and constructivism are useful, depending on the nature of the information students need to learn. An empirical focus on relationship between teaching and student learning does not necessarily require an experimental study that compares constructivist and traditional instruction. Agreement on the outcomes of instruction would be difficult to achieve because the goals for the two approaches are different. Since many students take national-level standardized tests (such as for dietetics), one would hope that constructivist instruction would yield decent scores on the measures (Richardson, 2003).

Instructional Learning Theories Specific to Dietetic Professional Education

A behaviorist approach is useful when developing learning objectives or designing competency-based curricula. Specific behavioral objectives allow the student to know exactly what behavior will be learned, the conditions under which it will be performed, and the criteria with which it will be evaluated. The behaviorist approach to medical education is frequently used in the development and evaluation of clinical skills instruction and simulated case scenarios. In the area of clinical skills instruction, teachers demonstrate specific desired behaviors, learners observe the exact manner or technique in which a clinical skill or behavior should be performed, and some scoring is used to evaluate performance and provide reinforcement (Torre et al., 2006). Within a constructivist framework, the learning process involves construction of meaning from experiences through critical reflection on the learners' assumptions. Educators who use a constructivist approach assist learners in understanding how they developed certain assumptions and question learners as to whether those assumptions remain valid (Torre et al., 2006).

Lockyer et al. (2004) wrote a review on reflection exercises for students in practice. This review reported that the theory of constructivism embraces learning opportunities within the practice setting and constructivism is founded in collaborative and ongoing partnerships between learners and preceptors. When a student is enrolled in the CPD, the ADA requires a minimum of 900 hours of supervised practice experience. Preceptors are the professionals who supervise the students during their clinical, foodservice, and community field placements. Nutrition preceptors must be active facilitators of

knowledge construction, and preceptors can use case-based examples that help coach learners in the application of thoughtful inquiry.

Reflection is the process that occurs between learning episodes, transforming learning into new knowledge, action, and subsequent learning goals. Supervised practice experience within the work setting using constructivist approaches can aim to reduce gaps in effective clinical nutritional care.

In a study conducted by Winter et al. (2002), the authors wanted to determine if development of clinical competency in dietetics was enhanced with problem-based learning (a form of constructivism). Problem-based learning is an educational method that differs from the traditional means of presenting knowledge in a lecture by providing students in small groups with a problem that acts as a trigger to stimulate development of their own learning goals. In this form of learning, the problem is presented to students first, before they have learned the clinical concepts. Their results indicated that the students rated highly their learning using the problem-based approach, a finding consistent with the literature (Bruhn, 1997; Maudsley, 1999). The authors also rated working in groups as one of the most positive aspects of problem-based learning. The evaluation indicated that students generally thought that this method of learning had helped to integrate their basic knowledge with dietetic case management and there was an apparent reduction in the number of students requiring additional placement time to meet competency standards.

In another study related to dietetics, Shafer & Knous (2001) reported that using conceptualization as an educational approach was significantly more likely to regard the learning experience as enjoyable (constructivist approach). Reflection is a critical

thinking skill and practicing critical thinking skills and dispositions is an integral component of developing expertise. Reliance on memorization more likely yields superficial understanding, low interest, and a less positive learning experience (behaviorist approach).

Competence now serves as the dominant framework for the education of health professionals, including registered dietitians, replacing a centuries-old model of knowledge-based learning and testing. This paradigm shift requires RDs to master not only the knowledge base of their discipline but also to understand why, when, and how that knowledge base should be applied to improve the health well-being outcomes for their patients (Leach, 2001; Carraccio et al., 2002; Leung, 2002). The ADA and other professional organizations are challenged to assure competency of their practitioners and infer from the RD exam test score a candidate's readiness for entry level practice.

The foundation knowledge and skill requirements are listed in eight content areas that students focus on in the academic component of a dietetic program. Foundation learning includes knowledge of a topic as it applies to the profession of dietetics and the ability to demonstrate the skill. To successfully achieve the foundation knowledge and skills, graduates must demonstrate the ability to communicate, solve problems, and apply critical thinking skills. The eight areas that students focus on throughout their undergraduate education include (CADE, 2006):

- Communications
- Physical and Biological Sciences
- Social Sciences
- Research
- Food
- Nutrition
- Management
- Health Care Systems

Core competency statements exist that specify what every practitioner should be able to do at the beginning of her or his career. These core competencies build on appropriate foundation knowledge, skills, and the constructivist and behaviorist learning theories are illustrated in Appendix B: Foundation Knowledge, and Skills for Entry Level Dietitians.

Instructional Delivery Method

In addition to instructional approaches, program delivery method (on-line vs. on-campus) was researched in this study. There is an apparent lack of consistency or agreement on the terminology used in the literature reviewed. A search for research related to on-line courses led to multiple keywords and a review of many studies that did not fit the definition of on-line courses for this study: courses offered completely on-line. The multiplicity of terms made it difficult to find articles to compare results of on-line courses across studies. Distance education is distinguished from on-line education by the fact that on-line education includes courses delivered completely via the Internet, whereas distance education is instruction delivered through various forms of electronic media (videotapes, teleconferencing, interactive television, Internet), as well as by faculty who travel to sites away from campus (Butner et al., 1999).

A fully on-line program is defined as a program in which students complete their courses entirely at a distance with no on-campus component. The fully on-line programs represent the most challenging shift in the delivery of education, with institutions educating and serving students who are completely removed from the campus environment (Gallagher, 2002). For purposes of this study, courses taught totally on-line and those with an on-line component added (that is hybrid or blended courses), will be

defined as on-line. Face-to-face courses are defined in this study as the on-campus instructional delivery method.

Curriculum instructional delivery via on-line learning is hailed as the most significant paradigm shift that is occurring in higher education today (Meyer, 2002). This shift has increased student-teacher flexibility, mobility, and choice. For the past decade, on-line enrollments have been growing exponentially faster than the overall higher education classroom-based student body, with nearly 3.2 million students taking at least one on-line course in 2005 (Allen & Seaman, 2006). Instructional technology via on-line delivery now allows continuing professional education to be more convenient through on-line learning. The information age and expansion of internet technologies have provided colleges, universities, and other institutions boundless opportunities to extend their reach to multiple populations, resource sharing, expanded course offerings, enrichment of learning in the traditional classroom environment, and expanded curricular for lifelong learning (Tallent-Runnels et al., 2006). Success of on-line learning has triggered a growing body of literature.

Some studies in the literature have focused on comparing students' learning in on-line and on-campus environments (Bata-Jones & Avery, 2004; Buckley, 2003; Faux & Black-Hughes, 2000; Keefe, 2003; and Sullivan, 2002). Effective learning was determined via a variety of criteria. Various ways of defining effective learning included test score results, course grades, cumulative GPAs, and performance of learned content (Tallent-Runnels et al., 2006). Many educators sought to determine whether on-line instruction produced as much learning as on-campus instruction. Researchers compared learners' academic performance in on-line courses with academic performance in regular on-campus

environments. Study results indicated on-line and on-campus environments have shown various outcomes on effectiveness (Tallent-Runnels et al., 2006).

Studies indicate that on-line instruction is at least on par with traditional methods of teaching. For example, Bata-Jones & Avery (2004) studied nursing students' performance on midterm and final examinations in a pharmacology course, comparing students who chose the on-line version with those who enrolled in an on-campus class. No significant difference in the test scores was found between the two groups. Students in the on-line session self-studied the content through on-line discussion. In the on-campus section, the instructor provided 30 hours of lecture and provided feedback in group discussions.

Buckley's (2003) study compared three groups of nursing students in on-campus and on-line sessions of a nutrition course taught by the same instructor and found no significant differences in learning.

Other studies found that on-campus courses created better learning results than on-line courses. For example, Faux & Black-Hughes (2000) compared on-campus and on-line sections of an undergraduate course in social work to determine the effectiveness of on-line learning. Their results showed the most improvement (from pretest to posttest) for students in the on-campus section. In Keefe's (2003) comparative study, students were randomly assigned in an organizational behavior course to either an on-campus or an on-line session taught by the same instructor using the same textbook. Keefe found that students in the on-campus section of the course did better and were more satisfied than those in the on-line session.

One study (Maki & Maki, 2003) found that on-line instruction could be even more effective for students' learning than on-campus instruction. The researchers compared achievement from undergraduate students who enrolled in either on-line or on-campus sections of a psychology course. Maki & Maki found that students in the on-line sections acquired more content knowledge and performed better on examinations than those students enrolled in the on-campus sections.

On-Line Delivery and Learning Theories

One of the major conflicts in on-line teaching mirrors the conflict in on-campus instruction – is on-line teaching behaviorist or constructivist? Both instructional approaches can be successful with on-line teaching and learning. Vygotsky (1978) asserted that students learn only when their current view of knowledge is challenged, reformed, and synthesized through their interaction with others. Vygotskian theories emphasize the importance of participation (Radziszewska & Rogoff, 1991; Rogoff, 1991). Instructors in on-line courses, like on-campus classrooms, play a crucial role in students' knowledge construction by scaffolding the learning process for them. If instructors do not assume responsibility for guiding students' learning, teaching approaches could be ineffective. It is the on-line instructor's responsibility to organize on-line interactions that are sufficiently structured to benefit students' learning.

Litchfield et al. (2000) used a model of learner-centered distance dietetics education. In an on-line course, learners must work autonomously at a computer to construct their own knowledge without an instructor being immediately present to guide learning. The authors found that their model improved competency, technological aptitude, professional partnering skills, and lifelong learning skills. In a similar study by Tallent-

Runnels et al. (2006), students in well-designed and well-implemented on-line courses learned significantly more than those in on-line courses where teaching and learning activities were not carefully planned.

Carr-Chellman & Duchastel (2001) state that "instructors need to choose for themselves the best mixture of behaviorist and constructivist learning experiences for their on-line courses but know that the majority of on-line learning, particularly those translated directly from lecture notes, are behaviorist in nature" (p. 148).

An example of a behaviorist study was conducted by Upton (2006). Nutrition students were presented with an on-line science module and asked to view their development of independent learning through the on-line material. Students were less motivated through on-line learning but believed that the module made them more of an independent learner. While on-line instruction is suitable for some students who thrive in this environment, it may be unsuitable for many others.

Instructional Delivery Methods Specific to Dietetics Professional Education

The Internet can be a powerful tool for undergraduate medical education and for all types of health professionals. A variety of Internet-based educational programs have made their curricula and training materials available on the web. For example, there are educational videos, lectures, virtual classrooms and simulation programs to teach surgical skills in medical school. There are many opportunities for educators in dietetics to design on-line education program add on-line components to an existing program (CADE, 2002).

To date CADE has not established separate accreditation standards for distance education programs. However, dietetic education programs conducted off-campus or

away from the sponsoring institution should be comparable to on-campus programs. Constructivist or learner-centered models provide principles for designing and facilitating on-line communities (Bonk & Cunningham, 1998). For example, in focusing on the learners' construction of reality, faculty can create real-world contexts in which learning can be meaningful and students can test and clarify their understanding of new information. Faculty can also design courses with opportunities for students to select their own experiences and seek guidance for clinical practice in dietetics (Bonk & Cunningham, 1998).

Although Benton-King et al. (2005) revealed a concern by faculty regarding the quality of education provided by on-line education methodologies, they assessed the availability of distance education in undergraduate dietetics education. They found that public institutions were more likely to offer dietetics distance education courses than private institutions. Courses in basic nutrition were the most common type of dietetics distance education courses offered, followed by medical nutrition therapy and food services management.

This literature review revealed that few studies actually focus on instruction and learning on-line. Research is needed to generate information that will guide on-line instruction design to facilitate students' learning. As colleges and universities expand their on-line programs, they need to seek faculty who are able to deliver courses on-line with the same effectiveness given to traditional on-campus courses (Lao & Gonzales, 2005).

This research study tested learning theories and models of teaching (constructivist vs. behaviorist) used in dietetic education programs. Additionally, the focus of accreditation

for dietetics education is the quality and integrity of a program regardless of its instructional delivery method. Therefore, this study examined the variations between on-line and on-campus delivery methods.

A current listing of all programs was available in *The Directory of Dietetics Programs* from the ADA website (www.eatright.org). This directory provided information about the length of the program, the number of students per class, estimated tuition, availability of financial aid, credit given toward an advanced degree, and the scheduled date for the next accreditation. While dietetics education is pursuing computer-mediated learning, on-line delivery is still a relatively marginal activity with only two programs in the United States offering the dietetics degree completely on-line.

Theoretical Framework

The general framework for this study encompasses two major theories of learning, behaviorist and constructivist, which are applied by classroom instructors as teaching approaches. The general framework also encompasses on-line and on-campus delivery methods used in higher education. The study's framework also assumes that there will be relative outcome measures that may be identified by grade point average, national examination score and knowledge, skills, and competence to work as an entry level Registered Dietitian.

The purpose of this study was thus to compare the learning impact resulting from various instructional delivery methods with the formal aspects of behaviorist and constructivist learning theories in dietetic education programs. Behaviorists concentrate on how individuals learn new habits or procedures through stimulus and response. The theory of behaviorism concentrates on the study of overt behaviors that can be observed

and measured (Good & Brophy, 1990). Changes in behavior are the result of an individual's response to events (stimuli) that occur in the environment. Constructivist learning theorists believe that the learner becomes an active participant in the learning process and is goal-directed. Constructivist approaches emphasize learners actively constructing their own knowledge rather than passively receiving information transmitted to them from teachers and textbooks. From a constructivist perspective, knowledge cannot simply be given to students; students must construct their own meanings based on their existing understanding (Gueldenzoph, 2003). In terms of how the behaviorist approach and the constructivist approach impacts learning, the study investigated interaction effects between instructional style and delivery methods.

Figure 1 (Theoretical Framework Illustrating Background Characteristics, Teaching Strategies, Environment, and Outcome Measures) is a conceptual model representing the study's focus. The behaviorist and constructivist teaching strategies depict a conceptual view with inputs from student demographics, and program background characteristics and classroom environment.

Classroom environment depicts a conceptual view with inputs from student demographics and program background characteristics, instructional delivery method, a behaviorist teaching environment (instructor-centered pedagogy) and the constructivist teaching environments. The constructivist teaching environment contains four subscales: student negotiation, critical voice, shared control, and uncertainty. The Critical Voice scale involves the extent to which students believe that it is beneficial to question the professor's pedagogical plans and methods and to express concerns about the quality of their learning activities. The Shared Control scale measures whether students share in the

learning process by assisting with goal-setting, course objectives, and assessment of learning. Students help with the design and management of learning activities and assist with determining and applying assessment criteria. The Student Negotiation scale measures the degree to which students are able to interact with each other to improve their understanding and assesses the extent to which opportunities exist for building student knowledge. The Uncertainty scale involves the extent to which opportunities are provided for students to experience knowledge based on experience and values in the dietetic curriculum and profession.

Both the teaching strategies and environment are modified themes from the Teacher Belief Survey (TBS) originally designed by Woolley et al. 1999, and the Constructivist Learning Environment Survey (CLES) originally designed by Taylor et al., 1995.

The instructional outcome measures reflect the foundation knowledge and skill requirements and include Grade Point Average, Registered Dietitian exam score and the knowledge of a topic as it applies to the profession of dietetics, and the ability to demonstrate the skill for entry level practitioners.

This conceptual model identifies linkages between each component to illustrate interlocking relationships between constructivist and behaviorist teaching strategies, constructivist and behaviorist classroom environments, and outcome measures in dietetic education programs (refer to *Figure 1.* Theoretical Framework Illustrating Background Characteristics, Teaching Strategies, Environment, and Outcome Measures.)
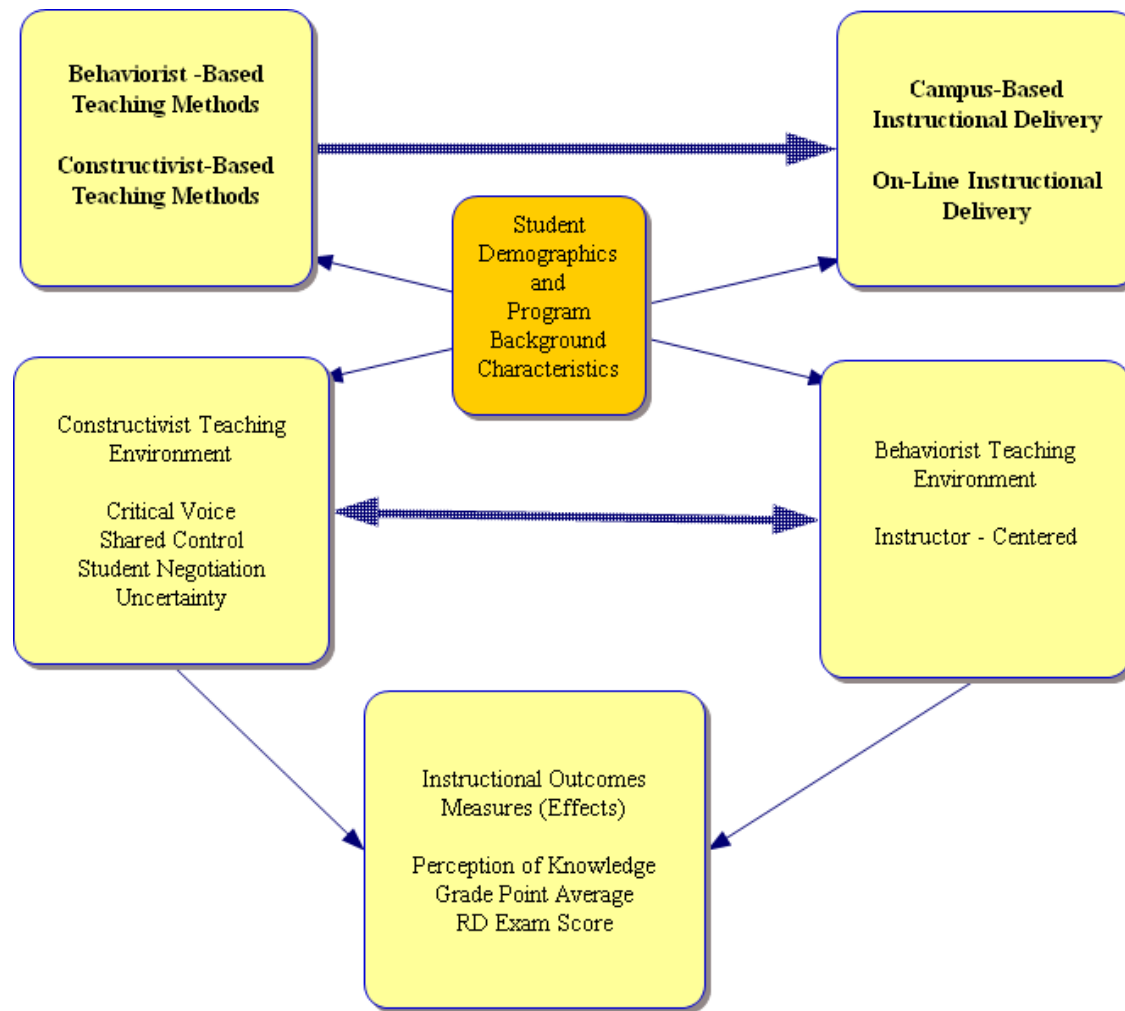
Figure 1. Theoretical Framework Illustrating Background Characteristics, Teaching Strategies, Environment, and Outcome Measures

Summary

This chapter discussed the learning theories of constructivism and behaviorism used in elementary education, history, nursing, and science education. Some literature pertaining to these learning theories was found specifically to dietetic education programs; however, no literature emerged that compared the use of both constructivism and behaviorism in professional dietetic programs. Also presented were explanations of type of delivery methods (on-line and on-campus), revealing that few studies actually focus on instruction and learning on-line. Research is needed to generate information that will guide on-line instruction design to facilitate students' learning. The literature review findings were synthesized, and a resulting theoretical framework that guided this research study was presented. Chapter 3 will discuss the methodology of the study.

Chapter 3

Methodology

Study Design

Several methods were used for evaluation of perceived preparation of competent

entry level dietitians. Student evaluations of their own performance and student opinion

of instruction are primary methods of determining the quality of dietetic professional

education. Graduates were surveyed to determine the following outcome measures:

1)   Scores achieved on RD exams,
        Did you pass or fail the Registration Examination for Dietitians?
        Was this the first time taking the exam?
        If no, how many times in total did you take the exam?

2)   Overall GPA acquired upon graduation,
        What was your overall GPA when you graduated from the dietetic program?
        Did you attend a private or public four year college/institution?

3)   Questions regarding acquired knowledge and skills, and

4)   Level of competence to work as an entry level Dietitian.

In addition, graduates from dietetic programs were surveyed to determine the following

characteristics of program measures:

1)   Obtain the perceived effect from graduates of instructional teaching strategies
        (constructivist vs. behaviorist) and instructional delivery methods (on-line vs.
        on-campus) used while enrolled in the dietetic program.

One objective of this research was to provide quantitative measures of learning

activities and frequency of involvement that might constitute entry level practice. These

data were sought primarily to provide information for the development and validation of

the national examination for the RD credential. This approach is similar in part to the

study conducted by Fincher et al. (1993), in which they addressed the questions of

whether medical students' GPA correlated with the performance assessments in specific

areas of competency. The study also compared students' self-assessment of preparedness for their internship and found that medical school academic performance related significantly to performance in the internship.

Research Questions

The research questions that are presented in this section emerged from the problem statement, the literature review, and the subsequent conceptual framework that guided this inquiry. The basic research questions addressed in the study include:

Research Question 1:
   To what extent do educators use constructivist or behaviorist theoretical approaches during instructional delivery?

Research Question 2:
   What are the differences in learning between on-line education and on-campus delivery methods?

Research Question 3:
   As far as constructivist and behaviorist teaching methods impact learning, is there an interaction between instructional style and delivery method?

Research Question 4:
   How do constructivist and behaviorist teaching methods impact learning (as measured by RD exam score, GPA and perceived level of knowledge) and skills to work as an entry level dietitian?

Sample Population

The study sample was comprised of Registered Dietitians throughout the United States. A total of 3,607 electronic mail addresses representing every state were sent to Registered Dietitians with a cover letter explaining the purpose of the research, benefits of participation, and reference to confidentiality.

Instrumentation

For this research project, questions were asked to obtain information on the relative achievement of professional dietetic education (type of dietetic program [coordinated vs.

didactic], type of university [public vs. private], GPA, and RD exam score), instructional teaching strategies (constructivist and behaviorist learning theories), instructional delivery methods (percent of on-line or on-campus instruction), and demographic information (age, gender, race/ethnicity). A Likert scale (1 = strongly disagree to 5 = strongly agree) was used to measure participants' attitudes, perceptions, and confidence levels regarding knowledge and skills acquired as it relates to dietetics in general as well as in their own careers.

Reliability and Validity of the Survey Tool

Content validity was assessed for clarity, readability, and comprehensiveness through a pilot test conducted on practicing Registered Dietitians (n = 8). The survey was slightly modified according to feedback. The pilot items were eliminated from the research inquiry and data analysis. Human subject approval was obtained through the Eastern Michigan University Human Subjects Institutional Review Board (Reference #071018: Refer to Appendix E: Human Subjects Approval Letter).

The 106-item survey was developed by the author and adapted from previously developed instruments including the Teaching Belief Survey (Benjamin, 2003) and the Constructivist Learning Environment Survey (Johnson & McClure, 2004). The Teacher Belief Survey (TBS) was created to assess beliefs related to constructivist and behaviorist theories of learning and was originally designed by Woolley et al., 1999. The CLES was developed to enable educators and researchers to measure students' perceptions of the extent to which the classroom learning environment enables them to reflect on their prior knowledge, develop as autonomous learners, and negotiate their understandings with

other former students (Taylor et al., 1994) and was originally developed by Taylor et al. in 1993.

Teacher Belief Survey

In developing the TBS, the authors measured beliefs along constructivists' and behaviorists' dimensions separately in order to track the development of both belief systems independently. The TBS was developed as a result of greater demands for educators to raise standards and be more accountable for the quality of graduates.

The TBS contains items in the following constructs: Behaviorist Management (BM), Behaviorist Teaching (BT), and Constructivist Teaching (CT). According to Woolley et al. (1999), the Behaviorist Management (BM) construct contains statements about the extent to which the instructor is in charge of classroom management and the physical and social climate of the classroom. Those who agree with the statements on this scale believe in professors being in charge by directing events, rather than sharing power with students.

The Behaviorist Teaching (BT) construct contains statements about the extent to which the instructor is in charge of planning, directing, and assessing students' learning. Those who agree with the statements on the BT scale believe in curricula following textbooks, having students work independently, and assessing students in traditional ways (e.g., homework, quizzes, and tests).

If the instructor involves students in planning, directing, and assessing, then it is part of the Constructivist Teaching (CT) construct, and those who agree with the statements on the CT scale believe in a student-centered classroom, curricula based on students' interests, and informal assessments.

Constructivist Learning Environment Survey

The CLES provides information about professors' and students' perceptions of their classroom learning environment (Johnson & McClure, 2002). The original version of the CLES developed by Taylor et al. (1993), at Curtin University of Technology in Perth, Australia, focused on students as co-constructors of knowledge. An updated version of the CLES was later developed (Taylor et al., 1997) to obtain measures of a critical constructivist learning environment from the students' perspective. The four scales used in this study replicated the original instrument as defined by Taylor et al., (1997); these four scales include Critical Voice, Shared Control, Student Negotiation, and Uncertainty.

The Critical Voice scale involves the extent to which students believe that it is beneficial to question the professor's pedagogical plans and methods and to express concerns about the quality of their learning activities. The Shared Control scale measures whether students share in the learning process by assisting with goal-setting, course objectives, and assessment of learning. Students help with the design and management of learning activities and assist with determining and applying assessment criteria. The Student Negotiation scale measures the degree to which students are able to interact with each other to improve their understanding and assesses the extent to which opportunities exist for building student knowledge. The Uncertainty scale involves the extent to which opportunities are provided for students to experience knowledge based on experience and values in the dietetic curriculum and profession.

The 106 item survey for this research project incorporated questions from both the CLES and the TBS instruments to gather behaviorist and constructivist learning theories (refer to Appendix C: Dietetics Learning Environment Survey: Student Perceptions).

In this study, the researcher:

1. Used instructional theories (behaviorist vs. constructivism) and delivery methods (on-line vs. on-campus) to predict GPA and perception of knowledge.

2. Used background characteristics and demographics (age, race/ethnicity, and gender to predict differences in student learning when using instructional theories (behaviorist vs. constructivism) and delivery method (on-line vs. on-campus).

3. Used background characteristics/demographics (age, race/ethnicity, and gender) to predict GPA and perceived level of knowledge to work as an entry level dietitian.

Data Collection Procedures

For this research, data were collected from dietetic program graduates residing in the United States. Specifically, electronic mail addresses were obtained from the American Dietetic Association contact list titled "Find a Nutrition Professional." Every state identifies Registered Dietitians available for consulting services.

Descriptive statistics such as means and percentages were used to compare response distributions. Factor analysis was performed and the value of Cronbach's alpha for all of the components were calculated. Paired sample *t*-tests and Pearson product-moment correlation coefficients were used to compare on-line and on-campus responses. Multiple linear regressions (using the backward stepwise approach) and path analysis were also used as part of the data analysis process.

Factor Analysis

According to Babbie (2001), factor analysis is used to discover patterns among variations in values of several variables. Two criteria are taken into account when performing factor analysis. First, a factor must explain a large portion of the variance found in the variables. Second, every factor must be independent of every other factor. According to Babbie, the output of a factor analysis program consists of columns

representing several factors generated from the relations among variables, plus the

correlations between each variable and each factor called the factor loadings. The author

cautions that the generation of factors does not ensure meaning. However, factor analysis

is an efficient method of discovering predominant patterns among a large number of

variables to a smaller number of factors and as such is a "non-dependent" procedure (that

is, it does not assume a dependent variable is specified).

Paired Sample *t*-Tests Analysis

According to Gay & Airasian (2003), paired samples *t*-tests are conducted to compare

two sets of scores for the same group of people so the relationship between the sets of

scores is dependent upon the group of people. For this research project, the on-campus

item numbers were paired with the on-line item numbers to determine if the difference

between the mean of the on-campus responses was significantly different from the mean

of the on-line responses. When looking at the null and alternative hypotheses of this

research:

H_0: There is no difference between scores of the mean environment and the mean teaching strategies in the on-line and on-campus populations.

H_1: There is a difference between scores of the mean teaching strategies and the mean environment in the on-line and the on-campus populations.

Pearson Product-Moment Correlation Coefficients

Pearson *r*, or "Pearson product-moment correlation coefficient" (Cohen & Cohen,

1983), was applied in this study to compare the age, type of delivery method (on-line vs.

on-campus), type of program (coordinated vs. didactic), and type of institution (public vs.

private) with the teaching strategies and the environment. In addition, bivariate

correlations were used to check the correlations between teaching strategies and the

environment and if there were differences found between on-line and on-campus responses.

Multiple Regression Analysis

For this research, data were collected from dietetic program graduates. Students' experiences may differ significantly even though the same 46 competency guidelines for RDs are followed as mandated by the accreditation agency of CADE. Perception of Knowledge and competence to work as a RD and GPA were analyzed using Multiple Regression Analysis (MRA).

Regression analysis is a method of determining the specific function relating Y to X (Babbie, 2001, p. 442). According to Babbie, a dependent variable is affected simultaneously by several independent variables. A multiple regression equation uses variables that are known to individually predict (correlate with) the criterion to make an accurate prediction. MRA determines not only whether variables are related, but also the degree to which they are related.

There are three underlying assumptions to consider when using multiple regressions. Without these taken into consideration, the study lacks validity and analyses could also be weakened (Tabachnick & Fidell, 1996).

The first assumption examines multicollinearity. Regression will be best when each independent variable is strongly correlated with the dependent variable but uncorrelated with other independent variables (Tabachnick & Fidell, 1996, pp. 131-132). For this study the Variance Inflation Factor (VIF) was applied to measure the impact of collinearity among the variables in a regression model. According to Schwab (2007), there is no formal VIF value for determining presence of multicollinearity. Schwab

(2007) asserts that the common rule of thumb is that multicollinearity exists when VIF > 4.0.

The second assumption to consider when using multiple regressions is that cases are evaluated for univariate extremeness with respect to the dependent variable and each independent variable. According to Tabachnick & Fidell, the goal of the independent and dependent variables is to contribute equally to the regression solution. "If there are extreme cases that have too much impact on the regression solution, they should be deleted, rescored or the variable transformed" (p. 133).

The last assumption to consider when using multiple regressions is to exam residual scatterplots. These provide a test of assumptions of normality, linearity, and homoscedasticity between predicted dependent variables scores and errors of predictions. According to Tabachnick & Fidell (1996), homoscedasticity means that "the band enclosing the residuals is approximately equal in width at all values of the predicted dependent variable" (p. 138).

Path Analysis

Byrne (2001) believes that path analysis is an appropriate method to use to test theory. It is an alternative multivariate approach for predictive validity and more powerful than regression. Path analysis is known by several names: causal modeling, causal analysis, structural equation modeling, or confirmatory factor analysis (Byrne, 2001). Path analysis provides a unique way of displaying explanatory results for interpretation by showing the strengths of several relationships (Babbie, 2001, p. 446).

According to Tabachnick & Fidell (1996), when a single path is tested, it is called a test of direct effects (e.g. Constructivist teaching strategies on GPA). Accordingly,

researchers need to determine if an independent variable (such as constructivist teaching strategies) directly affects a specific dependent variable such as GPA (direct effect) or if the independent variable affects the dependent variable through an intermediary, or mediating variable (indirect effect).

Summary

This exploratory-quantitative-descriptive research design attempts to respond to the research questions that are delineated in this inquiry. The methodology section provided the following components: a description of the study design, the itemized research questions, a description of the subjects, a description of the instrumentation that comprises modification from the Teacher Belief Survey (Woolley et al., 1999) and the Constructivist Learning Environment Survey (Taylor et al., 1995), and a description of how the data will be collected and analyzed. Discussions in this chapter have included a detailed presentation of methodological components that are relevant to the exploratory-quantitative-descriptive research design of this study. Chapter 4 presents the study's findings.

Chapter 4

Research Study Results

The purpose of this study was to determine the impact of two factors on learning from

accredited dietetic professional educational programs:

1)   constructivist and behaviorist theoretical approaches used during instruction,
     and

2)   type of delivery methods (on-line vs. on-campus) used while in the dietetics
     program.

Graduates from dietetic programs were surveyed to determine the following outcome

measures:

1)   Obtain score on RD exam,
     Did you pass or fail the Registration Examination for Dietitians?
     Was this the first time taking the exam?
     If no, how many times in total did you take the exam?

2)   Obtain GPA,
     What was your overall GPA when you graduated from the dietetic program?
     Did you attend a private or public four year college/institution?

3)   Answer questions about knowledge and skills, and

4)   Determine level of competence to work as an entry level dietitian.

The following sections in this chapter will consider: (a) the statistical analysis, (b)

study sample, (c) demographics, (d) descriptive statistics, (e) factor analysis, (f) paired-

sample *t*-tests, (g) nonparametric and bivariate correlations, and (h) multiple regressions

with interaction effects.

Statistical Analysis

Data were collected through an on-line survey developed through SNAP Survey

Software (version 9, 2008, Portsmouth, NH) and analyzed using the Statistical Package

for the Social Sciences (SPSS; version 15, 2007, SPSS Inc., Chicago, IL). Descriptive

statistics such as means and percentages were used to compare response distributions.

Principal Component analysis (varimax normalized rotation) was performed, and the

value of Cronbach's alpha for all of the components were calculated. Paired sample *t*-

tests or *t-test* for dependent means, Pearson product-moment correlation coefficients were

used to compare on-line and on-campus responses. Multiple linear regressions (using the

backward stepwise approach) and path analysis were also used as part of the data analysis

process.

Study Sample

Initially, electronic messages describing the research project were sent to the 43

Directors of Coordinated Programs in Dietetics (representing 25 states). The Directors

were contacted during November 2007 and asked for contact information on program

graduates within the last five years. Five Directors would not release names of graduates

but offered to forward the survey to each graduate (University of Connecticut, University

of Texas at Austin, University of Cincinnati, University of Akron, and Eastern Michigan

University). Three Directors sent email addresses of graduates. Youngstown State

University in Pennsylvania sent 25 names, Framingham State College in Massachusetts

sent 67 names, and Washington State University sent 96 names. Kansas State University

sent 46 contact names; however, email addresses were not provided, so the contact list

was not used. A few of the program directors notified the researcher providing the

following rationale:

> "…Thank you for contacting our Coordinated Program with your
> request. The rules and regulations regarding student privacy do not
> permit the issuance of student data to unauthorized parties. I
> appreciate the need for the data for your research but will not be
> able to provide the requested student information…"

> "…I am unable to give you this list, as I don't keep an active file. Graduates move and or change their addresses and email addresses. Even when I check on some of the more recent graduates, my messages bounce. I hope that you can get the information you need from other Coordinated Programs…"

Another avenue to locate graduates was through the professional organization mentioned previously in this document: The American Dietetic Association (ADA). Purchasing names from ADA was not feasible due to the following reasons: 1) only permanent mail addresses were sold, not email addresses, 2) high cost, and 3) ADA representatives who the researcher contacted could not guarantee that the names purchased would be those who graduated within the last 5-10 years. For this research study, electronic mail addresses were obtained from the American Dietetic Association website titled "Find a Nutrition Professional." Every state identifies Registered Dietitians available for consulting services.

The first survey was sent to a total number of 2,876 Registered Dietitians (representing 25 states with Coordinated Programs). The email cover letter explained the purpose of the research, benefits of participation, and reference to confidentiality (see Appendix F: Research Cover Letter). The first question of the survey asked: "Did you graduate from a Coordinated Program in Dietetics?" If the participant answered "no," the survey routed the respondent to the end of the survey and thanked him or her for participating since the original proposal was to gather data exclusively from graduates of Coordinated Dietetic Programs. Of the 2,876 emailed surveys, 132 email addresses were undeliverable, and 526 responded to the survey. Of the 526 respondents, 364 answered "no" to the first question, sending them to the end of the survey; therefore, no data were collected on these participants. Only 218 of the 526 who responded "yes" to the first

question completed the survey. Because of the low response rate (8% usable data), the survey was modified to include all "yes" and "no" responses to the first question (whether or not people graduated from a Coordinated program) and the survey was emailed to 731 Registered Dietitians in the remaining 25 states not previously surveyed. Of the 731 emailed questionnaires, 56 email addresses were undeliverable and 136 surveys were completed and returned (20% response rate). When both mailings of the survey were combined, 354 respondents completed the survey in total.

Demographics

Dietitians were graduated in 47 states by 143 universities (81% from public institutions), and a majority of the respondents graduated within the last 10 years (n = 163). In total, 96% of respondents were female (n=340) and 4% male (n=12). Mean age of participants was 39.92 years, and 91% of respondents were Caucasian (refer to Tables 2 and 3 for distribution of demographics).

Of the 354 participants who reported obtaining a degree in dietetics, 83.6% were from a Coordinated Program (n=296). Ninety percent of the respondents reported having an overall grade point average of ≥ 3.2 (n = 312). Most (n = 307, 87%) participants who passed the registration examination for dietitians did so on the first attempt; 20 individuals passed on the second attempt, and 6 on the third. Of the 354 respondents, only 18% (N = 66) took on-line courses during their undergraduate education.

Table 2

Demographic Distribution of Participants

	Frequency (n)	%
Type of Program		
Coordinated	296	83.6
Didactic	58	16.4
Type of Institution		
Private	61	17.2
Public	290	81.9
Gender		
Female	340	96.0
Male	12	3.4
Passed the Registration Examination for Dietitians		
Yes	344	97.2
No	5	1.4
Overall Grade Point Average		
3.8-4.0	85	24.0
3.6-3.79	94	26.6
3.4-3.59	77	21.8
3.2-3.39	56	15.8
3.0-3.19	20	5.6
2.8-2.99	13	3.7
2.5-2.79	3	.8
Race		
Caucasian	319	90.1
African American	7	2.0
Hispanic	11	3.1
Asian	6	1.7
Multiracial	3	.8
Native American	1	.3
Other	4	1.1
Percentage of Courses Taken On-Line		
76-100%	5	1.4
51-75%	4	1.1
26-50%	12	3.4
1-25%	50	14.1
0%	281	79.4%

*Some of the questions were not answered, therefore N ≠ 354

Table 3

Demographic Variables: Age and Year of Graduation

	Range	Mean (SD)
Age	22-70	39.92 (10.86)
Year of Graduation	1960-2007	1993 (10.67)

Descriptive Statistics

The highest scored item on the survey for all respondents (N = 351) was the statement, "It was expected that students follow the dietetic code of ethics for professional behavior" ($\bar{x} = 4.53$, *SD* = .61).

For the dietetics profession, entry level competence is documented as 46 competencies, divided into eight areas: Communication, physical and biological sciences, social sciences, research, food, nutrition, management, and health care systems (CADE, 2006). Using a Likert scale where 1 = poor, 2 = fair, 3 = good, 4 = very good and 5 = excellent, dietitians believed they were most competent in the area of nutrition ($\bar{x} = 3.92$) and the least competent in research and health care systems ($\bar{x} = 3.02$ and $\bar{x} = 2.50$ respectively) when asked, "How would you rate your knowledge and skills needed to work as an entry level dietitian?" (Refer to Table 4 for the mean responses of the content areas.)

Table 4

Overall Responses to the Question, "How Would You Rate Your Knowledge and Skills

Needed to Work as an Entry Level Dietitian?"

Content Areas	N	Mean (SD)
Nutrition (growth and normal development on nutritional requirements, health promotion and disease prevention theories, complementary, and alternative nutrition).	352	3.92 (.88)
Food (sensory evaluation of food, food and nutrition laws, food production, food safety, and sanitation).	354	3.74 (.87)
Physical and Biological Sciences (fluid and electrolyte requirements, general health assessment, drug-nutrient interaction, and nutrient metabolism).	354	3.62 (.98)
Social Sciences (health behaviors and educational needs of diverse populations).	354	3.42 (.93)
Communication (counseling theory and methods, interviewing techniques, lay, and technical writing).	354	3.33 (1.03)
Management (program planning, monitoring and evaluation, management theories, human resources management, and financial management).	353	3.23 (1.10)
Research (research and scientific methodologies).	350	3.02 (1.10)
Health Care Systems (health care policy and administration, current reimbursement issues, policies, and regulations).	352	2.50 (1.05)

Using the Likert scale for the remainder of the survey where 1 = strongly disagree, 2 =

disagree, 3 = neutral, 4 = agree and 5 = strongly agree, all respondents agreed, with little

variance, about the following statements (refer to Table 5: Overall Responses to Items

Describing the Environment):

Table 5

Overall Responses to Items Describing the Environment

Constructivist Uncertainty	N	Mean (SD)
I learned how nutrition is influenced by people.	352	4.24 (.72)
I learned about the differences in nutrition by people in other cultures.	350	4.13 (.82)
I learned how the dietetic profession has changed over time.	352	4.04 (.80)
I learned nutrition cannot provide perfect answers to problems.	350	3.96 (.81)
I learned how today's human nutrition is different from human nutrition of long ago.	352	3.94 (.84)

In addition to instructional approaches, program delivery methods (on-line vs. on-campus) were researched in this study. For the next set of questions, on-line and on-campus responses will be compared (refer to Tables 6-12: Overall Responses to Items Describing the Environment and Teaching Strategies).

Table 6

Overall Responses to Items Describing the Environment

Constructivist Critical Voice	On-campus		On-line	
	N	Mean (SD)	N	Mean (SD)
I felt comfortable approaching the professors for extra help.	340	4.04 (1.04)	53	3.83 (1.14)
I was comfortable expressing my opinion.	343	3.81 (1.10)	56	3.86 (.98)
I was comfortable speaking up for my rights	338	3.65 (1.13)	54	3.81 (.93)
I was comfortable complaining about anything that prevented me from learning.	333	3.51 (1.12)	55	3.62 (1.00)
I was comfortable complaining about activities that were confusing.	336	3.48 (1.12)	54	3.59 (1.06)
I was comfortable questioning the way I was being taught.	336	3.46 (1.10)	54	3.52 (1.02)
I was encouraged to negotiate and propose new policies if I felt the currently policies were not working.	329	2.81 (1.21)	48	3.23 (1.13)

Overall, the responses showed that on-line students believed they had more of a critical voice than on-campus students with one exception: On-campus students believed they were more comfortable approaching the professors for extra help than did on-line students.

Table 7

Overall Responses to Items Describing the Environment

Constructivist Shared Control	On-campus		On-line	
	N	Mean (SD)	N	Mean (SD)
I was involved in evaluating my own work and setting my own goals.	342	3.35 (1.09)	52	3.48 (1.07)
I helped the professor assess my learning.	343	2.84 (1.19)	53	3.21 (1.15)
Professors adjusted their lesson plans based on results of homework assignments.	336	2.81 (1.07)	49	3.10 (1.03)
I helped the professors decide how well I was learning.	342	2.71 (1.15)	52	3.59 (1.06)
Professors created thematic units based on the student's interests and ideas.	333	2.69 (1.08)	53	2.80 (1.06)
I helped the professor to decide which activities were best for me.	344	2.67 (1.15)	53	3.62 (1.00)
I helped the professors plan what I learned.	338	2.33 (1.01)	50	2.52 (.99)
I helped the professor decide how much time I spent on activities.	342	2.32 (1.02)	52	3.86 (.98)

The responses revealed that on-line students believed they had more shared control than on-campus students. For on-campus responses, dietitians believed they were involved in evaluating their own work and setting their own goals the most ($\bar{x} = 3.35$, *SD* = 1.09), while most disagreed that they helped the professor decide how much time was spent on activities ($\bar{x} = 2.32$, *SD* = 1.02).

Table 8

Overall Responses to Items Describing the Environment

Constructivist Student Negotiation	On-campus		On-line	
	N	Mean (SD)	N	Mean (SD)
I got the chance to communicate to other students.	342	4.45 (.70)	49	3.96 (1.24)
I communicated with other students about how to solve problems.	343	4.28 (.72)	49	3.73 (1.15)
I explained my ideas to other students.	343	4.22 (.74)	48	3.77 (1.13)
I asked other students to explain their ideas to me.	343	4.22 (.72)	48	3.69 (1.13)
Other students explained their ideas to me.	342	4.18 (.76)	49	3.79 (1.04)
Other students asked me to explain my ideas.	342	4.13 (.78)	49	3.57 (1.19)

In each case, dietitians who completed their dietetic educational program in the on-campus classroom environment believed they were able to negotiate more than the on-line students who responded to the same questions.

Both the on-campus and on-line respondents strongly agreed that they got the opportunity to communicate with other students while in their dietetic program ($\bar{x} = 4.45$, $SD = .70$ and $\bar{x} = 3.96$, SD =1.24 respectively). The lowest scoring item in the student negotiation section for both on-campus and on-line responses was the question, "Other students asked me to explain my ideas."

Table 9

Overall Responses to Items Describing the Environment

Behaviorist Environment	On-campus		On-line	
	N	Mean (SD)	N	Mean (SD)
Professors found it more effective to provide students with the information they need to know rather than encouraging them to experiment.	340	2.99 (1.03)	49	3.02 (1.16)
The professor immediately told students the correct answers when they could not figure them out by themselves.	341	2.27 (.95)	51	2.45 (1.15)

In the behaviorist environment, dietitians in both type of delivery method groups disagreed with the statement, "Professors immediately told students the correct answers when they could not figure them out by themselves." ($\bar{x} = 2.27$, *SD* = .95 and $\bar{x} = 2.45$, *SD* = 1.15 respectively).

Table 10

Overall Responses to Items Describing Teaching Strategies

Behaviorist Schedules and Rules	On-campus		On-line	
	N	Mean (SD)	N	Mean (SD)
It is important that professors enforce classroom policies once they are established.	343	3.86 (.76)	52	4.02 (.85)
I learned best when there was a fixed schedule.	342	3.58 (.96)	56	3.66 (1.13)
It is more important for professors to set rules and policies than to let students make their own decisions.	343	2.96 (1.11)	56	3.20 (1.30)

Both the on-campus and on-line respondents agreed that it was "important that professors enforce classroom policies once they were established" through out the dietetic program ($\bar{x}$ = 3.86, *SD* = .76 and $\bar{x}$ = 4.02, SD =.85 respectively).

Table 11

Overall Responses to Items Describing Teaching Strategies

Behaviorist Curriculum and Assessment	On-campus		On-line	
	N	Mean (SD)	N	Mean (SD)
The professor made curriculum choices for students.	344	3.89 (.88)	55	3.98 (.80)
My grades were based primarily on homework, quizzes, and tests.	345	3.79 (1.03)	56	4.16 (1.04)
In order to teach all necessary content and skills, the professor followed textbooks and other published material.	346	3.95 (.82)	55	4.02 (.93)
The professor used textbooks or guides to lead class discussion.	342	3.85 (.86)	48	3.88 (1.02)

All respondents agreed there were behaviorist teaching strategies used in the classroom, with the on-line environment answering higher on the Likert scale than the on-campus environment.

Table 12

Overall Responses to Items Describing Teaching Strategies

Constructivist Teaching	On-campus		On-line	
	N	Mean (SD)	N	Mean (SD)
Professors helped guide students in finding their own answers to academic problems.	339	3.73 (.95)	51	3.49 (1.21)
Professors encouraged collaboration among students to motivate them to learn more.	340	3.69 (.96)	47	3.53 (1.27)
Professors encouraged discussions of different opinions and reasons.	343	3.64 (1.09)	51	3.59 (1.28)
Professors gave students time to work together when they were not having instructional time.	338	3.55 (1.03)	47	3.21 (1.16)
Students were encouraged to discuss conflicts in group meetings or open forum sessions.	332	3.42 (1.21)	46	3.23 (1.25)
Professors expanded on students' ideas to effectively build the curriculum.	341	3.08 (1.11)	49	3.02 (1.25)
When there was a disagreement between students, the professors tried to intervene immediately to resolve the problem.	284	3.07 (.96)	32	2.94 (1.16)

In all cases, the on-campus respondents agreed that there were more constructivist teaching strategies used in the classroom than the on-line respondents. The question least responded to in the entire survey (N = 284 for on-campus and N = 32 for on-line) was "When there was a disagreement between students, the professors tried to intervene immediately to resolve the problem."

Factor Analysis

As mentioned previously, factor analysis was used to discover patterns among variations in values of several variables (Babbie, 2001). Factor analysis is an efficient

method of discovering predominant patterns among a large number of variables to a smaller number of factors and as such is a "non-dependent" procedure (that is, it does not assume a dependent variable is specified).

The first factor analysis of on-campus cases (varimax normalized rotation) revealed 8 components (Appendix G, Table 54). The first component includes item numbers 10a, 10b, 10c, 10d, 10e, and 10f and reflects a positive effect explaining 78% of variability (items numbers are detailed question by question in the previous section under the descriptive statistic section). The second component includes item numbers 6a, 6b, 6c, 6d, 6e 7b, 7c, and 7e and explains 62.1% of total variability. The third component includes item numbers 5a, 5b, 5c, 5d, 5e, 5f, and 11c and explains 69.2% of variability. Component four reveals a positive effect on item numbers 7d, 9c, 9d, 10g, 11a, 11b, and 11d for a total of 57.7% variability. The fifth component revealed 50.3% variability with item numbers 8b, 8c, and 8e. The sixth component revealed 51.7% variability with item numbers 8d, 8f, and 9a. Item numbers 8g, 9b, and 12f had an overall positive effect with 43.2% variability. The seventh component stood alone and had a Cronbach's Alpha of .111. As a result, item number 8a was forced into the fifth factor loading and item number 7a was dropped from analysis.

Factor loadings were analyzed for on-line responses. Only 66 participants responded as taking on-line courses, and the factor analysis revealed 6 components (Appendix G, Table 55).

One set of questions (item numbers 12a, 12b, 12c, 12d, and 12e) were answered by all participants (regardless of on-line or on-campus) and revealed a 52.5% variability (refer to Appendix G, Table 56).

Once all of the items from the survey were loaded into the factor analysis, overall themes were used to support the learning theories of the research project (constructivist and behaviorist). The themes correspond with the instruments described in the methodology section: Constructivist Learning Environment Survey and the Teacher Belief Survey. The themes for this study were grouped into the following concepts (refer to *Figure 2*. Theoretical Framework Illustrating Teaching Strategies, Environment, and Outcome Measures).

1) Teaching Strategies:
   Behaviorist Schedules and Rules,
   Behaviorist Curriculum and Assessment, and
   Constructivist Teaching

2) Environment:
   Constructivist Critical Voice,
   Constructivist Shared Control,
   Constructivist Student Negotiation,
   Constructivist Uncertainty, and
   Behaviorist Environment

3) Outcome Measures:
   Grade Point Average, and
   Perception of Knowledge

As these themes were grouped into their appropriate areas of either teaching strategies or the environment, the next set of data analysis examined Cronbach's Alpha (α) for reliability in both on-campus and on-line responses. Factor analysis was computed and the item numbers corresponding to each theme were "forced" into one component for T-factor analysis. The following tables (Table 13-20) illustrate the α and the forced loading component for each theme.

Table 13 describes critical voice. Cronbach's Alpha for the on-campus and on-line factors was excellent (.926 and .905, respectively). Table 14 describes shared control.

Cronbach's alpha for the on-campus and on-line factors was excellent (.910 and .924, respectively). Table 15 describes the student negotiation scale. Cronbach's alpha for the on-campus and on-line factors was excellent (.943 and .968, respectively). Table 16 describes uncertainty. There was not a separate Likert scale for on-line and on-campus; therefore, all respondents answered these items one time. Cronbach's alpha for this component was .771. In the behaviorist environment (Table 17), Cronbach's alpha results were low indicating low reliability (on-campus .146, on-line .244).
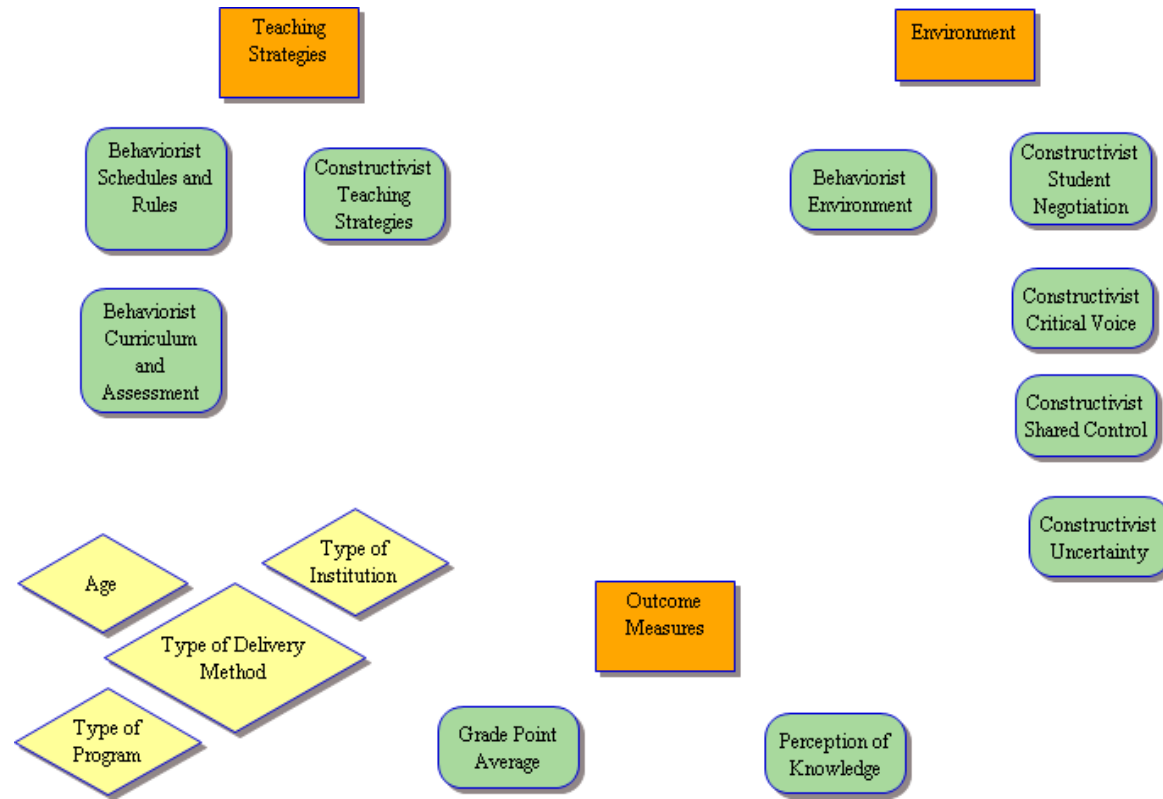
Figure 2. Theoretical Framework Illustrating Background Characteristic, Teaching Strategies, Environment and Outcome Measures

Table 13

Constructivist Environment- Critical Voice

	Cronbach's Alpha
On-campus	.926
On-line	.905
Item Number	**Forced Loading**

I was comfortable questioning the way I was being taught.	
On-campus	.821
On-Line	.747

I was comfortable complaining about activities that were confusing.	
On-campus	.890
On-Line	.878

I was comfortable complaining about anything that prevented me from learning.	
On-campus	.888
On-line	.882

I was comfortable expressing my opinion.	
On-campus	.881
On-line	.905

I was comfortable speaking up for my rights.	
On-campus	.897
On-line	.869

I was encouraged to negotiate and propose new policies if I felt the current policies were not working.	
On-campus	.716
On-line	.787

I felt comfortable approaching the professors for extra help.	
On-campus	.707
On-line	.679

Table 14

Constructivist Environment-Shared Control

	Cronbach's Alpha
On-campus	.910
On-Line	.924
Item Number	Forced Loading

I helped the professors plan what I learned.

On-campus	.797
On-line	.772

I helped the professors decide how well I was learning.

On-campus	.857
On-line	.871

I helped the professor to decide which activities were best for me.

On-campus	.829
On-line	.899

I helped the professor decide how much time I spent on activities.

On-campus	.816
On-line	.834

I was involved in evaluating my own work and setting my own goals.

On-campus	.686
On-line	.665

Professors adjusted their lesson plans based on results of homework assignments.

On-campus	.684
On-line	.753

Professors created thematic units based on the student's interests and ideas.

On-campus	.750
On-line	.782

Table 15

Constructivist Environment-Student Negotiation

	Cronbach's Alpha
On-campus	.943
On-line	.968
Item Number	Forced Loading

I got the chance to communicate to other students.	
On-campus	.736
On-line	.832

I communicated with other students about how to solve problems.	
On-campus	.867
On-line	.920

I explained my ideas to other students.	
On-campus	.938
On-line	.949

I asked other students to explain their ideas to me.	
On-campus	.936
On-line	.960

Other students asked me to explain my ideas.	
On-campus	.898
On-line	.950

Other students explained their ideas to me.	
On-campus	.910
On-line	.971

Table 16

Constructivist Environment-Uncertainty

	Cronbach's Alpha
On-campus and On-line	.771
Item Number	Forced Loading
I learned nutrition cannot provide perfect answers to problems.	.696
I learned how the dietetics profession has changed over time.	.745
I learned how nutrition is influenced by people's values and opinions.	.775
I learned about the differences in nutrition by people in other cultures.	.636
I learned how today's human nutrition is different from nutrition of long ago.	.762

Table 17

Behaviorist Environment

	Cronbach's Alpha
On-campus	.146
On-line	.244

Item Number	Forced Loading

The professor immediately told students the correct answers.

On-campus	.706
On-line	.755

Professors found it more effective to provide students with the information
they need to know rather than encouraging them to experiment.

On-campus	.772
On-line	.755

It was expected that students follow the dietetic code of ethics for
professional behavior.

Both on-campus and on-line	-.454

Conceptually, the other area analyzed was the teaching strategies used during on-campus and on-line delivery methods. Teaching strategies were grouped into three themes: Behaviorist schedules and rules, behaviorist curriculum and assessment and constructivist teaching. The first table (Table 18) describes schedules and rules and revealed a moderate reliability (on-campus .515 and on-line .562). Table 19 describes behaviorist teaching strategies with emphasis on curriculum and assessment. The on-campus Cronbach's alpha of .598 and the on-line Cronbach's alpha of .662 showed a moderate reliability. The final table for teaching strategies identifies constructivist teaching with a Cronbach's alpha's of .876 (on-campus) and .903 for on-line (Table 20).

Table 18

Teaching Strategies: Behaviorist Schedules and Rules

	Cronbach's Alpha
On-campus	.515
On-line	.562
Item Number	**Forced Loading**

I learned best when there was a fixed schedule.

On-campus	.710
On-line	.853

It is more important for professors to set rules and policies than to let students make their own decisions.

On-campus	.742
On-line	.738

It is important that professors enforce classroom policies once they are established.

On-campus	.704
On-line	.635

Table 19

Teaching Strategies: Behaviorist Curriculum and Assessment

	Cronbach's Alpha
On-campus	.598
On-line	.662
Item Number	**Forced Loading**

The professor made curriculum choices for students.

On-campus	.469
On-line	.562

My grades were based primarily on homework, quizzes and tests.

On-campus	.716
On-line	.637

In order to teach all necessary content and skills, the professor followed textbooks and other published material.

On-campus	.810
On-line	.884

The professor used textbooks or guides to lead class discussion.

On-campus	.688
On-line	.714

Table 20

Teaching Strategies- Constructivist

	Cronbach's Alpha
On-campus	.876
On-line	.903

Item Number	Forced Loading
Professors gave students time to work together when they were not having instructional time.	
On-campus	.726
On-line	.752
Professors encouraged collaboration among students to motivate them to learn more.	
On-campus	.791
On-Line	.885
Professors expanded on students' ideas to effectively build the curriculum.	
On-campus	.780
On-line	.702
Students were encouraged to discuss conflicts in group meetings or open forum sessions.	
On-campus	.793
On-line	.685
Professors helped guide students in finding their own answers to academic problems.	
On-campus	.809
On-line	.843
Professors encouraged discussions of different opinions and reasons.	
On-campus	.836
On-line	.832
When there was a disagreement between students, the professors tried to intervene immediately to resolve the problem.	
On-campus	.545
On-line	.779

Paired–Sample *t*-Tests

The next statistical analysis was to test the score of one mean that was paired (i.e.,

matched) with a score of the other mean (paired-sample *t*-test). For this research project,

the on-campus item numbers were paired with the on-line item numbers to determine if

the difference between the mean of the on-campus responses was significantly different

from the mean of the on-line responses. When looking at the null and alternative

hypotheses:

H_0: There was no difference between the mean environment and the mean teaching strategies in the on-line and on-campus populations.

H_1: There was a difference between the mean environment and the mean teaching strategies in the on-line and the on-campus populations.

Significant *t*-tests are explained in detail in this chapter. All of the non-significant *t*-tests

can be found in Appendix H.

The first set of *t*-tests analyzed was the behaviorist environment. There was no

difference between the mean behaviorist environment in the on-line and on-campus

populations. The second set of *t*- tests analyzed were the constructivist environment.

Refer to Table 21 for comparisons of on-campus and on-line responses for critical voice,

shared control, and student negotiation.

Table 21

Constructivist Environment

	N	On-campus Mean	On-Line Mean	Difference	On-campus SD	On-Line SD	*t*	*p**
Critical Voice								
I was comfortable questioning the way I was being taught.								
	48	3.81	3.48	.33	.82	.97	2.55	.014
I was comfortable complaining about activities that were confusing.								
	47	3.94	3.53	.40	.79	1.04	3.26	.002
I felt comfortable approaching the professors for extra help.								
	48	4.31	3.75	.56	.88	1.16	4.23	.000
Shared Control								
Professors created thematic units based on the students' interests and ideas.								
	44	2.98	2.70	.272	1.07	1.02	2.01	.050
Student Negotiation								
I got the chance to communicate to other students.								
	44	4.57	3.86	.705	.73	1.27	3.98	.000
I communicated with other students about how to solve problems.								
	44	4.43	3.64	.795	.55	1.16	4.75	.000
I explained my ideas to other students.								
	43	4.23	3.58	.651	.61	1.14	4.00	.000
I asked other students to explain their ideas to me.								
	43	4.21	3.58	.628	.71	1.14	3.70	.001

* Significant at the 0.05 level

Table 21

Constructivist Environment Continued

	N	On-campus Mean	On-Line Mean	Difference	On-campus SD	On-Line SD	*t*	*p**
Student Negotiation								
Other students asked me to explain my ideas.								
	44	4.13	3.48	.659	.82	1.21	3.38	.002
Other students explained their ideas to me.								
	42	4.21	3.71	.500	.72	1.07	2.98	.005

* Significant at the 0.05 level

Critical Voice

H_1: There is a difference between the mean critical voice for the on-line and the on-campus populations: μ1 ≠ μ2:

For the question "*I was comfortable questioning the way I was being taught,*" results indicated a significant preference for on-campus ($\bar{x}$ = 3.81, SD = .82) over on-line ($\bar{x}$ = 3.48, SD = .97), *t* (48) = 2.55, *p* = .014.

For the question "*I was comfortable complaining about activities that were confusing,*" results indicated a significant preference for on-campus ($\bar{x}$ = 3.94, SD = .79) over on-line ($\bar{x}$ = 3.53, SD = 1.04), *t* (47) = 3.26, *p* = .002.

For the question "*I felt comfortable approaching the professors for extra help,*" results indicated a significant preference for on-campus ($\bar{x}$ = 4.31, SD = .88) over on-line ($\bar{x}$ = 3.75, SD = 1.16), *t* (48) = 4.23, *p* = .000.

Shared Control

H_1: There is a difference between the mean shared control for the on-line and the on-campus populations: μ1 ≠ μ2:

For the question "*Professors created thematic units based on the student's interests and ideas,*" results indicated a significant preference for on-campus ($\bar{x}$ = 2.98, SD = 1.07) over on-line ($\bar{x}$ = 2.70, SD = 1.02), *t* (44) = 2.01, *p* = .050.

Student Negotiation

H_1: There is a difference between the mean student negotiation for the on-line and the on-campus populations: μ1 ≠ μ2:

For the question "*I got the chance to communicate to other students,*" results indicated a significant preference for on-campus ($\bar{x}$ = 4.56, SD = .73) over on-line ($\bar{x}$ = 3.86, SD = 1.26), *t* (44) = 3.98, *p* = .000.

For the question "*I communicated with other students about how to solve problems,*" results indicated a significant preference for on-campus ($\bar{x}$ = 4.43, SD = .55) over on-line ($\bar{x}$ = 3.64, SD = 1.16), t (44) = 4.75, *p* = .000.

For the question "*I explained my ideas to other students,*" results indicated a significant preference for on-campus ($\bar{x}$ = 4.23, SD = .61) over on-line ($\bar{x}$ = 3.58, SD = 1.14), *t* (43) = 4.00, *p* = .000.

For the question "*I asked other student to explain their ideas to me,*" results indicated a significant preference for on-campus ($\bar{x}$ = 4.21, SD = .71) over on-line ($\bar{x}$ = 3.58, SD = 1.14), *t* (43) = 3.70, *p* = .001.

For the question "*Other students asked me to explain my ideas,*" results indicated a significant preference for on-campus ($\bar{x}$ = 4.13, SD = .82) over on-line ($\bar{x}$ = 3.48, SD = 1.21), *t* (44) = 3.38, *p* = .002.

For the question "*Other students explained their ideas to me,*" results indicated a significant preference for on-campus ($\bar{x}$ = 4.21, SD = .72) over on-line ($\bar{x}$ = 3.71, SD = 1.07), *t* (42) = 2.98, *p* = .005.

The third set of *t*-tests analyzed was the teaching strategies. With the behaviorist schedule and rules and behaviorist curriculum and assessment teaching strategies, there were no differences found between the on-line and on-campus populations. However, for constructivist teaching strategies, significant differences were found. Refer to Table 22 for comparisons of on-campus and on-line responses for constructivist teaching strategies.

Table 22

Constructivist Teaching Strategies

	N	On-Campus Mean	On-Line Mean	Difference	On-Campus SD	On-Line SD	t	p*
Professors expanded on students' ideas to effectively build the curriculum.								
	44	3.20	2.86	. 341	1.15	1.21	2.10	.042
Students were encouraged to discuss conflicts in group meetings or open forum sessions.								
	41	3.63	3.20	.439	1.18	1.23	2.62	.012
Professors helped guide students in finding their own answers to academic problems.								
	45	3.76	3.42	.333	1.13	1.25	2.14	.038
Professors encouraged discussions of different opinions and reasons.								
	46	3.89	3.50	.391	1.10	1.31	2.72	.009
When there was a disagreement between students, the professors tried to intervene immediately to resolve the problem.								
	28	3.18	2.75	.429	1.09	1.11	2.27	.031

* Significant at the 0.05 level

Constructivist Teaching

H$_1$: There is a difference between the mean constructivist teaching for the on-line and the

on-campus populations: µ1 ≠ µ2

For the question "*Professors expanded on students' ideas to effectively build the

curriculum,*" results indicated a significant preference for on-campus ($\bar{x}$ = 3.20, SD =

1.15) over on-line ($\bar{x}$ = 2.86, SD = 1.21), *t* (44) = 2.10, *p* = .042.

For the question "*Students were encouraged to discuss conflicts in group meetings or open forum sessions*," results indicated a significant preference for on-campus ($\bar{x}$ = 3.63, SD = .1.18) over on-line ($\bar{x}$ = 3.20, SD = 1.23), t (41) = 2.62, p = .012.

For the question "*Professors helped guide students in finding their own answers to academic problems*," results indicated a significant preference for on-campus ($\bar{x}$ = 3.76, SD = 1.13) over on-line ($\bar{x}$ = 3.42, SD = 1.25), t (45) = 2.14, p = .038.

For the question "*Professors encouraged discussions of different opinions and reasons*," results indicated a significant preference for on-campus ($\bar{x}$ = 3.89, SD = 1.10) over on-line ($\bar{x}$ = 3.50, SD = 1.31), t (46) = 2.72, p = .009.

For the question "*When there was a disagreement between students, the professors tried to intervene immediately to resolve the problem*," results indicated a significant preference for on-campus ($\bar{x}$ = 3.17, SD = 1.09) over on-line ($\bar{x}$ = 2.75, SD = .1.11), t (28) = 2.27, p = .031.

Nonparametric Correlations

Pearson r is "Pearson product-moment correlation coefficient" and was used since the distribution of scores was approximately symmetrical (i.e., not highly skewed; Holcomb, 2006). The tables in Appendix I illustrate the value of Pearson r and compares the age, type of delivery method (on-line vs. on-campus), type of program (coordinated vs. didactic), and type of institution (public vs. private) with the teaching strategies and the environmental themes.

The first table displays correlations of teaching strategies for participants who took on-line course work (refer to Appendix I, Table 59: Teaching Strategies: On-Line). Results indicate that there was an inverse moderate relationship between on-line courses

taken and age (-.301), and an inverse moderate relationship between on-line courses and constructivist teaching strategies (-.328). There is a moderately strong correlation between behaviorist schedule and rules teaching strategies and behaviorist curriculum and assessment teaching strategies (.647).

In Appendix I, Table 60 (Teaching Strategies: On-Campus), those respondents who answered the on-campus teaching strategies theme had an inverse moderate relationship between on-line courses taken and age (-.301). There was also a moderately strong correlation between behaviorist schedule and rules teaching strategies and behaviorist curriculum and assessment teaching strategies (.277). Additionally, there was a moderately strong correlation between behaviorist schedule and rules teaching strategies and constructivist teaching strategies (.259).

Appendix I, Tables 61 and 62 display the analysis of the environmental theme for on-campus and on-line respondents. The on-campus correlation of the environment showed two moderately strong Pearson *r* values: Shared control with critical voice (.624) and student negotiation with critical voice (.504). A similar correlation was found with the on-line respondents. The *r* value for shared control and critical voice was .666, and student negotiation correlated moderately strongly with critical voice (.623)

Appendix I, Table 63 analyzed all of the independent variables in one SPSS output. There were four moderately strong Pearson *r* values. Critical voice correlated moderately strong with shared control (.624), student negotiation (.504), and constructivist teaching (.664). Student negotiation also correlated moderately strong with constructivist teaching (.588).

Because of these higher correlations, the concern of multicollinearity occurred. When two variables are highly correlated, they are basically measuring the same phenomenon or construct. According to Schwab (2007), if a correlation coefficient matrix demonstrates correlations of .75 or higher among variables, there may be multicollinearity. Another way to check for multicollinearity is to run Variance Inflation Factor (VIF), applied to measure the impact of collinearity among the variables in a multiple regression model. Schwab (2007) asserts that the common rule of thumb is that multicollinearity exists when VIF > 4.0.

Bivariate Correlations

Tabachnick and Fidell (1996) report that the required number of cases in the sample should be the larger of the number of independent variables (x)8 + 50 or the number of independent variables + 105. Because the sample size for on-line responses was low (N = 66), and multiple regression analyses were performed for questions pertaining to on-campus item numbers in the survey (detailed in the following section), the next statistical procedure (bivariate correlations) compared significant differences for on-campus responses and on-line responses for constructivist and behaviorist teaching strategies and the constructivist and behaviorist environment (refer to Table 23).

Table 23

Bivariate Correlations for On-Line and On-Campus Responses for Teaching Strategies

and Environment

	Pearson Correlation
Constructivist - Teaching Strategies and Behaviorist - Environment	
On-campus	-.315**
On-line	.182
Constructivist - Teaching Strategies and Student Negotiation - Constructivist Environment	
On-campus	.588**
On-line	.617**
Constructivist - Teaching Strategies and Critical Voice - Constructivist Environment	
On-campus	.664**
On-line	.852**
Constructivist - Teaching Strategies and Shared Control - Constructivist Environment	
On-campus	.724**
On-line	.739**
Behaviorist Schedules and Rules - Teaching Strategies and Behaviorist – Environment	
On-campus	.011
On-line	.324*
Behaviorist Schedules and Rules - Teaching Strategies and Student Negotiation - Constructivist Environment	
On-campus	.248**
On-line	.019
Behaviorist Schedules and Rules - Teaching Strategies and Critical Voice – Constructivist Environment	
On-campus	.202**
On-line	.331*

Table 23

Bivariate Correlations for On-Line and On-Campus Responses for Teaching Strategies

and Environment Continued

	Pearson Correlation
Behaviorist Schedules and Rules - Teaching Strategies and Shared Control - Constructivist Environment	
On-campus	.160**
On-line	.255
Behaviorist Curriculum and Assessment - Teaching Strategies and Behaviorist - Environment	
On-campus	.204**
On-line	.362*
Behaviorist Curriculum and Assessment - Teaching Strategies and Student Negotiation - Constructivist Environment	
On-campus	-.024
On-line	.078
Behaviorist Curriculum and Assessment - Teaching Strategies and Critical Voice - Constructivist Environment	
On-campus	-.067
On-line	.030
Behaviorist Curriculum and Assessment - Teaching Strategies and Shared Control - Constructivist Environment	
On-campus	-.142*
On-line	.136

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

As evident by the Pearson correlation results, many of the teaching strategies and

environment were similar for on-campus and on-line responses with the exception of

three items: There was a moderately strong correlation between constructivist teaching strategies and critical voice for on-campus (.664) and on-line (.852).

This means in on-line and on-campus classroom environments where professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum (constructivist teaching strategies), graduates indicated a level of comfort expressing opinions, speaking up for rights, and questioning professors (critical voice). The correlation showed a stronger impact for on-line vs. on-campus responses.

There was a moderately strong correlation between behaviorist schedules and rules teaching strategies and behaviorist environment for on-campus (.011) and on-line (.342).

This means in the on-line environment where classroom policies, rules, and fixed schedules were enforced (behaviorist schedules and rules), graduates were immediately given the correct answers by the professor rather than encouraging experimentation or critical thinking skills (behaviorist environment).

There was a moderately strong correlation between behaviorist schedules and rules teaching strategies and student negotiation for on-campus (.248) and on-line (.019).

This means in the on-campus environment where classroom policies, rules, and fixed schedules were enforced (behaviorist schedules and rules), graduates indicated they were empowered to engage each other in sharing ideas about course content presented by the professor (student negotiation).

Multiple Regressions

Multiple Regression Analysis (MRA) allows for simultaneous examination of several independent variables in relation to a dependent variable. In this study, MRA was conducted to evaluate how well the instructional teaching strategies (constructivist,

behaviorist schedules and rules, and behaviorist curriculum and assessment) predicted the

environment (behaviorist, constructivist critical voice, constructivist shared control,

constructivist student negotiation, and constructivist uncertainty). MRA was also

conducted to evaluate how well both the teaching strategies and the environment

predicted perceived level of knowledge and GPA. For all regressions, the following

background characteristics were considered for analysis:

1. Age

2. Type of institution attended (public vs. private)

3. Type of program (coordinated vs. didactic)

4. Type of delivery method (on-line vs. on-campus).

The three underlying assumptions when analyzing MRA (e.g. multicollinearity,

normal distribution of variables, and homoscedasticity) as previously discussed in

Chapter 3 were taken into consideration and checked for this research project. The

following concept map (*Figure 3.* Multiple Regression Analysis of Age, Type of

Program, Type of Institution, Type of Delivery Method, and Teaching Strategies on

Environment) illustrates the multiple regression of the independent variables (age, type of

program, type of institution, type of delivery method, and teaching strategies including

constructivist, behaviorist schedules and rules, and behaviorist curriculum and

assessment) and the dependent variables of constructivist critical voice, constructivist

shared control, constructivist student negotiation, constructivist uncertainty, and

behaviorist environment.

Figure 4. Multiple Regression Analysis of Age, Type of Program, Type of Institution,

Type of Delivery Method, and Teaching Strategies on Environment is located in

Appendix J and illustrates the interaction effects of the independent variables on the dependent variables.

The solid line on the concept maps illustrates the significant effects of the teaching strategy or background characteristic on the environment. A dashed line and/or a circle around the β value represent significance when an interaction effect took place between the independent and dependent variables.

Overall, 12 significant models emerged: One model emerged for critical voice (refer to Table 25). Two significant models emerged for shared control (refer to Tables 27 and 28) and behaviorist environment (refer to Tables 39 and 40). Three significant models emerged for student negotiation (refer to Tables 30-32). Four significant models emerged for uncertainty (refer to Tables 34-37).

The first set of MRA had critical voice as the criterion variable (refer to Table 24).
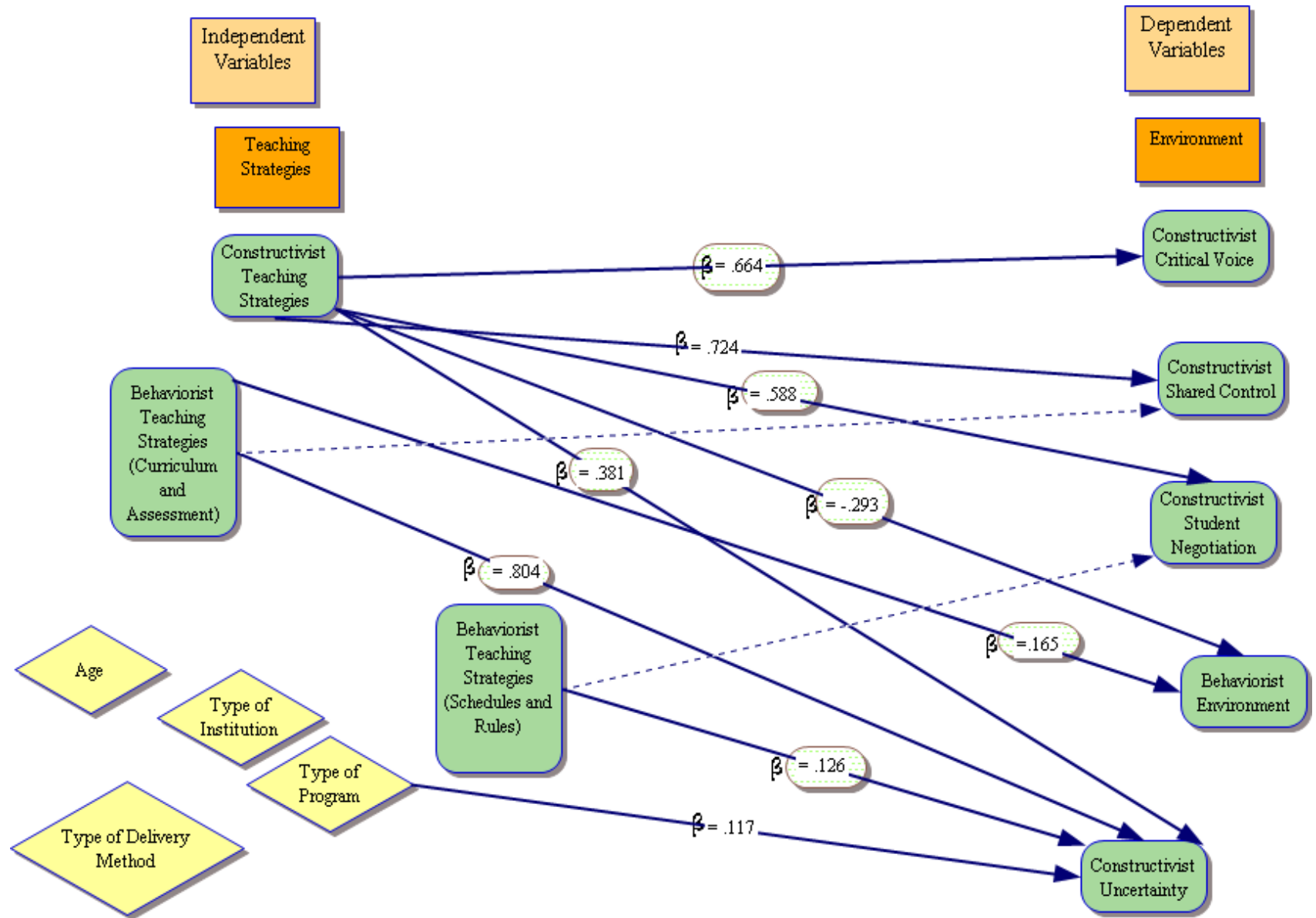
Figure 3. Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, and Teaching Strategies on Environment

Critical Voice

Table 24

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of

Delivery, and Teaching Strategies on Critical Voice

Dependent Variable = Critical Voice	Standardized Coefficient β	t	Sig.	VIF
Constructivist Teaching	.664	13.89	.000	1.00
F	193.00		.000	
Adjusted R^2	.438			

Using the backward method, a significant model emerged ($F_{1,246} = 193$, $p < 0.0005$).

R^2 indicates that 43.8% of the variance in critical voice can be explained by the combined

influence of constructivist teaching. $F = 1$ independent variable, with 246 total number of

participants in this study. Constructivist teaching strategies had a significant effect and

strong impact on critical voice ($p < 0.000$, β = .664).

Combining age, type of program, type of institution, type of delivery method with

behaviorist schedules and rules teaching strategies and behaviorist curriculum and

assessment teaching strategies revealed no significant interaction effects on critical voice.

Type of institution (public or private) and constructivist teaching strategies had a

significant effect on critical voice (refer to Appendix K, Table 62). Table 25 shows the

breakdown between public and private institutions.

Table 25

Multiple Regression Analysis of Type of Institution and Constructivist Teaching

Strategies on Critical Voice

Dependent Variable = Critical Voice	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Public Institution and Constructivist Teaching	.696	.482	13.79	.000	190.09	1.0
Private Institution and Constructivist Teaching	.522	.254	3.82	.000	14.61	1.0

Public institutions and constructivist teaching strategies had a significant effect on critical voice ($F_{1, 203}$ = 190.09, p <0.000). The model has accounted for 48.2% of the variance in the criterion variable. Similarly, private institutions and constructivist teaching strategies had a significant effect on critical voice ($F_{1, 40}$ = 14.61, p <0.000). The model has accounted for 25.4% of the variance in the criterion variable.

This means in public and private institutions, professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum. Graduates indicated a level of comfort expressing opinions, speaking up for rights, and questioning professors. Public institutions (β = .696) had more of an impact on critical voice than private institutions (β = .522).

Shared control is the next dependent variable used in the MRA and is shown in Table 26.

Shared Control

Table 26

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, and Teaching Strategies on Shared Control

Dependent Variable = Shared Control	Standardized Coefficient β	t	Sig.	VIF
Constructivist Teaching	.724	16.55	.000	1.00
F	273.77		.000	
Adjusted R^2	.523			

Using the backward method, a significant model emerged ($F_{1, 249} = 273.77$, p <0.0005). R^2 indicates that 52.3% of the variance in shared control can be explained by the constructivist teaching strategies. $F = 1$ independent variable, with 249 total number of participants in this study. Multicollinearity (VIF = 1.000) is not a problem as constructivist teaching is not correlated with other predictor variables. Constructivist teaching had a great impact and a significant effect on shared control ($β = .724$, $p <$ 0.000).

When all of the independent variables were combined, (age, type of program, type of institution, type of delivery method, and teaching strategies), there were two significant findings (refer to Appendix K, Table 63). Age and behaviorist curriculum and assessment teaching strategies had a significant effect on shared control (refer to Table 27). Type of delivery method and behaviorist curriculum and assessment teaching strategies had a significant effect on shared control (refer to Table 28).

Table 27

Multiple Regression Analysis of Age and Behaviorist Curriculum and Assessment

Teaching Strategies on Shared Control

Dependent Variable = Shared Control	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Age ≤ 39 and Behaviorist Curriculum and Assessment Teaching Strategies	-.262	.062	-3.33	.001	.001	1.0
Age ≥ 40 and Behaviorist Curriculum and Assessment Teaching Strategies						

Age and behaviorist curriculum and assessment teaching strategies had a significant

effect on shared control ($F_{1, 152} = 11.11$, $p < 0.000$). The model has accounted for 6.2% of

the variance in the criterion variable. Once the file was split using the median age of

respondents, findings indicated that those who were less than 39 years of age and

experienced behaviorist curriculum and assessment teaching strategies had a significant

negative effect on shared control (β = -.262).

This means that RDs who were less than 39 years of age reported having professors

who used textbooks to teach all content and based grades on homework, quizzes, and

tests. This age group was less likely to assist with their goal setting, course objectives,

and assessment of learning in the classroom (as evident by β = -.262). This was not true

for RDs who were over 40 years of age. They experienced behaviorist curriculum and

assessment teaching strategies; however, there was no significant effect on shared

control.

Table 28

Multiple Regression Analysis of Type of Delivery Method and Behaviorist Curriculum

and Assessment Teaching Strategies on Shared Control

Dependent Variable = Shared Control	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
On-Campus and Behaviorist Curriculum and Assessment Teaching Strategies	-.200	.036	-3.28	.001	10.73	1.0
On-Line and Behaviorist Curriculum and Assessment Teaching Strategies						

The on-campus delivery method and behaviorist curriculum and assessment teaching strategies had a significant negative effect (β = -.200) on shared control ($F_{1, 259} = 10.73$, p <0.000). Professors based grades on homework, quizzes, and tests. Graduates were less likely to assist with their goal setting, course objectives, and assessment of learning while in the classroom. RDs who took on-line with behaviorist curriculum and assessment teaching strategies had no significant effect on shared control. Student negotiation is the next dependent variable used in the MRA and is shown in Table 29.

Student Negotiation

Table 29

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of

Delivery Method, and Teaching Strategies on Student Negotiation

Dependent Variable = Student Negotiation	Standardized Coefficient β	t	Sig.	VIF
Constructivist Teaching Strategies	.588	11.47	.000	1.00
F	131.49		.000	
Adjusted R^2	.343			

Constructivist teaching had a moderate impact (β = .588) and a significant effect on student negotiation ($F_{1, 250} = 131.49$, $p < 0.0005$). When all of the independent variables were combined, (age, type of program, type of institution, type of delivery method, and teaching strategies), there were three significant findings (refer to Appendix K, Tables 64 and 65). Type of program and constructivist teaching strategies had a significant effect on student negotiation (refer to Table 30). Type of program and behaviorist schedule and rules teaching strategies had a significant effect on student negotiation (refer to Table 31). Type of institution and behaviorist schedule and rules teaching strategies had a significant effect on student negotiation (refer to Table 32).

Table 30

Multiple Regression Analysis of Type of Program and Constructivist Teaching Strategies

on Student Negotiation

Dependent Variable = Student Negotiation	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Coordinated Program and Constructivist Teaching Strategies	.546	.295	9.77	.000	95.32	1.00
Didactic Program and Constructivist Teaching Strategies	.766	.575	7.34	.000	53.80	1.00

The coordinated program in dietetics and constructivist teaching strategies had a significant effect on student negotiation ($F_{1, 225} = 95.32$, $p < 0.000$). Similarly, the didactic program in dietetics and constructivist teaching strategies had a significant effect on student negotiation ($F_{1, 39} = 53.80$, $p < 0.000$).

That is, in coordinated and didactic programs, professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum. Graduates believed they were empowered to engage each other in sharing ideas about course content presented by the professor. There was more of an impact for those who graduated from a didactic program in dietetics (β = .766) than those who graduated from a coordinated program in dietetics (β = .546) on student negotiation.

Table 31

Multiple Regression Analysis of Type of Program and Behaviorist Schedules and Rules

Teaching Strategies on Student Negotiation

Independent Variable = Student Negotiation	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Coordinated Program and Behaviorist Schedules and Rules Teaching Strategies	.232	.050	3.96	.000	15.69	1.0
Didactic Program and Behaviorist Schedules and Rules Teaching Strategies	.335	.094	2.54	.014	6.43	1.0

The coordinated program in dietetics and behaviorist schedules and rules teaching strategies had a significant effect on student negotiation ($F_{1, 277} = 15.69$, $p <0.000$). The model has accounted for 5% of the variance in the criterion variable. Similarly, the didactic program in dietetics and behaviorist schedules and rules teaching strategies had a significant effect on student negotiation ($F_{1, 52} = 6.43$, $p <0.014$).

That is, in the coordinated and didactic programs where classroom policies, rules, and fixed schedules were enforced, graduates indicated they were empowered to engage each other in sharing ideas about course content presented by the professor. There was more of an impact on student negotiation for those who graduated from a didactic program in dietetics ($\beta = .335$) than those who graduated from a coordinated program in dietetics ($\beta = .232$).

Table 32

Multiple Regression Analysis of Type of Institution and Behaviorist Schedules and Rules

Teaching Strategies on Student Negotiation

Independent Variable = Student Negotiation	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Private Institution and Behaviorist Schedules and Rules Teaching Strategies	.319	.085	2.50	.016	6.24	1.0
Public Institution and Behaviorist Schedules and Rules Teaching Strategies						

Attendance at a private institution and experiencing behaviorist schedules and rules teaching strategies had a significant effect on student negotiation ($F_{1, 56} = 6.24$, p <0.016). The model has accounted for 8.5% of the variance in the criterion variable.

That is, in the private institutions where classroom policies, rules, and fixed schedules were enforced, graduates indicated they were empowered to engage each other in sharing ideas about course content presented by the professor.

Attendance at a public institution and experiencing behaviorist schedules and rules teaching strategies did not have a significant effect on student negotiation.

Uncertainty is the next dependent variable used in the MRA and is shown in Table 33.

Uncertainty

Table 33

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method and Teaching Strategies on Uncertainty

Dependent Variable = Uncertainty	Standardized Coefficient β	t	Sig.	VIF
Type of Program	.117	2.06	.041	1.01
Behaviorist Schedule and Rules Teaching Strategies	.126	2.14	.033	1.07
Constructivist Teaching Strategies	.381	6.48	.000	1.07
F	21.55			
Adjusted R^2	.20			

Using the backward method, a significant model emerged ($F_{3, 249} = 21.55$, p <0.0005). R^2 indicates that 20% of the variance in uncertainty can be explained by the combined influence of type of program, behaviorist schedules and rules teaching strategies, and constructivist teaching strategies. $F = 3$ independent variables, with 249 total number of participants in this study.

The type of program (coordinated vs. didactic) had a significant effect on the constructivist scale of uncertainty ($p < 0.041$). Behaviorist schedule and rules teaching strategies had a significant effect on uncertainty ($p < 0.033$). Constructivist teaching strategies had a significant effect on uncertainty ($p < 0.000$).

When all of the independent variables were combined, (age, type of program, type of institution, type of delivery method, and teaching strategies), there were four significant findings (refer to Appendix K, Tables 66 -68).

Type of delivery and constructivist teaching strategies had a significant effect on uncertainty (refer to Table 34). Type of program and behaviorist schedule and rules teaching strategies had a significant effect on uncertainty (refer to Table 35). Age and behaviorist schedule and rules teaching strategies had a significant effect on uncertainty (refer to Table 36). Type of delivery method (on-line vs. on-campus) and behaviorist curriculum and assessment teaching strategies had a significant effect on uncertainty (refer to Table 37).

Table 34

Multiple Regression Analysis of Type of Delivery Method and Constructivist Teaching

Strategies on Uncertainty

Dependent Variable = Uncertainty	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
On-Campus Courses and Constructivist Teaching	.450	.199	7.22	.000	56.67	1.00
On-Line Courses and Constructivist Teaching						

    Those who took on-campus courses and experienced constructivist teaching strategies had a significant effect (β = .450) on uncertainty ($F_{1, 224}$ = 56.67, p <0.000). The model has accounted for 19.9% of the variance in the criterion variable.

    This means in the on-campus classroom environment, professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum. Graduates learned about the dietetic profession and cultural influences related to nutrition. This was not true for RDs who took on-line courses. They experienced constructivist teaching strategies; however, there was no significant effect on uncertainty.

Table 35

Multiple Regression Analysis of Type of Program and Behaviorist Schedule and Rules

Teaching Strategies on Uncertainty

Dependent Variable = Uncertainty	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Coordinated Program and Behaviorist Schedules and Rules Teaching Strategies	.184	.030	3.10	.002	9.60	1.0
Didactic Program and Behaviorist Schedules and Rules Teaching Strategies	.457	.193	3.63	.001	13.19	1.0

Those who graduated from a coordinated program and experienced behaviorist

schedules and rules teaching strategies had a significant effect on uncertainty ($F_{1, 274}$ =

9.60, p <0.002). The model has accounted for 3% of the variance in the criterion variable.

Similarly, the didactic program in dietetics and behaviorist schedules and rules teaching

strategies had a significant effect on uncertainty ($F_{1, 51}$ = 13.19, p <0.001). The model

has accounted for 19.3% of the variance in the criterion variable.

That is, in coordinated and didactic programs where classroom policies, rules, and

fixed schedules were enforced, graduates learned about the dietetic profession and

cultural influences related to nutrition. There was more of an impact on uncertainty for

those who graduated from a didactic program in dietetics (β = .457) than RDs who

graduated from a coordinated program in dietetics (β = .184).

Table 36

Multiple Regression Analysis of Age and Behaviorist Schedules and Rules Teaching

Strategies on Uncertainty

Dependent Variable = Uncertainty	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Age ≤ 39 and Behaviorist Schedules and Rules Teaching Strategies	.261	.063	3.45	.001	11.88	1.0
Age ≥ 40 and Behaviorist Schedules and Rules Teaching Strategies						

Age and behaviorist schedules and rules teaching strategies had a significant effect on uncertainty ($F_{1, 163}$ = 11.88, p <0.001). The model accounted for 6.3% of the variance in the criterion variable. Once the file was split using the median age of respondents, findings indicated that those who were ≤ 39 years of age and experienced behaviorist schedules and rules teaching strategies had a significant effect on uncertainty (β = .261).

This means that for RDs who were ≤ 39 years of age reported taking classes where rules and fixed schedules were enforced, they learned about the dietetic profession, and they learned about cultural influences relating to nutrition.

This was not true for RDs who were ≥ 40 years of age. They experienced behaviorist schedules and rules teaching strategies; however, there was no significant effect on uncertainty.

Table 37

Multiple Regression Analysis of Type of Delivery Method and Behaviorist Curriculum

and Assessment Teaching Strategies on Uncertainty

Dependent Variable = Uncertainty	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
On-campus Courses and Behaviorist Curriculum and Assessment Teaching Strategies						
On-Line Courses and Behaviorist Curriculum and Assessment Teaching Strategies	.400	.145	3.27	.002	10.69	1.0

Type of delivery method (on-campus vs. on-line) and behaviorist curriculum and assessment teaching strategies had a significant effect on uncertainty ($F_{1,57}$= 10.69, p <0.000). Once the file was split between on-campus and on-line course work, findings indicated that those who took on-line courses and experienced behaviorist curriculum and assessment teaching strategies had a significant effect on uncertainty (β = .400).

That is, in the on-line classroom environment, professors used textbooks to teach all content and made curriculum choices for students. Professors also based grades on homework, quizzes, and tests. Graduates learned about the dietetic profession and cultural influences related to nutrition. This was not true for RDs who took on-campus courses. They experienced behaviorist curriculum and assessment teaching strategies; however, there was no significant effect on uncertainty.

Behaviorist environment is the next dependent variable used in the MRA and is shown in Table 38.

Behaviorist Environment

Table 38

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of

Delivery Method and Teaching Strategies on Behaviorist Environment

Dependent Variable = Behaviorist Environment	Standardized Coefficient β	t	Sig.	VIF
Behaviorist Curriculum and Assessment Teaching Strategies	.165	2.75	.006	1.02
Constructivist Teaching Strategies	-.293	-4.87	.000	1.02
F	17.78			
Adjusted R^2	.119			

Using the backward method, a significant model emerged ($F_{2, 249} = 17.78$, p <0.0005). R^2 indicates that 11.9% of the variance in behaviorist environment can be explained by the combined influence of behaviorist curriculum and assessment teaching strategies and constructivist teaching strategies. $F = 2$ independent variables, with 249 total number of participants in this study.

When all of the independent variables were combined, (age, type of program, type of institution, type of delivery method, and teaching strategies), there were two significant findings (refer to Appendix K, Table 68-70). Type of institution (public vs. private) and constructivist teaching strategies had a significant effect on behaviorist environment (refer to Table 39). Type of program and behaviorist curriculum and assessment teaching strategies had a significant effect on behaviorist environment (refer to Table 40).

Table 39

Multiple Regression Analysis of Type of Institution and Constructivist Teaching

Strategies on Behaviorist Environment

Dependent Variable = Behaviorist Environment	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Public Institution and Constructivist Teaching Strategies	-.332	.106	-5.14	.000	26.45	1.0
Private Institution and Constructivist Teaching Strategies						

Public institutions and constructivist teaching strategies had a significant negative effect on behaviorist environment ($F_{1, 214}$ = 26.45, p <0.000). The model has accounted for 10.6% of the variance in the criterion variable.

That is, in public institutions, professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum. Graduates reported they were less likely to be given the correct answers by the professor and were not encouraged to experiment or use critical thinking skills (as evident by β = -.332). This was not true for RDs who enrolled in a private institution. They experienced constructivist teaching strategies; however, there was no significant effect on behaviorist environment.

Table 40

Multiple Regression Analysis of Type of Program and Behaviorist Curriculum and

Assessment Teaching Strategies on Behaviorist Environment

Dependent Variable = Behaviorist Environment	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Coordinated Program and Behaviorist Curriculum and Assessment Teaching Strategies	.129	.013	2.15	.033	4.60	1.0
Didactic Program and Behaviorist Curriculum and Assessment Teaching Strategies	.449	.185	3.51	.001	12.34	1.0

Coordinated programs and behaviorist curriculum/assessment teaching strategies had a significant effect on behaviorist environment ($F_{1, 272} = 4.60$, $p <0.033$). The model has accounted for 1.3% of the variance in the criterion variable. Similarly, Didactic programs and behaviorist curriculum and assessment teaching strategies had a significant effect on behaviorist environment ($F_{1, 50} = 12.34$, $p <0.001$). The model has accounted for 18.5% of the variance in the criterion variable.

That is, in coordinated and didactic programs, professors used textbooks to teach all content and made curriculum choices for students. Professors also based grades on homework, quizzes, and tests. Graduates reported they were immediately given the correct answers by the professor rather than encouraging experimentation or critical thinking skills. Didactic program graduates ($\beta = .449$) had more of an impact on behaviorist environment than coordinated program graduates ($\beta = .124$).

Outcome Measures

The next set of regressions analyzed all of the teaching strategies and the environment on outcome measures. The following concept map (*Figure 5.* Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment on Outcome Measures) illustrates the multiple regression of the independent variables (age, type of program, type of institution, type of delivery method, teaching strategies [including behaviorist schedules/rules, behaviorist curriculum/assessment, and constructivist] and environment [behaviorist, constructivist critical voice, constructivist shared control, constructivist student negotiation, and constructivist uncertainty]) on the dependent variables (outcome measures including perception of knowledge and grade point average).

Figure 6. Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment with Interaction Effects on Outcome Measures in Appendix L illustrate the interaction effects of the independent variables on the dependent variables.

The solid lines on the concept maps illustrate the significant effects of the teaching strategies, background characteristics, and the environment on the outcome measures. A dashed line and/or a circle around the β value represent significance when an interaction effect took place between the independent and dependent variables.

Table 41 shows the details of the regression for grade point average and Table 42 details perception of knowledge.

Overall nine significant models emerged: The only significant model to emerge for grade point average was age and critical voice (refer to Table 46). One model emerged

for type of program and critical voice on perception of knowledge (refer to Table 47).

One model emerged for type of program and shared control on perception of knowledge

(refer to Table 48). One model emerged for type of delivery method and student

negotiation on perception of knowledge (refer to Table 49). Two models emerged for

constructivist teaching strategies and perception of knowledge (one for type of institution

and one for type of program; refer to Tables 43 and 44). One model emerged for age and

behaviorist curriculum and assessment teaching strategies on perception of knowledge

(refer to Table 45). Two models emerged (age and type of institution) for behaviorist

environment and perception of knowledge (refer to Tables 50 and 51).

Figure 5. Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment on Perception of Knowledge and Grade Point Average

Table 41

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of

Deliver Method, Teaching Strategies, and Environment on Grade Point Average

Dependent Variable = Grade Point Average	Standardized Coefficient β	t	Sig.	VIF
Type of Program	.141	2.26	.025	1.01
Behaviorist Curriculum and Assessment Teaching Strategies	.144	2.31	.022	1.01
Critical Voice	.147	2.36	.019	1.01
F	5.33		.002	
Adjusted R^2	.050			

Using the backward method, a significant model emerged ($F_{3,\,246} = 5.33$, $p < 0.001$).

R^2 indicates that 5% of the variance in grade point average can be explained by the

combined influence of type of program, behaviorist curriculum, and assessment teaching

strategies and critical voice. $F = 3$ independent variables, with 246 total number of

participants in this study. Even though the predictor variables are correlated with each

other, the common rule of thumb is that only when VIF > 4.0 does it indicate a

multicollinearity problem.

Type of program had a significant effect on grade point average ($p < 0.025$).

Behaviorist curriculum and assessment teaching strategies had a significant effect on

grade point average ($p < 0.022$). Critical voice had a significant effect on grade point
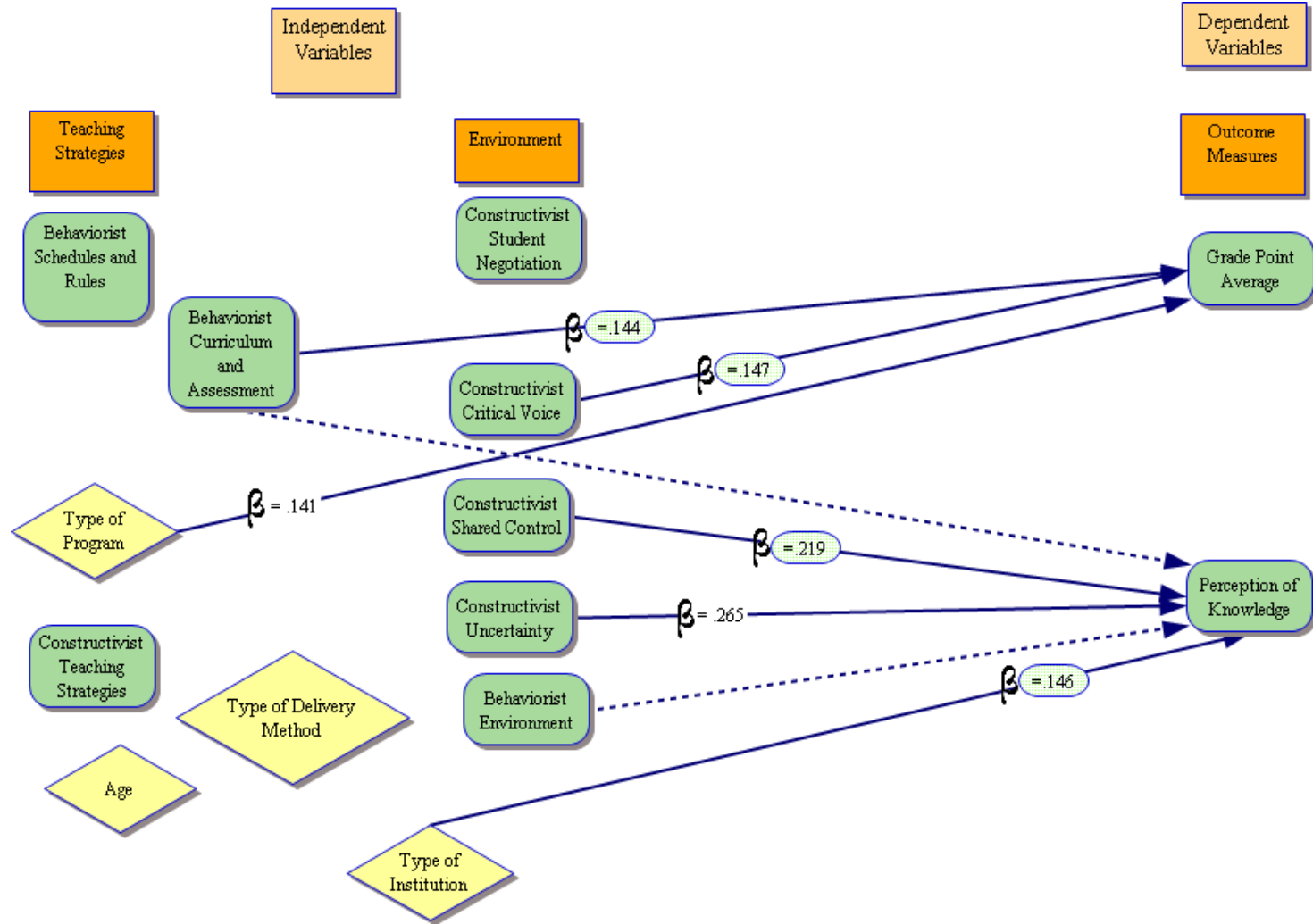
average ($p < 0.019$).

Table 42

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of

Delivery Method, Teaching Strategies, and Environment on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	t	Sig.	VIF
Shared Control	.219	3.51	.001	1.15
Uncertainty	.265	4.25	.000	1.15
Type of Institution	.146	2.50	.000	1.0
F	17.48			
Adjusted R^2	.167			

Using the backward method, a significant model emerged ($F_{3,\ 246} = 17.48$, $p < 0.000$). R^2 indicates that 16.7% of the variance in perception of knowledge can be explained by the combined influence of shared control, uncertainty, and type of institution. $F = 3$ independent variables, with 246 total number of participants in this study. Even though the predictor variables are correlated with each other, the common rule of thumb is that only when VIF > 4.0 does it indicate a multicollinearity problem.

Shared control had a significant effect on perception of knowledge ($p < 0.001$). Uncertainty had a significant effect on perception of knowledge ($p < 0.000$). Type of institution (public vs. private) had a significant effect on perception of knowledge ($p < 0.000$).

Interaction Effects-Teaching Strategies

   Multiple regressions were conducted to analyze the effect between the independent

variables of teaching strategies using the interaction components (both constructivist and

behaviorist) with perception of knowledge and grade point average (dependent variables).

   Type of program, type of institution and constructivist teaching strategies had

significant interaction effects on perception of knowledge (refer to Appendix M, Table

71). Type of institution (public vs. private) and constructivist teaching strategies had a

significant effect on perception of knowledge (refer to Table 43). Type of program

(coordinated vs. didactic) and constructivist teaching strategies had a significant effect on

perception of knowledge (refer to Table 44).

   Age, type of delivery method, and behaviorist curriculum/assessment teaching

strategies had a significant effect on perception of knowledge (refer to Appendix M,

Table 72). Age and behaviorist curriculum/assessment teaching strategies had a

significant effect on perception of knowledge (refer to Table 45).

   When the files were split on type of delivery method (on-line and on-campus) there

were no significant differences found on perception of knowledge. This could be

explained by the sample size, and therefore the interaction is less reliable and will not be

shown in table format.

Table 43

Multiple Regression Analysis of Type of Institution and Constructivist Teaching

Strategies on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Public and Constructivist Teaching Strategies	.329	.104	5.04	.000	25.35	1.0
Private and Constructivist Teaching Strategies						

Public institutions and constructivist teaching strategies had a significant effect on perception of knowledge ($F_{1, 210} = 25.35$, $p < 0.000$). The model has accounted for 10.4% of the variance in the criterion variable.

That is, in public institutions, professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum. Graduates had the knowledge, skills, and competence to work as an entry level RD. Graduates reported they were likely to be given the correct answers by the professor and were encouraged to experiment and use critical thinking skills (as evident by β = .329).

This was not true for RDs who enrolled in private institutions. They experienced constructivist teaching strategies; however, there was no significant effect on perception of knowledge.

Table 44

Multiple Regression Analysis of Type of Program and Constructivist Teaching Strategies

on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	Adjusted R^2	*t*	Sig.	*F*	VIF
Coordinated Program and Constructivist Teaching Strategies	.293	.082	4.49	.000	20.17	1.0
Didactic Program and Constructivist Teaching Strategies						

Coordinated programs and constructivist teaching strategies had a significant effect on perception of knowledge ($F_{1, 216} = 20.17$, $p < 0.000$). The model has accounted for 8.2% of the variance in the criterion variable.

This means in coordinated programs, professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum. Graduates had the knowledge, skills, and competence to work as an entry level RD. This is not true for RDs enrolled in didactic programs. They experienced constructivist teaching strategies; however, there was no significant effect on perception of knowledge.

Table 45

Multiple Regression Analysis of Age and Behaviorist Curriculum and Assessment

Teaching Strategies on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
≤ 39 and Curriculum and Assessment Teaching Strategies	.157	.019	2.03	.044	4.10	1.0
≥ 40 and Curriculum and Assessment Teaching Strategies						

Age and behaviorist curriculum/assessment teaching strategies had a significant effect on perception of knowledge ($F_{1, 164} = 4.10$, $p < 0.044$). The model has accounted for 1.9% of the variance in the criterion variable.

For RDs who were ≤ 39 years of age, professors used textbooks to teach all content and made curriculum choices for students. Professors also based grades on homework, quizzes, and tests. Graduates had the knowledge, skills, and competence to work as an entry level RD. This is not true for those who were ≥ 40 years of age. They experienced curriculum and assessment teaching strategies; however, there was no significant effect on perception of knowledge.

Interaction Effects-Environment

Multiple regressions were conducted to analyze the effect between the independent variables of the environment using the interaction components (both constructivist and behaviorist) with perception of knowledge and grade point average (dependent variables).

Refer to Appendix M, Table 73 for analysis of age, type of program, type of institution, type of delivery method, teaching strategies, and environment (with constructivist critical voice interaction components) on grade point average. Age and constructivist critical voice had a significant interaction effect on grade point average (refer to Table 46). Type of program and constructivist critical voice had a significant interaction effect on perception of knowledge (refer to Appendix M, Table 74). Type of program (coordinated vs. didactic) and environment (constructivist critical voice as the interaction) had a significant effect on perception of knowledge (refer to Table 47).

Type of program (coordinated vs. didactic) and environment (constructivist shared control) had a significant interaction effect on perception of knowledge (refer to Appendix M, Table 75). Type of program (coordinated vs. didactic) and environment (constructivist shared control) had a significant effect on perception of knowledge (refer to Table 48).

Age, type of program, type of institution, type of delivery method, teaching strategies, and environment (constructivist uncertainty) had a significant effect on perception of knowledge (refer to Appendix M, Table 76). Age and constructivist uncertainty appeared to have a significant effect on perception of knowledge; however, when the file was split the β levels were the same (β = .345 for $\leq$ age 39 and β = 357 for $\geq$ age 40; therefore, will not be shown in table format.)

Type of delivery method and environment (constructivist student negotiation) had a significant interaction effect on perception of knowledge (refer to Appendix M, Table 77). On-line and on-campus delivery methods and environment (student negotiation) had a significant effect on perception of knowledge (refer to Table 49).

Age, type of institution, and a behaviorist environment had a significant interaction effect on perception of knowledge (refer to Appendix M, Table 78). Age and behaviorist environment had a significant effect on perception of knowledge (refer to Table 50). Type of institution (public vs. private) and behaviorist environment had a significant effect on perception of knowledge (refer to Table 51).

Table 46

Multiple Regression Analysis of Age and Constructivist Critical Voice on Grade Point Average

Dependent Variable = Grade Point Average	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
≤ 39 and Constructivist Critical Voice						
≥ 40 and Constructivist Critical Voice	.214	.039	2.5	.013	6.32	1.0

Age and constructivist teaching strategies had a significant effect on grade point average ($F_{1, 132}$ = 6.32, p <0.013). The model has accounted for 3.9% of the variance in the criterion variable.

Once the file was split using the median age of respondents, findings indicated that those who were ≥ 40 years of age and experienced constructivist teaching strategies had a significant effect on grade point average (β = .214). This means for those who were ≥ 40 years of age were comfortable expressing opinions, speaking up for rights, and questioning professors had a significant impact on grade point average. This was not true for RDs who were years of age. They experienced constructivist critical voice; however, there was no significant effect on grade point average.

Table 47

Multiple Regression Analysis of Type of Program and Constructivist Critical Voice on

Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Didactic Program and Critical Voice						
Coordinated Program and Critical Voice	.332	.106	5.54	.000	30.67	1.0

Coordinated programs and constructivist critical voice had a significant effect on

perception of knowledge ($F_{1, 249} = 30.67$, $p < 0.000$). The model has accounted for 10.6%

of the variance in the criterion variable.

That is, for those who attended a coordinated program, RDs were comfortable

expressing opinions, speaking up for rights, and questioning professors. Graduates had

the knowledge, skills, and competence to work as an entry level RD. This was not true

for RDs who attended didactic programs. They experienced constructivist critical voice;

however, there was no significant effect on perception of knowledge.

Table 48

Multiple Regression Analysis of Type of Program and Constructivist Shared Control on

Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Didactic Program and Shared Control						
Coordinated Program and Shared Control	.325	.102	5.52	.000	30.45	1.0

Coordinated program graduates who experienced constructivist shared control had a significant effect on perception of knowledge ($F_{1, 259} = 30.45$, $p <0.000$). The model has accounted for 10.2% of the variance in the criterion variable.

That is, for RDs who attended a coordinated program, who assisted with goal setting, course objectives, and assessment of learning, they expressed confidence in their level of knowledge, skills, and competence to work as an entry level RD. This was not true for RDs who attended didactic programs. They experienced constructivist shared control; however, there was no significant effect on perception of knowledge.

Table 49

Multiple Regression Analysis of Type of Delivery Method and Constructivist Student

Negotiation on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	Adjusted R^2	*t*	Sig.	*F*	VIF
On-Line Delivery Method and Student Negotiation	.426	.167	3.52	.001	12.40	1.0
On-Campus Delivery Method and Student Negotiation	.218	.044	3.68	.000	13.51	1.0

Graduates who took on-campus courses and experienced constructivist student

negotiation had a significant effect on perception of knowledge ($F_{1, 271}$ = 13.51, *p*

<0.000). The model has accounted for 10.2% of the variance in the criterion variable.

Similarly, graduates who took on-line courses and experienced constructivist student

negotiation had a significant effect on perception of knowledge ($F_{1, 57}$ = 12.40, *p*

<0.001).

That is, in both delivery methods, RDs were empowered to engage each other in

sharing ideas about course content. Graduates believed they had the knowledge, skills,

and competence to work as entry level RDs. On-line programs (β = .426) had more of an

impact on perception of knowledge than on-campus programs (β = .218).

Table 50

Multiple Regression Analysis of Age and Behaviorist Environment on Perception of

Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
≤ 39 and Behaviorist Environment						
≥ 40 and Behaviorist Environment	-.272	.068	-3.41	.001	11.60	1.0

Graduates who were ≥ 40 years of age and experienced a behaviorist environment had a significant negative effect on perception of knowledge ($F_{1, 146} = 11.60, p < 0.001$). The model has accounted for 6.8% of the variance in the criterion variable.

That is, for RDs who were ≥ 40 years of age had professors who immediately gave the correct answers rather than encouraging experimentation or critical thinking skills. Graduates did not have the knowledge, skills, and competence to work as an entry level RD (as evident by $\beta = -.272$). Graduates who were ≤ 39 years of age may have experienced a behaviorist environment; however, there was no significant effect on perception of knowledge.

Table 51

Multiple Regression Analysis of Type of Institution (Public vs. Private) and Behaviorist

Environment on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	Adjusted R^2	t	Sig.	F	VIF
Public Institution and Behaviorist Environment	-.229	.049	-3.81	.000	14.50	1.0
Private Institution and Behaviorist Environment						

Graduates from public institutions who experienced a behaviorist environment had a significant negative effect on perception of knowledge ($F_{1, 262} = 11.60$, $p < 0.000$). The model has accounted for 4.9% of the variance in the criterion variable. That is, for RDs who attended a public institution, professors immediately gave the correct answers rather than encouraging experimentation or critical thinking skills. Graduates did not have the knowledge, skills, and competence to work as an entry level RD (as evident by β = -.229). Graduates from private institutions may have experienced a behaviorist environment; however, there was no significant effect on perception of knowledge.

Path Analysis

Path analysis was used to describe the relationship among predicting variables and the outcome variables (GPA and Perception of Knowledge). Refer to *Figure 7*. Direct, Indirect and Total Effects of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment on Perception of Knowledge and Grade Point Average.

Figure 7. Direct, Indirect and Total Effects of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment on Perception of Knowledge and Grade Point Average
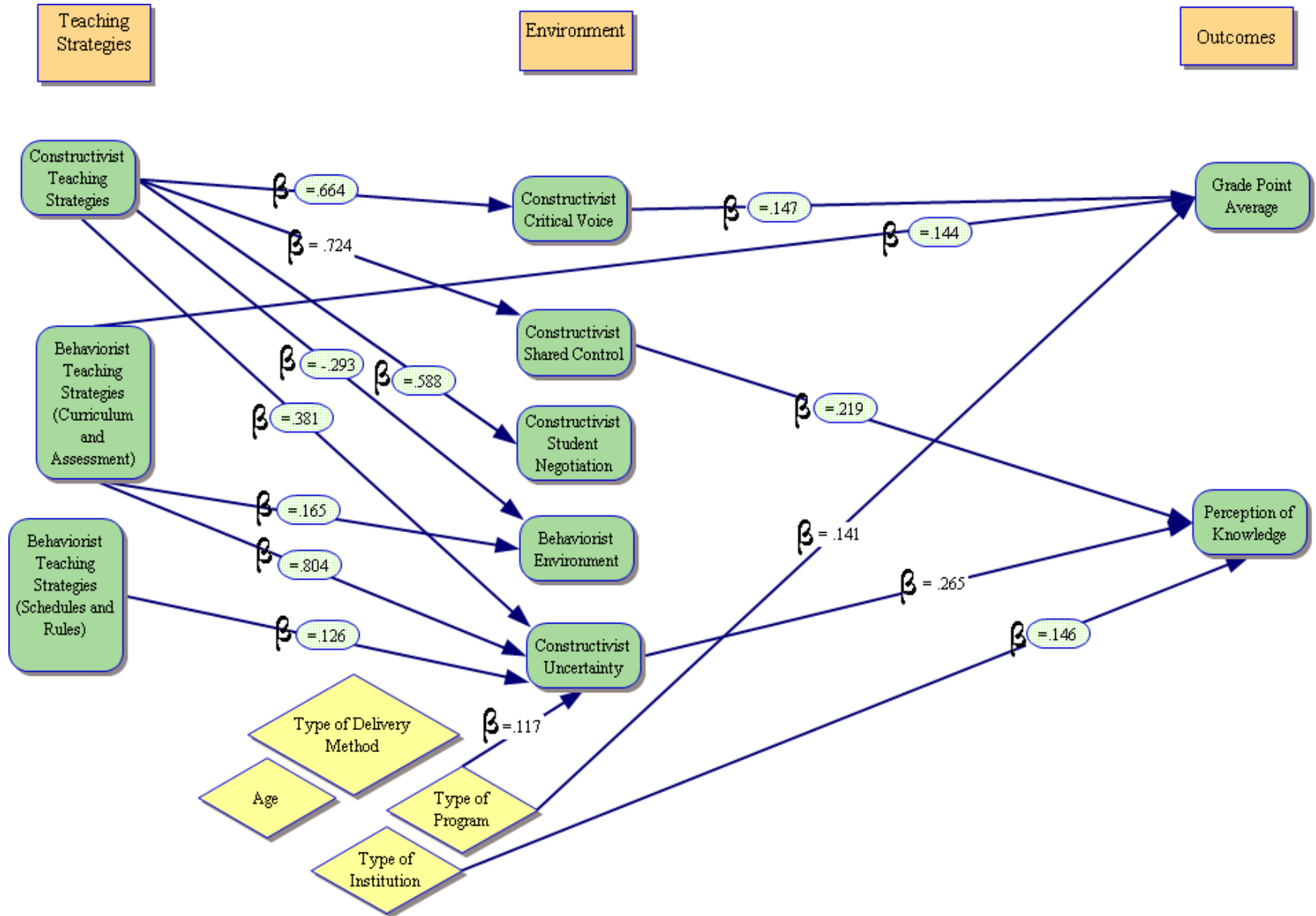
Teaching Strategies Effects

Results from this path analysis model support a direct effect of behaviorist curriculum and assessment teaching strategies on GPA (standardized coefficient = .144). Following this is the relationship between constructivist teaching strategies and GPA mediated by critical voice (total effect = .098). An interesting finding was the type of institution attended with constructivist teaching strategies mediated by critical voice on GPA. Public institutions had a larger total effect (.102) than private institutions (.077) on GPA.

The relationship between behaviorist curriculum/assessment teaching strategies and perception of knowledge mediated by constructivist uncertainty had the largest indirect effect (standardized coefficient = .213). On-line courses had a larger total effect (.101) than on-campus courses (.000) on perception of knowledge.

The relationship between constructivist teaching strategies and perception of knowledge mediated by constructivist shared control had the next largest indirect effect (standardized coefficient = .159). Following this was the relationship between constructivist teaching strategies and perception of knowledge mediated by constructivist uncertainty (standardized coefficient = .101). On-campus courses had a larger total effect (.119) than on-line courses (.000) on perception of knowledge.

The smallest effect on perception of knowledge was the relationship between behaviorist schedules and rules teaching strategies mediated by constructivist uncertainty (standardized coefficient = .033). Graduates who were ≤ 39 years of age (standardized coefficient = .069) had a larger total effect than those who were ≥ 40 years of age (standardized coefficient = .000) on perception of knowledge. Also, didactic programs in

dietetics (standardized coefficient = .121) had a larger total effect than coordinated programs in dietetics (standardized coefficient = .049) on perception of knowledge.

Environment Effects

Constructivist critical voice furnished the largest direct and total effect (.147) on GPA. Those who were ≥ 40 years of age (standardized coefficient = .031) had a larger total effect than those who were ≤ 39 years of age (standardized coefficient = .000) on GPA.

Constructivist uncertainty furnished the largest direct and total effect (.265) on perception of knowledge. Constructivist shared control had the next largest direct and total effect (.219) on perception of knowledge. Coordinated programs in dietetics (standardized coefficient = .071) had a larger total effect than didactic programs in dietetics (standardized coefficient = .000) mediated by shared control on perception of knowledge.

Age, Type of Program, Type of Institution, and Type of Delivery Method Effects

Type of program had a direct and total effect (standardized coefficient = .141) on GPA. Type of institution had the largest direct and total effect (standardized coefficient = .146) on perception of knowledge. The relationship between the type of program and perception of knowledge mediated by constructivist uncertainty had an indirect effect (standardized coefficient = .031).

Summary

This chapter illustrated data analysis from the 354 survey responses. Descriptive statistics, factor analysis, paired sample t-tests, non-parametric and bivarate correlations, and multiple regressions with interaction effects for the study sample were analyzed.

Concept maps identified all of the multiple regression conducted to analyze instructional

teaching strategies (constructivist and behaviorist), environment (constructivist and

behaviorist), age, type of institution, type of program, type of delivery method,

perception of knowledge, and GPA attained from the Registered Dietitians' perspective.

Chapter 5 will present a summary of the research findings and a discussion of its

implications.

Chapter 5:

Dissertation Overview: Discussion, Limitations, Implications, and Recommendations

This chapter contains an overview, discussion of findings, implications for dietetic professional education, and recommendations for future research. The overview presents a brief statement of the purpose of the study, an overview of research procedures, the questions being investigated, and the relationship of this study to the theoretical framework (theories of learning and delivery methods utilized in higher education). The discussion has been organized around the four research questions initially proposed for this study. Major findings from each research question are highlighted and reported. Limitations to this research project are identified and implications for theory, practice, and research provide suggestions for future research.

We never educate directly but indirectly by means of the environment. Whether
we permit chance environments to do the work or whether we design
environments for the purpose, makes a great deal of difference.
John Dewey, 1966

Overview

The purpose of this study was to determine the impact of two factors on learning from accredited dietetic professional educational programs:

1) constructivist and behaviorist theoretical approaches used during instruction, and

2) type of delivery methods (on-line vs. on-campus) used while enrolled in the dietetics program.

Graduates from dietetic programs were surveyed to determine the following outcome measures:

1) Scores achieved on the RD exam,

2) Overall GPA acquired upon graduation,

3) Regarding acquired knowledge and skills, and

4) Level of competence to work as an entry level RD.

Research questions that guided this study included:

1) To what extent do educators use constructivist or behaviorist theoretical approaches during instructional delivery?

2) What are the differences in learning between on-line education and on-campus delivery methods?

3) As far as constructivist and behaviorist teaching methods impact learning, is there an interaction between instructional style and delivery method?

4) How do constructivist and behaviorist teaching methods impact learning (as measured by RD exam score, GPA and perceived level of knowledge) and skills to work as an entry level dietitian?

Data were collected from dietetic program graduates residing in the United States. Descriptive statistics such as means and percentages were used to compare response distributions. Factor analysis was performed and the value of Cronbach's alpha for all of the components were calculated. Paired sample *t*-tests and Pearson product-moment correlation coefficients were used to compare on-line and on-campus responses. Multiple linear regressions and path analysis were also used as part of the data analysis process.

Discussion

Upon review of the demographic sample distribution, results from this research project were similar to Roger's (2005) needs assessment of RDs. The results of the needs assessment were as follows:

- The median age of RDs was 45 years old, with 22% under the age of 35 and 17% age 55 or older.

- Ninety-eight percent of ADA member practitioners were female and 2% were male.

- Data regarding respondent ethnicity were missing for some segments of the database. Based solely on those for whom data were available, 85% of the respondents were White, 5% Asian/Native Hawaiian/Pacific Islander, 3% Black/African American, and 3% Hispanic/Latino.

For this research project, demographics were similar:

- The median RD was 43 years old, with 41% under the age of 35 and 10% age 55 or older.

- Ninety six percent of ADA member practitioners were female and 4% were male.

- Ninety percent of the respondents were White, 2% Asian/Native Hawaiian/Pacific Islander, 2% Black/African American, and 3% Hispanic/Latino.

Of the 354 participants who reported obtaining a degree in dietetics, 83.6% were from a Coordinated Program (n=296), with 81.9% attending a public university. Eighty-eight percent of the respondents reported having an overall grade point average of ≥ 3.2 (n = 312). Less than 5% percent reported having a GPA of ≤ 3.0. Refer to Table 2 for demographic distribution of participants.

The next section of the discussion is organized around the four research questions.

Research Question 1: To what extent do educators use constructivist or behaviorist theoretical approaches during instructional delivery?

While reviewing results of the descriptive statistics, this study revealed that both behaviorist and constructivist teaching strategies were utilized in the classroom. Graduates scored behaviorist teaching strategies somewhat higher than constructivist teaching strategies (behaviorist schedules and rules $\bar{x} = 3.55$, behaviorist curriculum and assessment $\bar{x} = 3.94$, and constructivist teaching strategies $\bar{x} = 3.37$). The highest scored item was from the behaviorist curriculum and assessment teaching strategies, "In order to teach all necessary content and skills, the professor followed textbooks and other published material" (on-campus: N=346, $\bar{x} = 3.95$; on-line: N = 55, $\bar{x} = 4.02$). Refer to

the following tables for the specific breakdown of each teaching method (Table 10: Overall Responses to Items Describing Teaching Strategies [Behaviorist Schedules and Rules], Table 11: Overall Responses to Items Describing Teaching Strategies [Behaviorist Curriculum and Assessment], and Table 12: Overall Responses to Items Describing Teaching Strategies [Constructivist Teaching Strategies]).

Question 2: What are the differences in learning between on-line education and on-campus delivery methods?

Only 18% of the respondents took on-line courses, (N = 66). Of those who did take on-line courses, 14% of them had ≤ 25% of classes on-line. The on-campus item numbers were paired with the on-line item numbers to determine if the difference between the mean of the on-campus responses were significantly different from the mean of the on-line responses (paired-sample *t*-tests).

There was no difference found on the *t*-tests between the mean behaviorist environment in the on-line and on-campus populations. From the descriptive statistics, dietitians in both delivery method groups disagreed with the statement, "Professors immediately told students the correct answers when they could not figure the answers out by themselves." This statement indicated that RDs experienced a constructivist learning environment where effective learning requires meaningful, open-ended, challenging problems for the learner to solve (Fox, 2007).

In the constructivist environment, the following findings were discovered:

Constructivist Environment

Overall, the responses showed that on-line students believed they had more of a critical voice and shared control, in contrast to on-campus students with the exception of

a few questions. Pertaining to critical voice, on-campus students were more comfortable approaching the professors for extra help, questioning the way they were being taught, and complaining about activities that were confusing to them. For shared control, which measured whether students share in the learning process by assisting with course objectives and assessment of learning, graduates in the on-campus environment believed they were more involved in evaluating their own work and setting their own goals than on-line students.

Both the on-campus and on-line respondents strongly agreed that they had the opportunity to communicate with other students while in their dietetic program. Dietitians who completed their dietetic educational program in the on-campus classroom environment believed they were able to negotiate more than the on-line students who responded to the same questions. According to Tallent-Runnels et al. (2006), instructors need to participate in the on-line discussions and faculty should strive to promote both teacher-student and student-student interaction to help learners construct knowledge in on-line environments.

Teaching Strategies

According to the *t*-tests, both the behaviorist schedule and rules and behaviorist curriculum and assessment teaching strategies revealed no differences between the on-line and on-campus populations. However, from the descriptive statistics, all respondents agreed there were behaviorist teaching strategies used in the classroom. Former dietetic students who took on-line courses rated higher on the Likert scale than the on-campus environment. Both the on-campus and on-line respondents agreed that it was "important

that professors enforce classroom policies once they were established" throughout the dietetic program.

In the constructivist teaching strategies category, significant differences were found as outlined below:

Constructivist Teaching Strategies

All questions pertaining to constructivist teaching strategies showed that the on-campus respondents agreed that there were more constructivist teaching strategies used in the classroom than the on-line respondents. In other words, those who were in an on-campus environment believed they had professors who expanded on students' ideas to effectively build the curriculum, encouraged discussions of different opinions, and were encouraged to discuss conflicts in group meetings more so than students in an on-line environment.

Research Question 3: As far as constructivist and behaviorist teaching methods impact learning, is there an interaction between instructional style and delivery method?

Multiple regressions were conducted to determine not only whether variables were related, but the degree to which they were related. There were interactions between constructivist and behaviorist teaching strategies and delivery method.

The relationship between behaviorist curriculum and assessment teaching strategies and perception of knowledge mediated by constructivist uncertainty had the largest indirect effect (standardized coefficient = .213). Regarding perception of knowledge, there was a larger total effect for those who took on-line courses (.101) than those who took on-campus courses (.000). There was an interaction effect for RDs who took on-line courses (β = .400) on uncertainty; however, there was no effect for RDs who took on-

campus courses and behaviorist curriculum and assessment teaching strategies on uncertainty.

In addition, there was a relationship between constructivist teaching strategies and perception of knowledge mediated by constructivist uncertainty (standardized coefficient = .101). Regarding perception of knowledge, there was a larger total effect for those who took on-campus courses (.119) than those who took on-line courses (.000). In the on-campus classroom environment (β = .450) where professors utilized constructivist teaching strategies, graduates learned about the dietetic profession and cultural influences relating to nutrition. There was no effect for RDs who took on-line courses and constructivist teaching on uncertainty.

The following studies present a strong argument for selecting on-line courses vs. on-campus courses. Billings (2000) found that nursing students who took distance education courses were more likely to collaborate with peers and learn from each other, thus promoting feelings of preparedness and acquired knowledge confidence. Post et al. (2006) analyzed RD exam pass rates, post educational employment, and preparedness for entry level dietetic positions. The authors compared distance-based and on-site dietetic programs and concluded that on-line programs were successful. The authors found that graduates who took on-line courses were likely to pass the RD exam on their first try and to begin practicing in dietetics than those graduating from an on-site program. In addition, the authors found that compared to on-line education, graduates who took on-campus course work were 26% less likely to pass the RD exam on the first attempt.

Research Question 4: How do constructivist and behaviorist teaching methods impact learning (as measured by RD exam score, GPA and perceived level of knowledge and skills) to work as an entry level dietitian?

One method used to show how constructivist and behaviorist teaching methods impacted learning was comparing the on-line data to on-campus responses via bivariate correlations. As evident by the Pearson Correlation Covariant results, many of the teaching strategies and environment were similar for on-campus and on-line responses with the exception of three items:

(1) Constructivist teaching strategies had a significant effect on critical voice for on-campus (.664) and on-line (.852). This means in coordinated programs where professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum, graduates indicated a level of comfort expressing opinions, speaking up for rights, and questioning professors. The correlation showed a stronger impact for on-line vs. on-campus responses.

(2) There was a moderately strong correlation between behaviorist schedules and rules teaching strategies and behaviorist environment for on-line (.342). The on-campus correlation did not reveal a significant impact (.011). This means in the on-line environment where classroom policies, rules, and fixed schedules were enforced, graduates were immediately given the correct answers by the professor rather than encouraging experimentation or critical thinking skills.

(3) Behaviorist schedules and rules teaching strategies and student negotiation had a significant effect for on-campus responses (.248). There was not a significant impact for on-line responses (.019). This means in the on-campus environment where classroom policies, rules, and fixed schedules were enforced, graduates indicated they were empowered to engage each other in sharing ideas about course content presented by the professor. The findings in this study are consistent with Buckley's (2003) study, which

compared undergraduate nursing students in on-campus and on-line courses and found no statistical differences in the learning outcomes of the delivery modes.

RD Exam Score

In Chapter 3, the researcher proposed that background characteristics and demographics (age, race/ethnicity, and gender) would be used to predict differences in student learning (perception of knowledge) when instructional theories (behaviorist vs. constructivist) and delivery method (on-line vs. on-campus) were utilized. In addition, the background characteristics, demographics, learning theories, and instructional delivery methods would be used to predict GPA and RD exam passage rates. Since the response rate was predominantly white females, race/ethnicity and gender were not used for any data analysis. In addition, it was determined that the RD exam scores could not be used in the analysis of this research project. Many of the survey respondents sent messages to the researcher explaining the difficulty in submitting exam scores:

> "…I did not answer the RD exam question as I was grandfathered in. You need to put that in the survey if you want accurate results but the year of graduation should tell you that I guess…"

> "…I completed your research survey and I admit to not remembering my RD test exam score. There wasn't any way for me to say this on your survey… all I remembered was that I passed. So I had to leave that question blank…"

> "…I just wanted to let you know that I had absolutely no idea what my RD score was (but I couldn't leave it blank, so I just typed in 999 because I didn't know how else to end the questionnaire). I'm not sure that too many RD's would remember their scores either…"

According to CADE (2007), the examination is scored on a scale of 1–50. The scaled score required to pass the examination is 25. However, the number of questions the examinee must answer correctly to obtain the scaled score of 25 varies from one

examination to another. If the examinee does not complete the minimum of 125 questions, he/she will receive a failing score. The test specifications of the Registration Examination for Dietitians are shown in Appendix N (Registration Examination for Dietitians).

The respondents listed scores received on the RD exam ranging from 11-999 (N = 115). Two hundred thirty-nine (239) respondents did not answer the question on the survey. Although accurate numbers in the exam were not obtained, this study revealed that of the 354 respondents, 97% (N = 344) passed the RD exam, 39 respondents took the exam more than once, 20 RDs took the exam at least two times, and 6 respondents reported taking the exam a total of three times.

In addition to RD exam score, other outcome measures for this study included overall GPA acquired upon graduation and perception of knowledge and skills to work as an entry level RD analyzed by Multiple Regression Analysis (MRA). The three underlying assumptions when analyzing MRA (e.g., multicollinearity, normal distribution of variables and homoscedasticity) as previously discussed in Chapter 3 were taken into consideration and checked for this research project. Many unique and interesting findings resulted and are shown in Chapter 4. However, the discussion points when answering research question #3 focus on *Figure 7:* Direct, Indirect and Total Effects of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment on Perception of Knowledge and Grade Point Average.

Outcome Measure: GPA

Results from this path analysis model support the largest direct and total effect (.147) constructivist critical voice had on GPA. There was a larger total effect for those ≥ 40

years of age (standardized coefficient = .031) than those who were ≤ 39 years of age (standardized coefficient = .000) on GPA. For RDs ≥ age 40 who were comfortable expressing opinions, speaking up for rights, and questioning professors, there was an impact on grade point average (β = .214). There was no effect for RDs who were ≤ age 39 with critical voice on grade point average. This finding promotes student empowerment and fosters students learning activities thus having an impact on higher GPA.

The next relationship was the direct effect between behaviorist curriculum and assessment teaching strategies and GPA (standardized coefficient = .144). Following this is the relationship between constructivist teaching strategies and GPA mediated by critical voice (total effect = .098). An interesting finding was the type of institution attended, experiencing constructivist teaching strategies mediated by critical voice on GPA. There was a larger total effect for those who attended a public institution (.102) than those who attended a private institution (.077) on GPA.

In others words, in institutions where the professor encouraged collaboration among students and expanded on student ideas to effectively build the curriculum (constructivist teaching strategies), graduates indicated a significant level of comfort expressing opinions, speaking up for rights, and questioning professors (critical voice). There was more of an impact for those who attended public institutions (β = .696) than RDs who attended private institutions (β = .522) on critical voice. This finding supports the literature from Thornton & Chapman (2000). These authors found that in a large public university, curriculum negotiation was used in the nursing education program, which

allowed students to have a voice in the choice and development of learning opportunities resulting in improved grades.

Perception of Knowledge

Other outcome measures for this study included answering questions about knowledge and skills acquired in the dietetic program to determine level of competence to work as an entry level dietitian. For the dietetics profession, entry level competence is documented as 46 competencies, divided into eight areas: communication, physical and biological sciences, social sciences, research, food, nutrition, management, and health care systems (CADE, 2006). According to Gilmore et al. (1997), competencies are functional statements of the skills, knowledge, and professional values necessary to begin independent professional practice. The competency statements guide the development of educational curricula that prepares entry level dietetic professionals to compete effectively in the workforce. Dietitians believed they were most competent in the area of nutrition ($\bar{x}$ = 3.92) and the least competent in research and health care systems ($\bar{x}$ = 3.02 and $\bar{x}$ = 2.50 respectively) when asked, "How would you rate your knowledge and skills needed to work as an entry level dietitian?" (Refer to Table 4, which explains the mean responses of all eight content areas.)

While the competencies are divided into the eight areas, "nutrition" is where dietitians were the most comfortable working. The area of lowest believed competence was research and health care systems. According to Mathieu (2008), dietetics professionals graduate from their undergraduate program without knowing how to do research, and unless graduate school is attended, some professionals never gain research skills. Mathieu asserts that dietetic professionals need to embrace the idea that they can

play a role in contributing to research in food and nutrition. Whelan (2007) concurs with Mathieu (2008) in stating "all dietitians have the potential to become involved in research, from understanding, interpreting and applying research to supervision and leadership in it. A good knowledge of research methods may be instilled in new graduates and those with previous research involvement. With guidance and support from peers and supervisors, these skills can be nurtured in practice." According to Byham-Gray et al. (2006), involvement in research by RDs is largely determined by their perceptions, attitudes, and knowledge of evidence-based practice and their level of education.

The area of health care systems ranked the lowest on this survey. According to Stitzel (2006), it is the position of the American Dietetic Association that registered dietitians are leaders in delivering preventive services in healthcare settings, including advocating for funding and inclusion of these services in programs and policy initiatives at local, state, and federal levels. Dietitians were the least comfortable practicing in the area of health care systems as entry level professionals (N = 352, $\bar{x}$ = 2.50).

Experiences promoting application of knowledge and skills are considered a benchmark of effective educational practice. According to Short & Chittooran (2004), it is important to consider the pedagogical approaches and different curricular strategies in nutrition education to enhance learning.

Constructivist uncertainty furnished the largest direct and total effect (.265) on perception of knowledge followed by constructivist shared control (.219) on perception of knowledge. There was a larger total effect for those who attended a coordinated program in dietetics (standardized coefficient = .071) than those who attended a didactic

program in dietetics (standardized coefficient = .000) mediated by shared control on perception of knowledge. There was no effect for those who attended a didactic program with shared control on perception of knowledge. However, those who attended a coordinated program, assisted with goal setting, course objectives, and assessment of learning believed they had the knowledge, skills, and competence to work as an entry level RD (β = .325).

Another relationship occurred between behaviorist curriculum and assessment teaching strategies and perception of knowledge mediated by constructivist uncertainty with an indirect effect (standardized coefficient = .213). Uncertainty is the extent to which opportunities are provided for students to experience knowledge based on experience and values in the dietetic curriculum and profession and there was a larger total effect for those who took on-line courses (.101) than those who took on-campus courses (.000) on perception of knowledge. This finding is similar to Faison (2003), who investigated how professionalism is impacted by distance education. Faison found that nursing students using the distance learning mode showed a greater change in professional values, beliefs, and attitudes for their profession than the students in the on-campus program.

The relationship between constructivist teaching strategies and perception of knowledge mediated by constructivist shared control had the next largest indirect effect (standardized coefficient = .159). Following this was the relationship between constructivist teaching strategies and perception of knowledge mediated by constructivist uncertainty (standardized coefficient = .101). Regarding perception of knowledge, there

was a larger total effect for those who took on-campus courses (.119) than those who took on-line courses (.000).

The smallest effect on perception of knowledge was the relationship between behaviorist schedules and rules teaching strategies mediated by constructivist uncertainty (standardized coefficient = .033). There was a larger total effect for graduates who were $\leq$ 39 years of age (standardized coefficient = .069) than those who were $\geq$ 40 years of age (standardized coefficient = .000) on perception of knowledge. Age and uncertainty appeared to have a significant interaction effect on perception of knowledge. However, when the age groups were divided the β levels were the same (β = .345 for who were $\leq$ 39 years of age, and β = 357 for those who were $\geq$ 40 years of age) and will not be further discussed.

Also, there was a larger total effect for those who attended a didactic program in dietetics (standardized coefficient = .121) than those who attended a coordinated program in dietetics (standardized coefficient = .049) on perception of knowledge. In other words, in programs where classroom policies, rules, and fixed schedules were enforced (behaviorist schedules and rules teaching strategies), graduates learned about the dietetic profession and cultural influences relating to nutrition. With respect to uncertainty, there was more of an impact for RDs who graduated from a didactic program in dietetics (β = .457) than RDs who graduated from a coordinated program in dietetics (β = .184).

Age, Type of Program, Type of Institution, and Type of Delivery Method Effects

Type of program had a direct and total effect (standardized coefficient = .141) on GPA. This finding is not an interaction effect; however, it reveals that when all variables were controlled, there was a difference between type of program (coordinated vs.

didactic) the RD graduated from had on GPA. There was a positive effect regarding those who graduated from a coordinated program and had a higher GPA ($\beta = .141$).

Type of institution had the largest direct and total effect (standardized coefficient = .146) on perception of knowledge. This finding is not an interaction effect. However, it reveals that when all variables were controlled, there was a difference between the type of institution (public vs. private) the RD attended had a difference on perception of knowledge. There was a positive effect regarding those who attended a public institution and had a higher perception of knowledge ($\beta = .146$).

The relationship between the type of program and perception of knowledge mediated by constructivist uncertainty had an indirect total effect (standardized coefficient = .031). There was a positive effect for those who graduated from a coordinated program and had a higher perception of knowledge ($\beta = .117$).

Other Findings

For this research project, analysis of findings indicated that those who enrolled in a public institution ($\beta = -.332$) and experienced constructivist teaching strategies had a significant negative effect on behaviorist environment. That is, in public institutions, professors encouraged collaboration among students and expanded on student ideas to effectively build the curriculum. Graduates reported they were less likely to be given the correct answers by the professor and were not encouraged to experiment or use critical thinking skills. This was not true for RDs who enrolled in a private institution. There was no effect for RDs who enrolled in a private institution and constructivist teaching strategies on behaviorist environment. In both cases behaviorist environment did not have an indirect or direct effect on GPA or perception of knowledge.

Interestingly, the findings for didactic programs showed a stronger impact than coordinated programs in four areas of this research study:

1) constructivist teaching strategies on student negotiation,
2) behaviorist schedules and rules teaching strategies on student negotiation,
3) behaviorist curriculum and assessment on behaviorist environment, and
4) behaviorist schedules and rules teaching strategies on uncertainty.

The first three areas mentioned have no direct or indirect impact on GPA or perception of knowledge. Behaviorist schedules and rules teaching strategies on uncertainty does have an indirect impact on perception of knowledge as mentioned earlier. However, there were no literature findings (including the Journal of the American Dietetic Association) that compared coordinated and didactic programs with teaching strategies, classroom environments, or outcome measures such as competence levels to work as an entry level dietitian, GPA, or RD exam scores.

Study Limitations

As with all research, this research study had limitations. Students who completed a CADE accredited program and achieved the RD credential are considered competent to work as entry level dietitians. However, it is recognized that the relationship between demonstrating competency on examinations and performance in the actual work place appears to be questionable (Rethans et al., 1991). No evaluation method and process exist for measuring whether dietitians who completed different programs were equally competent to perform as entry level dietitians. As a result of not being able to obtain the RD exam scores for the respondents, this became a limitation of the research study.

The second limitation relates to the techniques used to collect data for the study. Although the modified Constructivist Learning Environment Survey (CLES) proven to be valid and reliable by Johnson & McClure (2004) was used, results of this research study

may be limited by the accuracy of the participants' responses. Data in this study were quantitative in nature, confining the respondents to specific choices. This research relied on self-reports from each student's perspective and memory. Using self-reports from former dietetic students to assess the quality of undergraduate education is a limitation as it required students to recall activities that took place during their educational program that may have occurred five or more years in the past. Since the surveys are self-reported by each participant in terms of their beliefs and actual practice related to a behaviorist or constructivist learning environment, they may have incorrectly remembered their experiences in response to the question.

The third limitation relates to the sample used to collect data for the study. Although the number of RD's identified for the population of this study was relatively large (N = 3,607), the actual number of individuals who responded to the survey was significantly smaller (N = 354). Only those graduates currently employed in the field of dietetics were studied. These graduates might be the people who found higher levels of satisfaction with the field of dietetics and might rate their learning higher. Conversely, there may have been graduates who might have had negative experiences in school or are unhappy with their current positions and might have rated levels of understanding lower.

A fourth limitation of this study relates to the selection of participating institutions. The programs in the sample selection included all Registered Dietitians listed in the professional organization of the American Dietetic Association. The original research project was going to evaluate Coordinated Program in Dietetics exclusively (50 programs) and not the Dietetic Internship programs. Due to the low response rate, a second mailing of the identical survey included states with a list of RDs who did not

participate in the first mailing. Had the original survey allowed the graduates of didactic programs to complete the survey, the response rate would have been closer to a 35% return rate. As a result, this study may not be generalizable to other settings.

Finally, it is conceivable that by limiting the sample to former students, versus current students, faculty, and program directors, the outcomes of this study would be different.

Implications for Theory

There are two concepts worth noting in this section titled implications for theory: 1) the relationship between behaviorism and constructivism, and 2) the differences between teaching strategies and learning environments.

With respect to the relationship between behaviorism and constructivism, the literature review, for the most part, put behaviorist on one end of the teaching/learning spectrum and constructivism on the other end of the spectrum. Contrary to the literature findings, multiple interaction effects were found in this study indicating that constructivism and behaviorism as learning theories are not mutually exclusive nor are either one considered to be superior to the other.

With respect to the differences between teaching strategies and learning environments, given what was found in the literature, a learning environment may be defined as containing a minimum of four components. These components are temporal, spatial, psychological (climate), and student/instructor interaction. For example, the time of day a course is offered will have a specific and/or particular impact on the creation of the learning environment. With on-line course delivery, time creates a dimension that will yield different learning environments. A student can access an on-line course anywhere internet is available: work, library, home, and so on. Similarly, as with time, the size of a

classroom, particularly on-campus, compounded with psychological dimensions of student/instructor interactions, will also create differential learning environments.

Teaching strategies may be defined as a set of instructional methods that are designed to provide effective student learning. These methods emanate from the instructors' beliefs and attitudes about how optimal learning is achieved. Temporal, spatial, and psychological dimensions not withstanding, teaching strategies are critical to the creation of any learning environment.

Returning to implications of theory with respect to dietetic education, Svard (1998) highlights the dangers of narrowly applying a single theory to practice:

> "When a theory is translated into an instructional prescription, exclusivity becomes the worst enemy of success. Educational practices have an overpowering propensity for extreme, one-for-all practical recipe. Because no two students have the same needs and no two teachers arrive at their best performance in the same way, theoretical exclusivity and didactic single-mindedness can be trusted to make even the best of educational ideas fail (Svard, 1998, pp. 10-11)."

Faculty members in dietetic programs can be informed by theory but not confined to it. Professors should keep a theory in mind or maybe many theories at once, when considering the teaching approach or learning environment and deciding on a course of action. But the teaching approach or learning environment, not the theory, is at the center.

Ertmer and Newby (1993) suggest that theoretical strategies can complement the learner's level of knowledge, allowing professors to make the best use of all available practical applications of different learning theories. With this approach, professors are able to draw from a large number of learning theories to meet a variety of learning situations.

The findings from this study showed that there was no impact on behaviorist environment or constructivist student negotiation on GPA or perception of knowledge. However, a behaviorist environment was impacted by both behaviorist curriculum and assessment teaching strategies, and constructivist teaching strategies. Behaviorist schedules and rules teaching strategies only had a direct effect on the constructivist uncertainty environment. Constructivist teaching strategies had an impact on both behaviorist and constructivist learning environments.

Second, although dietetic programs have established outcomes and appropriate measures to assess achievement of goals and program effectiveness, including program completion rates, graduate school acceptance rates and GPA, this study did not measure perception of knowledge and GPA. CADE establishes and enforces eligibility requirements and accreditation standards that ensure the quality and continued improvement of dietetics education programs. However this research did not measure the compliance with professional standards. Theoretical conclusions cannot be drawn based on GPA and level of competency. Even if GPA were analyzed to compare program quality, are the grades achieved in the undergraduate program accurate reflections of entry level dietitians' ability levels? Cizek (1996) believes issues such as grade inflation distorts students' perceptions of their own competency, and affects students' ability to critically rate their own performance and abilities.

The next section discusses elements drawn from *Figure 7*. Direct, Indirect and Total Effects of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment on Perception of Knowledge and Grade Point Average to discuss implications for dietetic educators.

Implications for Dietetic Educators

The findings from this study show that dietetic educators should spend more time on behaviorist curriculum and assessment teaching strategies and less time on behaviorist schedules and rules since curriculum and assessment had both a direct and indirect effect on GPA and perception of knowledge.

Specifically, if a dietetic program wants to increase GPA, then more emphasis should be placed on behaviorist curriculum and assessment teaching strategies. This translates into approaches such as the professors making curriculum choices for students (i.e., thematic research papers); grading based primarily on homework, quizzes, and tests; and professors following textbooks and other published material to teach classroom content and lead class discussions.

Another key area to focus on is encouraging critical voice in the classroom. The critical voice scale involved the extent to which students believed it was beneficial to question the professor's pedagogical plans and methods and to express concerns about the quality of their learning activities. Students who indicated they had a higher GPA were comfortable approaching the professors for extra help, comfortable expressing opinions, and speaking up for rights, comfortable complaining about activities that were confusing or questioning the way they were being taught. Thus professors need to encourage this type of behavior among their students.

Another area to concentrate on is constructivist teaching strategies, since this impacted both constructivist and behaviorist classroom environments. Professors who used constructivist teaching strategies gave students time to work together when they were not having instructional time, encouraged collaboration among students to motivate

them to learn more, and encouraged discussions of different opinions and reasons. In addition, professors expanded on students' ideas to effectively build the curriculum, encouraged students to discuss conflicts in group meetings, and helped guide students in finding their own answers to academic problems.

The shared control scale measured whether students shared in the learning process by assisting with goal setting, course objectives, and assessment of learning. Students in such settings helped with the design and management of learning activities, and assisted with determining and applying assessment criteria. The results from this study showed that perception of knowledge was increased when students had more shared control in the classroom environment. Thus professors should include more activities such as placing students in collaborative group activities that builds on and assigns value to each unit of instruction.

The uncertainty scale involved the extent to which opportunities were provided for students to experience knowledge based on experience and values in the dietetic curriculum and profession. Specifically, how nutrition is influenced by people, the differences in nutrition by people in other cultures, how the dietetic profession has changed over time, and how today's human nutrition is different from human nutrition of long ago. Uncertainty was impacted by both behaviorist and constructivist teaching strategies. In order for students to experience knowledge based on values in the dietetic curriculum and profession, it begins with recruiting a diverse population into dietetic educational programs. As previously stated, a comprehensive needs assessment was undertaken by the ADA and the Commission on Dietetic Registration (CDR) to better

understand the practice and career issues facing dietetics professionals in 2004. This assessment produced the following results (Rogers, 2005):

- The median age of RDs was 45 years old, with 22% under the age of 35 and 17% age 55 or older. The median age of ADA's student members was 27.

- Ninety-eight percent of ADA member practitioners were female and 2% were male. Among ADA student members, 95% were female.

- Data regarding respondent ethnicity were missing for some segments of the database. Based solely on those for whom data were available, 85% of the respondents were White, 5% Asian/Native Hawaiian/Pacific Islander, 3% Black/African American, and 3% Hispanic/Latino.

This study found that the majority of respondents were white females. In addition to diversity issues, all students should be required to join a campus-operated student dietetic organization, the professional American Dietetic Association, and attend professional meetings so graduates learn about the dietetic profession and cultural influences relating to nutrition.

The final area to focus on as a dietetics educator pertains to use of technology in the classroom. Few universities currently offer dietetic education using on-line delivery methods; however, this could have strong implications for dietetic practice. As mentioned previously, Billings (2000) found that nursing students who took distance education courses were more likely to collaborate with peers and learned from each other, thus promoting feelings of preparedness and acquired knowledge confidence. Post et al. (2006) analyzed RD exam pass rates, post-educational employment, and preparedness for entry level dietetic positions. The authors compared distance-based and on-site dietetic programs and concluded that on-line programs were successful. The authors found that graduates who took on-line courses were likely to pass the RD exam on their first try and to begin practicing in dietetics in comparison to those graduating from an on-site

program. In addition, the authors found that compared to on-line education, graduates who took on-campus course work were 26% less likely to pass the RD exam on the first attempt. Thus it would seem that on-line delivery of dietetic education should be strongly encouraged.

In summary, dietetic educators are encouraged to incorporate behaviorist and constructivist teaching strategies in the classroom environment in order to impact GPA and perception of knowledge to work as entry level dietitians. For detailed examples, refer to Appendix B: Foundation Knowledge and Skills for Entry Level Dietitians. One example drawn from this Appendix would be a food safety and sanitation unit. The professor would use constructivist teaching strategies in the following example: Open-ended assignments linked to changing learning objectives. The assignments would be constructed to reflect "real world" conditions and requirements. Students would be encouraged to work in collaborative learning groups as a motivation for collective input into their learning achievements.

When students process information using higher order thinking skills and question the professor in the food laboratory during this specified unit, the students are engaged in critical voice. An example of shared control would be when the professor establishes teaching methods that allows students to manage their own learning. Examples are developing goals and objectives, activities and corresponding assessment tools for safe production of hot and cold foods and conducting a sanitation audit. In order to assess learning from the food safety and sanitation unit and incorporate the behaviorist curriculum and assessment teaching strategies, the professor would administer the ServSafe exam. The ServSafe exam is a state exam that is administered in an on-line

delivery format. At the end of this food safety and sanitation unit, it is hoped that the concept of uncertainty dissipates through the acquisition of new knowledge as evidenced by improved GPA and increased student perception of knowledge.

Implications for Future Research

On-Line Delivery Methods

Although *t*-tests were conducted for on-line and on-campus questions, future research may consider evaluating dietetic programs offered completely via distance education where a better on-line response rate may occur. Few universities offer dietetic education completely on-line at this time, and doubt has remained as to whether on-line delivery can fully achieve educational learning objectives (Mazurak et al., 2005). These authors assert that on-line learning is emerging as a solution for providing education to those who cannot attend scheduled on-campus courses, expanding access to learners, introducing novel teaching and learning methods, and shifting the paradigm of how students and instructors interact. Results of this research project would support the expansion of on-line delivery based on improved RD exam passage rates on the first try.

Given the state of the economy, students are most likely to gravitate toward on-line education overall. This phenomenon may cause a significant decline in on-campus classroom instruction and would encourage the expansion of on-line delivery.

Follow-up studies are also needed to track the progress of on-line education in the field of dietetics. This study relied on retrospective experiences of dietitians who took on-line courses (in some cases more than 10 years ago) when technology may not have been as advanced as it is today. In the past, on-line instruction was a novelty. Like most new ideas, institutions tend to be guarded against wholesale application. On-line courses as

they exist today are always evolving in level of sophistication. Problems with software

compatibility, connection speed, server unreliability, and computer problems are ongoing

challenges for both instructors and students. Today, technical support and technical

infrastructure have rapidly emerged to enable faculty and students to take full advantage

of the variety of instructional tools to support teaching and learning in on-line

environments. Some examples of instructional tools to create dynamic content includes

downloaded media such as podcasting, multimedia, threaded discussions, email,

storyboards, audio, video, simulation, laboratory exercises, graphics, and texts (plain or

hyperlinked).

Perceptions

Another implication for future research is to repeat the survey comparing professor

perceptions to graduating student perceptions. Many educators are incorporating teaching

methods based on constructivist and behaviorist theories of learning and may apply each

theory to different aspects of their teaching. The results of this approach could be used by

educators to make professors more aware of the theoretical bases of their beliefs about

teaching and learning.

Program Comparisons

Interestingly, the findings for didactic programs showed a stronger impact than

coordinated programs in four areas of this research study: 1) constructivist teaching

strategies on student negotiation, 2) behaviorist schedules and rules teaching strategies on

student negotiation, 3) behaviorist schedules and rules teaching strategies on uncertainty

and 4) behaviorist curriculum and assessment on behaviorist environment. However,

there were no literature findings that compared coordinated and didactic programs with

teaching strategies, classroom environments, or outcome measures such as RD exam scores or GPA. Future research is indicated for improvements in professional dietetic educational programs. For example, this study revealed that CPD graduates had a higher GPA than DPD graduates. As mentioned in Chapter 1, the Didactic Program in Dietetics (DPD) is followed by completion of a Dietetic Internship (DI), and a Coordinated Program in Dietetics (CPD) includes the supervised practice experiences. Grades for the practice experiences are not part of a didactic program since a student has already graduated from the university setting. However, grades for the practice experiences are part of a CPD. The literature offers little insight on the value of, and issues inherent in, assigning letter grades in clinical practice courses. However, future studies could examine the distribution of clinical grades compared to theoretical grades. Research examining this issue could provide direction to dietetic faculty.

Scores from RD Exam

Since the RD exam score could not be used in the data analysis, recommendations for future research include adapting the survey instrument to include a scaled set of RD scores for individuals to respond appropriately or researchers may explore the option of obtaining the scores from the graduating institution or from the American Dietetic Association.

Dissertation Summary

The purpose of this study was to compare the learning impact resulting from various instructional delivery methods with the formal aspects of behaviorist and constructivist learning theories in dietetic education programs. This research study has attempted to provide a number of contributions to the development of professional dietetic educational

program knowledge. Higher education institutions play a key role in meeting increased employment demands by educating and training many Registered Dietitians. An entry level dietetics education program is based on knowledge, skills, and competencies necessary to provide dietetic services.

The 106-item survey was developed by the author and adapted from previously developed instruments including the Teaching Belief Survey and the Constructivist Learning Environment Survey. Questions were asked to obtain information on the relative achievement of professional dietetic education (type of dietetic program (coordinated vs. didactic), type of university (public vs. private), and GPA), instructional teaching strategies (constructivist and behaviorist learning theories), instructional delivery methods (percent of on-line or on-campus instruction), and demographic information (age, gender, race/ethnicity).

This study met the outcome measures of obtaining GPA and addressed knowledge and skills to determine competence to work as an entry level dietitian. The multiple regressions were conducted to determine not only whether variables were related but the degree to which they were related. Multiple interaction effects were found, indicating that constructivist and behaviorist teaching strategies and learning environments are not mutually exclusive nor is either one considered to be superior to the other. The findings in this study showed that both constructivist and behaviorist teaching strategies and classroom environment had an effect on GPA and perception of knowledge.

Considering the need for well educated dietitians, there is a tremendous need for research that tests effectiveness of particular educational approaches in dietetic programs.

Such proven approaches should be encouraged and expanded in order to strengthen future outcomes of dietetic education across the country.

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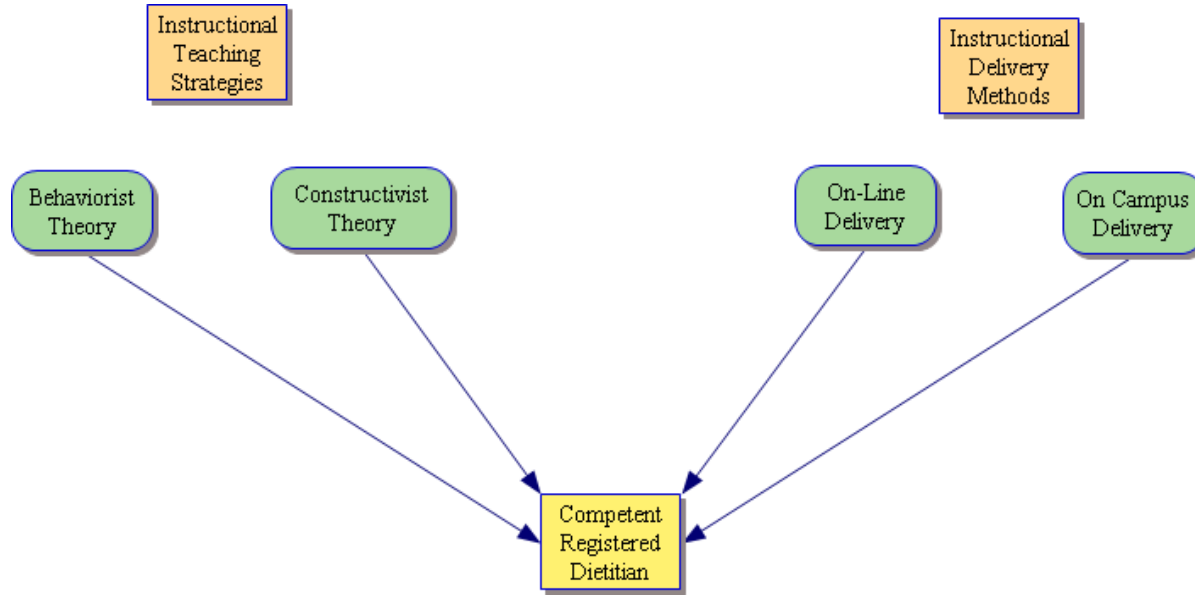
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Appendix A: Effectiveness of Dietetic Education Programs

Appendix B: Foundation Knowledge and Skills for Entry Level Dietitians

Requirement for Dietetic Programs	Behaviorist Perspective	Constructivist Perspective
Area of Communication		
Educational materials development	Teacher provides resources	Students find resources Regional, cultural menu and educational material development
Interpersonal communication skills public speaking Concepts of human and group dynamics	Individual study	Cooperative learning and peer interaction Perform patient/client instruction Video-tape counseling session Case study Problem solving (presentation of problem or case) Role playing Nutrition assessment care plans Use oral and written communications in presenting an educational session for a group Participate in medical team rounds Patient case study presentation Interaction with experienced practitioner
Counseling theory and methods	Teacher dominates	Teacher observes, coaches, and facilitates Student counsels individuals on nutrition
Interviewing techniques	Students learn meaning	Students create meaning Interview a Registered Dietitian Interview aging/geriatric person
Lay and technical writing	Teacher provides examples	Write letter to legislators taking a position on a nutrition issue Grant writing assignment

Appendix B: Foundation Knowledge and Skills for Entry Level Dietitians

Requirement for Dietetic Programs	Behaviorist Perspective	Constructivist Perspective
		Journals
Negotiation techniques	Teacher demonstrates	Debates
Area of Physical and Biological Sciences		
Genetics	Teacher Driven Learning	Student centered learning
Exercise physiology	Rote Memory	Knowledge is created
General health assessment e.g. Blood pressure and vital signs	Knowledge is acquired	Knowledge formation
Organic and biochemistry	Knowledge transmission	
Microbiology		Examples:
Pathophysiology related to nutrition care		Nutrition assessment care plan; written and oral case study presentation
Pharmacology: nutrient-nutrient and drug-nutrient interaction		Interpret medical terminology
Nutrient metabolism		Nutrition assessment care plan; written and oral case study presentation
Fluid and electrolyte requirements		Sanitation audit
		Written and oral case study presentation
Area of Social Sciences		
Health behaviors and educational needs of diverse populations	Teacher plans investigation and activities	Development of culture-specific education materials
Area of Research:		
Research methodologies	Teacher provides resources	Student acquires resources and evaluates abstracts from professional journals
		Student collects and organizes data

Appendix B: Foundation Knowledge and Skills for Entry Level Dietitians

Requirement for Dietetic Programs	Behaviorist Perspective	Constructivist Perspective
Scientific method	Teacher transmits knowledge and is expert	Student interpret current research and interprets basic statistics
Area of Food		
Applied sensory evaluation of food and nutrition products Role of food in promotion of a healthy lifestyle	Teacher structures environment	Student: Evaluate new food products and menu items Apply food science knowledge to functions of ingredients in food Participate in food preparation Learn about production of hot and cold foods Modify recipes to make health-promoting changes Modify recipe/formula for individual or group dietary needs Cycle menu project Participate in food preparation
Food and nutrition laws, regulations and policies	Teacher is expert Transmits information on laws, regulations and policies	Students' knowledge is valid starting point
Food production that meets nutritional guidelines, cost parameters, and consumer acceptance Food technology and delivery systems	Teacher manages student learning	Students learn to manage their own learning by following examples: Preparation of menu items; Conduct patient satisfaction survey Calculate and interpret nutrient composition of foods

Appendix B: Foundation Knowledge and Skills for Entry Level Dietitians

Requirement for Dietetic Programs	Behaviorist Perspective	Constructivist Perspective
		Determine recipe/formula proportions and modifications for volume food production
Culinary techniques	Teachers present knowledge	Students discover and construct knowledge by: Preparing and presenting foods in laboratory experiments Demonstrate basic food preparation and presentation skills
Socio-cultural and ethnic food consumption issues and trends	Teacher locates educational resources	Development of culture-specific menus and educational materials
Food safety and sanitation	Teacher gives ServSafe exam	Student conducts sanitation audit
Area of Nutrition		
Evolving methods of assessing health status	Student learns by memorization Student regurgitates information	Learner as processor analysis, exploration, synthesis of information (higher order thinking skills Examples: Collect pertinent information for comprehensive nutrition assessments
Influence of age, growth and normal development on nutritional requirements	Teacher is expert and transmits knowledge	Determine nutrient requirements across the lifespan
Health promotion and disease		Calculate and/or define diets for health conditions addressed by health promotion/ disease prevention

Appendix B: Foundation Knowledge and Skills for Entry Level Dietitians

Requirement for Dietetic Programs	Behaviorist Perspective	Constructivist Perspective
prevention theories and guidelines		activities or uncomplicated instances of chronic diseases of the general population
Influence of socioeconomic, cultural and psychological factors on food and nutrition behavior		Translate nutrition needs into food choices and menus for people of diverse cultures and religions
Nutrition and metabolism	Structured assignments directly linked to learning objectives.	Open-ended assignments linked to changing learning objectives. Assignments constructed to reflect "real world" conditions and requirements. Manage monitoring of patients'/clients' food and/or nutrient intake Calculate enteral and parenteral nutrition formulations
Assessment and treatment of nutritional health risks	Teacher dominates	Teacher observes, coaches, and facilitates Student screens individuals for nutritional risk Students identify risks and consequences Measure, calculate and interpret body composition data
Strategies to assess need for adaptive feeding techniques and equipment	Little or no cohort discussion	Emphasis on discussion and collaboration among cohort of students. Design and implement nutrition care plans as indicated by the patient's/client's health status for adaptive feeding techniques and equipment
Complementary and alternative nutrition and herbal therapies Dietary supplements	Teacher identifies the issue/topic	Herbal/CAM therapy paper Student writes dietary supplement laws and regulations paper

Appendix B: Foundation Knowledge and Skills for Entry Level Dietitians

Requirement for Dietetic Programs	Behaviorist Perspective	Constructivist Perspective
Area of Management		
Program planning, monitoring and evaluation Management theories Human resources management, including labor relations Financial management including accounting principles	Teacher contacts needed human resources	Student Driven: Prepare a marketing and business plan Develop a portfolio with a resume, professional goals and samples of work Plotting personal development Develop marketing materials for business Prepare an operating budget-determine costs of services/operation Interpret financial data Development of pricing structure for nutrition business
Area of Health Care		
Health care policy and administration Current reimbursement issues, policies, and regulations	Teacher presents knowledge	Student: knowledge formation. Determine types of insurance accepted at proposed business

APPENDIX C: Dietetics Learning Environment Survey

DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

This survey requests information from those who have graduated from an undergraduate Coordinated Program in Dietetics. If you did not graduate from a Coordinated Program in Dietetics, please indicate below by clicking the "No" button below and then click "Next". You will be then be taken to the last page of the survey. Please click on "Submit". Thank you.

For those who have graduated from an undergraduate Coordinated Program in Dietetics, this survey asks you to describe your experiences with the program. You will be asked to complete a questionnaire regarding demographic information, educational information and your level of competence to work as a Registered Dietitian.

There are no right or wrong answers. Your answers are confidential and anonymous. Be assured that your personal information will in no way be associated with this study. Your participation is strictly voluntary. You have the right to refuse participation and withdraw from participation in the study at any time. You may refuse to answer any item on the survey. No penalties or negative consequences will result from your withdrawal or refusal.

If you would like a summary of results or you have any questions or concerns related to this study, please contact: Martha Sutton, MS, RD (734.487.0918 or msutton@emich.edu). This research has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee (Reference Number 071018).

Did you graduate from an undergraduate Coordinated Program in Dietetics?
    ○   Yes   ○   No

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DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

Based on your undergraduate program, how would you rate your knowledge and skills needed to work as an entry level dietitian in the following areas:

	Poor	Fair	Good	Very Good	Excellent
Communication (counseling theory and methods, interviewing techniques, lay and technical writing).	○	○	○	○	○
Physical and Biological Sciences (fluid and electrolyte requirements, general health assessment, drug-nutrient interaction and nutrient metabolism).	○	○	○	○	○
Social Sciences (health behaviors and educational needs of diverse populations).	○	○	○	○	○
Research (research and scientific methodologies).	○	○	○	○	○
Food (sensory evaluation of food, food and nutrition laws, food production, food safety and sanitation).	○	○	○	○	○
Nutrition (growth and normal development on nutritional requirements, health promotion and disease prevention theories, complementary and alternative nutrition).	○	○	○	○	○
Management (program planning, monitoring and evaluation, management theories, human resources management and financial management).	○	○	○	○	○
Health Care Systems (health care policy and administration, current reimbursement issues, policies and regulations).	○	○	○	○	○

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APPENDIX C: Dietetics Learning Environment Survey Continued

DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

Did you take any courses online or had courses with an online component during your undergraduate Coordinated Program in Dietetics?

○ Yes   ○ No

Approximately, what percentage of your instruction was online during your undergraduate Coordinated Program in Dietetics?

○ 76-100%   ○ 1-25%
○ 51-75%   ○ 0%
○ 26-50%

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DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

The next few screens will prompt you to respond to your overall coursework instruction and supervised learning experiences while in the Coordinated Program. On the left side of the screen please respond while thinking about your On Campus environment. If you did not receive any On Campus instruction please select the "not applicable" button. On the right side of the screen answer the same question for your On-Line environment. If you did not receive any On-Line instruction please select the "not applicable" button.

| | During the On Campus Course Work in the Coordinated Program: | | | | | | During the On-Line Course Work in the Coordinated Program: | | | | | |
	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I was comfortable questioning the way I was being taught.	○	○	○	○	○	○	○	○	○	○	○	○
I was comfortable complaining about activities that were confusing.	○	○	○	○	○	○	○	○	○	○	○	○
I was comfortable complaining about anything that prevented me from learning.	○	○	○	○	○	○	○	○	○	○	○	○
I was comfortable expressing my opinion.	○	○	○	○	○	○	○	○	○	○	○	○
I was comfortable speaking up for my rights.	○	○	○	○	○	○	○	○	○	○	○	○
The students were encouraged to propose and negotiate new classroom policies if they felt the current policies were not working.	○	○	○	○	○	○	○	○	○	○	○	○

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APPENDIX C: Dietetics Learning Environment Survey Continued

DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

	During the On Campus Course Work in the Coordinated Program:						During the On-Line Course Work in the Coordinated Program:					
	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I helped the professors plan what I learned.	O	O	O	O	O	O	O	O	O	O	O	O
I helped the professors decide how well I was learning.	O	O	O	O	O	O	O	O	O	O	O	O
I helped the professor to decide which activities were best for me.	O	O	O	O	O	O	O	O	O	O	O	O
I helped the professors to decide how much time I spent on activities.	O	O	O	O	O	O	O	O	O	O	O	O
I helped the professor assess my learning.	O	O	O	O	O	O	O	O	O	O	O	O

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DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

	During the On Campus Course Work in the Coordinated Program:						During the On-Line Course Work in the Coordinated Program:					
	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Students were encouraged to solve problems independently when doing group work.	O	O	O	O	O	O	O	O	O	O	O	O
Students were involved in evaluating their own work and setting their own goals.	O	O	O	O	O	O	O	O	O	O	O	O
Professors adjusted their lesson plans based on results of homework assignments.	O	O	O	O	O	O	O	O	O	O	O	O
Professors gave students time to work together when whey were not having instructional time.	O	O	O	O	O	O	O	O	O	O	O	O
Professors created thematic units based on the students' interests and ideas.	O	O	O	O	O	O	O	O	O	O	O	O

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APPENDIX C: Dietetics Learning Environment Survey Continued

DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

	During the On Campus Course Work in the Coordinated Program:						During the On-Line Course Work in the Coordinated Program:					
	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The professors made curriculum choices for students.	○	○	○	○	○	○	○	○	○	○	○	○
My grades were based primarily on homework, quizzes and tests.	○	○	○	○	○	○	○	○	○	○	○	○
In order to teach all necessary content and skills, the professor followed textbooks and other published material.	○	○	○	○	○	○	○	○	○	○	○	○
I learned best when there was a fixed schedule.	○	○	○	○	○	○	○	○	○	○	○	○
The professors used textbooks or guides to lead class discussion.	○	○	○	○	○	○	○	○	○	○	○	○
It is more important for professors to set rules, or policies than to let students make their own decisions.	○	○	○	○	○	○	○	○	○	○	○	○
The professors immediately told students the correct answers when they could not figure them out by themselves.	○	○	○	○	○	○	○	○	○	○	○	○

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DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

	During the On Campus Course Work in the Coordinated Program:						During the On-Line Course Work in the Coordinated Program:					
	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
It is very important that professors enforce classroom policies once they are established.	○	○	○	○	○	○	○	○	○	○	○	○
Professors found it more effective to provide students with the information they need to know, rather than encouraging them to experiment.	○	○	○	○	○	○	○	○	○	○	○	○
Professors encouraged collaboration among students to motivate them to learn more.	○	○	○	○	○	○	○	○	○	○	○	○
Professors expanded on students' ideas to effectively build the curriculum.	○	○	○	○	○	○	○	○	○	○	○	○

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APPENDIX C: Dietetics Learning Environment Survey Continued

DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

	During the On Campus Course Work in the Coordinated Program:						During the On-Line Course Work in the Coordinated Program:					
	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I got the chance to communicate to other students.	O	O	O	O	O	O	O	O	O	O	O	O
I communicated with other students about how to solve problems.	O	O	O	O	O	O	O	O	O	O	O	O
I explained my ideas to other students.	O	O	O	O	O	O	O	O	O	O	O	O
I asked other students to explain their ideas.	O	O	O	O	O	O	O	O	O	O	O	O
Other students asked me to explain my ideas.	O	O	O	O	O	O	O	O	O	O	O	O
Other students explained their ideas to me.	O	O	O	O	O	O	O	O	O	O	O	O
Students were encouraged to discuss conflicts in group meetings or open forum sessions.	O	O	O	O	O	O	O	O	O	O	O	O

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DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

	During the On Campus Course Work in the Coordinated Program:						During the On-Line Course Work in the Coordinated Program:					
	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Professors helped guide students in finding their own answers to academic problems.	O	O	O	O	O	O	O	O	O	O	O	O
Professors encouraged discussions of different opinions and reasons.	O	O	O	O	O	O	O	O	O	O	O	O
I felt comfortable approaching the professors for extra help.	O	O	O	O	O	O	O	O	O	O	O	O
When there was a disagreement between students the professors tried to intervene immediately to resolve the problem.	O	O	O	O	O	O	O	O	O	O	O	O

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APPENDIX C: Dietetics Learning Environment Survey Continued

DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

During the Coordinated Program in Dietetics:

	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I learned nutrition cannot provide perfect answers to problems.	O	O	O	O	O	O
I learned how the dietetics profession has changed over time.	O	O	O	O	O	O
I learned how nutrition is influenced by people's values and opinions.	O	O	O	O	O	O
I learned about the differences in nutrition by people in other cultures.	O	O	O	O	O	O
I learned how today's human nutrition is different from the human nutrition of long ago.	O	O	O	O	O	O
It was expected that students follow the dietetic code of ethics for professional behavior.	O	O	O	O	O	O

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DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

Demographic Information

Age

What race/ethnicity do you consider yourself to be a member of?
- O Caucasian
- O Black
- O Hispanic
- O Asian
- O Multiracial
- O Native American
- O Other

Please specify:

Gender
- O Male
- O Female

Progress

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APPENDIX C: Dietetics Learning Environment Survey Continued

DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

Educational Information

Was your College/University
- ○ Private
- ○ Public

Name of your Undergraduate College/University
[ ]

Year of graduation from the Undergraduate Coordinated Program in Dietetics
[ ]

What was your overall grade point average (GPA) when you graduated from the Coordinated Program in Dietetics?
- ○ 3.8-4.0
- ○ 3.6-3.79
- ○ 3.4-3.59
- ○ 3.2-3.39
- ○ 3.0-3.19
- ○ 2.8-2.99
- ○ 2.5-2.79
- ○ Less than 2.5

Progress ( )

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DIETETICS LEARNING ENVIRONMENT SURVEY
STUDENT PERCEPTIONS

Educational Information

Did you pass the Registration Examination (RD exam) for Dietitians?
- ○ Yes
- ○ No

If yes, was this the first time taking the RD exam?
- ○ Yes
- ○ No

Please list the overall score(s) you received each time you took the RD exam:
RD Exam First Test Score: [ ]

RD Exam Second Test Score (if applicable): [ ]

RD Exam Third Test Score (if applicable): [ ]

Progress ( )

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Appendix D: Approval of the Dissertation Proposal

EASTERN MICHIGAN UNIVERSITY
Graduate School

APPROVAL OF THE DISSERTATION PROPOSAL[1]

Candidate _Martha Sutton_   Date _10/22/07_

Major _Educational Leadership_   Cognate _____

Dissertation Committee Chair _David Anderson_

TENTATIVE TITLE OF PROPOSED DISSERTATION

Effectiveness of Instruction and Delivery Methods for Preparing Competetent Dietitians Graduating from Accredited Coordinated Program in Dietetics.

COMMITTEE REPORT ON DISSERTATION PROPOSAL

After review of the dissertation proposal, the Doctoral Committee certifies that:

☒ The proposal is satisfactory and the candidate may proceed.

☐ The proposed research does not involve the use of human subjects OR

☐ The proposed research involves human subjects and will be sent to University Human Subjects Review Committee prior to data collection.

☐ The proposal is not satisfactory and the following deficiencies must be corrected.[2]

Description of deficiencies _____

COMMITTEE SIGNATURES

Chair _____

Member Representing the Graduate School _Polly Buchanan_

Member _____

Member _____

Member _Polly Buchanan_

Member _____

RECEIVED OCT 29 2007   Office of Records & Registration

GRADUATE SCHOOL APPROVAL

Date _10/25/07_   Graduate School _DL d. Jaski-Smith_

Signed original to Record's student file .Copies to: Graduate School, chair and department/college file

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[1] To be completed only after student has been officially notified of having passed the qualifying examination.

[2] After the deficiencies have been corrected, a new form must be submitted indicating that the proposal is satisfactory and the candidate may proceed. .

Appendix E: University Human Subjects Review Committee Approval Letter

EASTERN MICHIGAN UNIVERSITY

Education First

November 13, 2007

Martha Sutton
302 Everett L. Marshall Building
College of Health & Human Services Advising Center

Dear Martha Sutton:

The Human Subjects Institutional Review Board (IRB) of Eastern Michigan University
has granted approval to your proposal, "Effectiveness of Instruction and Delivery
Methods for Preparing Competent Dietitians Graduating from Accredited Coordinated
Programs in Dietetics."

After careful review of your completion application, the IRB determined that the rights
and welfare of the individual subjects involved in this research are carefully guarded.
Additionally, the methods used to obtain informed consent are appropriate, and the
individuals participating in your study are not at risk.

You are reminded of your obligation to advise the IRB of any change in the protocol that
might alter your research in any manner that differs from that upon which this approval is
based. Approval of this project applies for one year from the date of this letter. If your
data collection continues beyond the one-year period, you must apply for a renewal.

On behalf of the Human Subjects Committee, I wish you success in conducting your
research.

Sincerely,

Deb de Laski-Smith, Ph.D.
Interim Dean
Graduate School
Administrative Co-Chair
University Human Subjects Review Committee

Note: If project continues beyond the length of **one** year, please submit a continuation
request form by **11/14/08**.

Reference # 071018

Appendix F: Research Cover Letter

Subject: Dissertation Research to Study the Effectiveness of Selected Educational
Approaches in Accredited Dietetic Programs

I am a doctoral student in the School of Education at Eastern Michigan University. I am also a Registered Dietitian who is seeking your assistance in participating in a research project to study the effectiveness of specific educational approaches in dietetic programs. If you choose to assist me, you are being asked to complete a questionnaire regarding demographic and educational information, and your level of competence to work as a Registered Dietitian. By participating in this research, the results of this study have the potential to be very valuable in improving instructional methodology and overall curriculum development in dietetic professional educational programs on a national basis.

The total time to complete the survey should take approximately 10 minutes. To complete the survey, please refer to the following link:

http://survey.emich.edu/ms/dietetics_learning_final.htm

Upon assessing the link, you will be asked a series of questions related to your knowledge and skills needed to work as an entry level dietitian, overall course instruction, supervised learning experiences in both on-campus and on-line (if applicable) learning environments, and some test scores (RD exam score and GPA). There is no "right" or "wrong" answers. Although you are currently working as a professional registered dietitian, I am requesting to think back and reflect upon when you were enrolled as a student. *Your perspective as a former student is vitally important to assuring the validity and reliability of your responses.*

Information collected from this research survey will be held in the strictest confidence. At no time will your name be associated with your responses to the survey. There are no foreseeable risks to you by completing this survey, as all results will be kept completely confidential. Your participation in this study is voluntary. Regardless of your initial decision to participate, you may change your mind at any time and withdraw from the study without negative consequences. This research protocol has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee (Reference Number 071018).

Please accept my profound appreciation for your willingness to participate in this study. If you have any questions, or would like results from this survey please contact me at your earliest convenience and I will respond as quickly as possible.

Martha Sutton MS, RD
Assistant Dean, College of Health and Human Services
Eastern Michigan University
324 Everett L. Marshall Building
Ypsilanti, MI 48197
Phone: 734.487.0918
Email: msutton@emich.edu

Appendix G: Factor Analysis

Table 52

Factor Loadings (Varimax Normalized Rotation) of On-Campus Survey Items

	Components							
Item No.	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
10a	.616							
10b	.777							
10c	.894							
10d	.899							
10e	.861							
10f	.875							
6a		.760						
6b		.753						
6c		.807						
6d		.772						
6e		.783						
7b		.485						
7c		.449						
7e		.557						
5a			.760					
5b			.823					
5c			.821					
5d			.784					
5e			.797					
5f			.490					
11c			.530					
7d				.643				
9c				.578				
9d				.569				
10g				.581				
11a				.580				

Appendix G: Factor Analysis

Table 52

Factor Loadings (Varimax Normalized Rotation) of On-Campus Survey Items Continued

Components

Item No.	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
10a	.616							
10b	.777							
10c	.894							
10d	.899							
10e	.861							
10f	.875							
6a		.760						
6b		.753						
6c		.807						
6d		.772						
6e		.783						
7b		.485						
7c		.449						
7e		.557						
5a			.760					
5b			.823					
5c			.821					
5d			.784					
5e			.797					
5f			.490					
11c			.530					
7d				.643				
9c				.578				
9d				.569				
10g				.581				
11a				.580				

Appendix G: On-Campus Factor Analysis

Table 52

Factor Loadings (Varimax Normalized Rotation) of On-Campus Survey Items Continued

				Components				
Item No.	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
11b				.551				
11d				.622				
8b					.529			
8c					.775			
8e					.773			
8d						.597		
8f						.692		
9b						.689		
8g							.660	
9b							.606	
12f							-.396	
7a								.519
8a								.686

Appendix G: On-Line Factor Analysis

Table 53

Factor Loadings (Varimax Normalized Rotation) of On-Line Survey Items

			Components			
Item No.	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
10h	.557					
10i	.946					
10j	.949					
10k	.968					
10l	.928					
10m	.968					
10n	.589					
11f	.569					
5g		.615				
5h		.673				
5i		.805				
6f		.754				
6h		.642				
6i		.699				
7h		.695				
7i		.779				
9g		.764				
9h		.740				
11e		.489				
5j			.617			
5k			.558			
5l			.716			
6g			.659			
6j			.859			
7g			.879			
7j			.785			
8l			.520			

Appendix G: On-Line Factor Analysis

Table 53

Factor Loadings (Varimax Normalized Rotation) of On-Line Survey Items Continued

	Components					
Item No.	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
9f			-.496			
11g			.571			
8i				-.887		
8j				-.646		
8m					.473	
8n					.913	
9e					.434	
11h					.571	
7f						-.649
8h						.535
8k						.811

Appendix G: Factor Analysis On-Campus and On-Line

Table 54

Factor Loading of On-Campus and On-Line Survey Items in One Component

Item	Component
I learned nutrition cannot provide perfect answers to problems.	.699
I learned how the dietetics profession has changed over time.	.718
I learned how nutrition is influenced by people's values and opinions.	.727
I learned about the differences in nutrition by people in other cultures.	.567
I learned how today's human nutrition is different from nutrition of long ago.	.703

Appendix H: Paired Sample *t*-Tests

Table 55

Environment

	N	On-Campus Mean	On-Line Mean	Difference	*t*	*p**
Critical Voice						
I was comfortable complaining about anything that prevented me from learning.						
	49	3.73	3.51	.22	1.71	.094
I was comfortable expressing my opinion.						
	50	3.98	3.76	.22	1.80	.078
I was comfortable speaking up for my rights.						
	48	3.88	3.73	.15	1.36	.181
I was encouraged to negotiate and propose new policies if I felt the currently policies were not working.						
	42	3.19	3.12	.07	.48	.637
Shared Control						
I helped the professors plan what I learned.						
	45	2.44	2.47	-.022	-.178	.860
I helped the professors decide how well I was learning.						
	47	2.98	2.98	.000	.000	1.0
I helped the professor to decide which activities were best for me.						
	48	2.79	2.81	-.020	-.167	.868

* Significant at the 0.05 level

Appendix H: Paired Sample *t*-Tests Continued

Table 55

Environment

	N	On-Campus Mean	On-Line Mean	Difference	*t*	*p**
Shared Control						
I helped the professors to decide how much time I spent on activities.						
	47	2.66	2.66	.000	.000	1.00
I helped the professor assess my learning.						
	48	3.13	3.13	.000	.000	1.00
I was involved in evaluating my own work and setting my own goals.						
	47	3.30	3.40	-106	-1.04	.302
Professors adjusted their lesson plans based on results of homework assignments.						
	43	3.18	3.05	.140	1.00	.323
Behaviorist Environment						
The professor immediately told students the correct answers when they could not figure them out by themselves.						
	45	2.40	2.44	-.044	-.813	.420
Professors found it more effective to provide students with the information they need to know rather than encouraging them to experiment.						
	44	3.28	3.05	.227	1.76	.086

* Significant at the 0.05 level

Appendix H: Paired Sample *t*-Tests Continued

Table 56

Teaching Strategies

	N	On-Campus Mean	On-Line Mean	Difference	*t*	*p**
Behaviorist Schedules and Rules						
I learned best when there was a fixed schedule.						
	50	3.70	3.62	.080	.850	.399
It is more important for professors to set rules and policies than to let students make their own decisions.						
	51	3.25	3.16	.098	1.15	.255
It is important that professors enforce classroom policies once they are established.						
	47	4.04	4.00	.043	.496	.622
Behaviorist Curriculum and Assessment						
The professor made curriculum choices for students.						
	50	4.06	4.00	.060	1.00	.322
My grades were based primarily on homework, quizzes and test.						
	51	4.02	4.12	-.098	-.759	.451
In order to teach all necessary content and skills, the professor followed textbooks and other published material.						
	50	4.18	3.96	.220	1.80	.078
The professor used textbooks or guides to lead class discussion.						
	43	3.91	3.77	.140	1.29	.204
Constructivist Teaching						
Professors gave students time to work together when they were not having instructional time.						
	42	3.36	3.10	.262	1.72	.094
Professors encouraged collaboration among student to motivate them to learn more.						
	41	3.76	3.39	.366	1.85	.070

* Significant at the 0.05 level

Appendix I: Pearson Correlation Coefficient-Teaching Strategies On-Line

Table 57

	Type of Institution	Type of Program	Type of Delivery	Age	Construct Teaching-	Behav Curric and Assess	Behav Schedules and Rules
Type of Institution	1						
Type of Program	.022	1					
Type of Delivery	-.180	.094	1				
Age	.190	-.105	-.301	1			
Constructivist Teaching	.000	.136	-.328	-.056	1		
Behav Curr & Assessment	.029	-.002	.109	-.052	.129	1	
Behav Sched and Rules	.137	.024	.043	-.332	.314	.647	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix I: Pearson Correlation Coefficients-Teaching Strategies On-Campus

Table 58

	Type of Institution	Type of Program	Type of Delivery	Age	Construct Teaching-	Behav Curric & Assess	Behav Schedules & Rules
Type of Institution	1						
Type of Program	.022	1					
Type of Delivery	-.180	.094	1				
Age	.190	-.105	-.301	1			
Construct Teaching	.061	.072	.139	-.099	1		
Curriculum & Assess	-.037	-.014	.075	-.083	-.135	1	
Schedules & Rules	.034	.062	.164	-.185	.259	.277	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix I: Pearson Correlation Coefficient-Environment On-Campus

Table 59

	Type of Institution	Type of Program	Type of Delivery	Age	Critical Voice	Shared Control	Student Negot	Uncertain	Behav Environ
Type of Institution	1								
Type of Program	.022	1							
Type of Delivery	-.180	.094	1						
Age	.190	-.105	-.301	1					
Critical Voice	.054	.070	.109	-.086	1				
Shared Control	.010	.106	.135	-.130	.624	1			
Student Negotiation	-.041	.124	.102	-.091	.504	.417	1		
Uncertainty	-.056	.154	.174	-.036	.390	.348	.237	1	
Behav. Environment	-.137	-.054	-.007	-.040	-.315	-.261	-.319	-.191	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix I: Pearson Correlation Coefficients-Environment On-Line

Table 60

	Type of Institution	Type of Program	Type of Delivery	Age	Critical Voice	Shared Control	Student Negot	Behav Environ	Uncertain
Type of Institution	1								
Type of Program	.022	1							
Type of Delivery	-.180	.094	1						
Age	.190	-.105	-.301	1					
Critical Voice	.294	-.009	-.246	-.190	1				
Shared Control	.001	.200	-.296	-.191	.666	1			
Student Negotiation	.216	.108	-.218	.096	.623	.291	1		
Behav. Environment	.033	.026	.063	-.065	-0134	.010	.062	1	
Uncertainty	-.056	.154	.174	-.036	.206	.064	.087	.032	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed)

Appendix I: Pearson Correlation Coefficients-All Independent Variables-On-Campus

Table 61

	Type of Institution	Type of Program	Type of Delivery	Age	Critical Voice	Shared Control	Student Negot.	Behav Environ.	Uncertain	Construct Teaching	Behav Curric & Assess	Behav Schedule & Rules
Type of Institution	1											
Type of Program	.022	1										
Type of Delivery	-.180	.094	1									
Age	.190	-.105	-.301	1								
Critical Voice	.054	.070	.109	-.086	1							
Shared Control	.010	.106	.135	-.130	.624	1						
Student Negotiation	-.041	.124	.102	-.091	.504	.417	1					
Behaviorist Environment	-.137	-.054	-.007	-.040	-.315	-.261	-319	1				
Uncertainty	-.056	.154	.174	-.036	.390	.348	.327	-.191	1			
Constructivist Teaching	.061	.072	.139	-.099	.664	.717	.588	-.313	.423	1		

Curric & Assessment	-.037	-.014	.075	-.083	-.067	-.133	-.028	.200	.005	-.135	1
Schedule & Rules	.034	.062	.164	-.185	.202	.160	.247	.010	.230	.259	.277	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Appendix J: Multiple Regression Analysis with Interaction Effects on Environment

Figure 4. Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, and Teaching Strategies (with Interaction Effects) on Environment

Appendix K: Multiple Regression (Critical Voice)

Table 62

Multiple Regression Analysis of Age, Type of Program, Type of Delivery Method, Type of

Institution, and Constructivist Teaching Strategies (with Interaction Effects) on Critical Voice

Dependent Variable = Critical Voice	Standardized Coefficient β	t	Sig.	VIF
Type of Institution and Constructivist Teaching Strategies	.670	13.76	.000	1.00
F	189.25		.000	
Adjusted R^2	.447			

Using the backward method, a significant model emerged ($F_{1,233}$ = 189.25, p <0.0005). R^2 indicates that 44.7% of the variance in critical voice can be explained by the combined effect of type of institution and constructivist teaching strategies. F = 1 independent variable, with 233 total responses in this study. Multicollinearity (VIF = 1.000) is not a problem since the type of institution (public or private) and constructivist teaching is not correlated with other predictor variables.

The type of institution (public or private) attended and constructivist teaching strategies had a significant effect and strong impact on critical voice (p <0.000, β = .670).

Appendix K: Multiple Regression (Shared Control)

Table 63
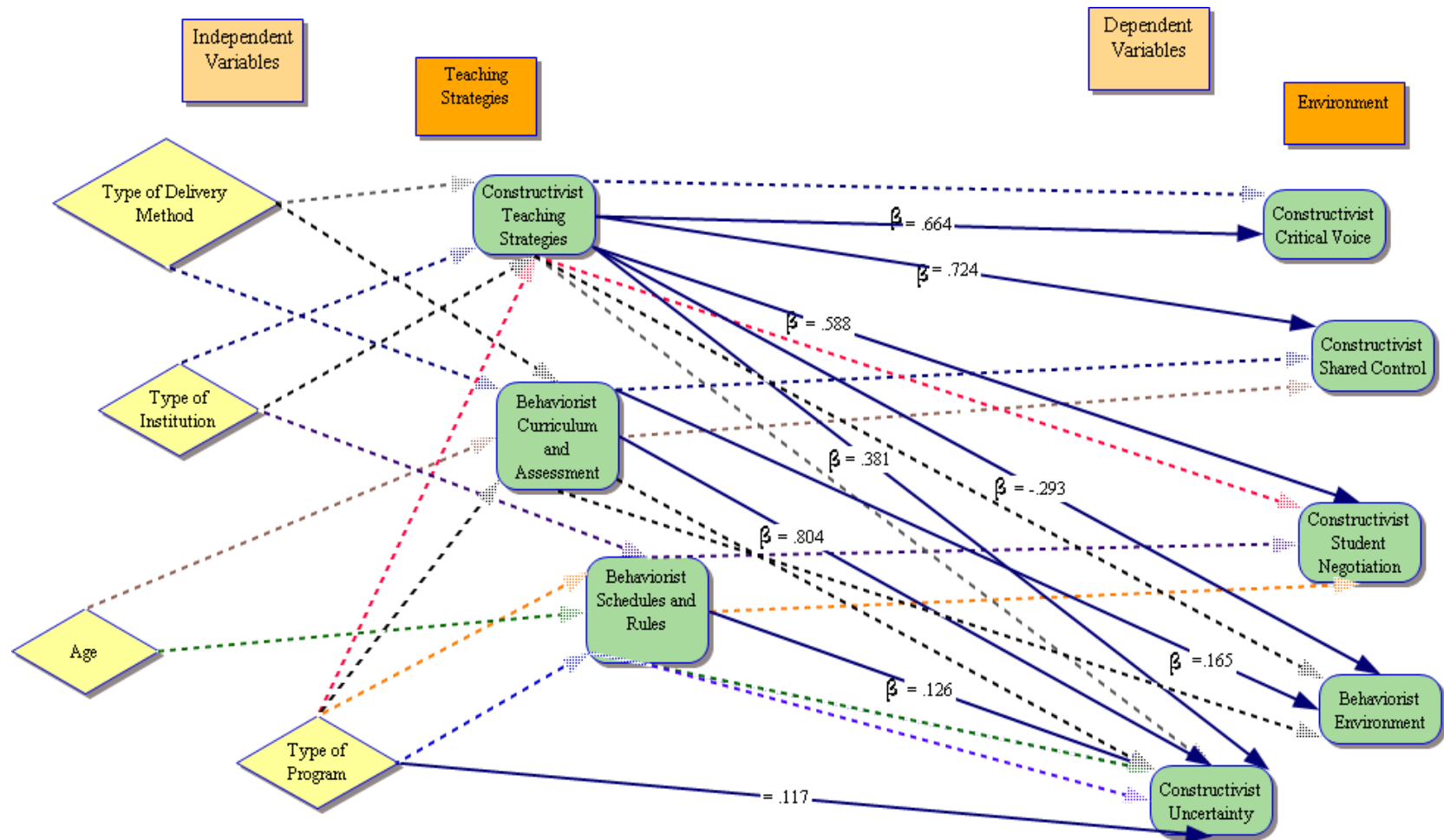
Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery and Teaching Strategies (Curriculum and Assessment with Interaction Effects) on Shared Control

Dependent Variable = Shared Control	Standardized Coefficient β	t	Sig.	VIF
Constructivist Teaching	.715	16.27	.000	1.03
Age with Curriculum and Assessment Teaching Strategies	.473	2.77	.006	15.44
Type of Delivery Method with Curriculum and Assessment Teaching Strategies	-.510	-2.98	.003	15.48
F	95.79			
Adjusted R^2	.536			

Using the backward method, a significant model emerged ($F_{3, 246} = 95.79$, $p < 0.0005$). R^2 indicates that 53.6% of the variance in shared control can be explained by constructivist teaching strategies. $F = 3$ independent variables, with 246 total number of participants in this study. Constructivist teaching had a great impact and a significant effect on shared control ($β = .715$, $p < 0.000$). Age and behaviorist curriculum/assessment teaching strategies had a significant effect on shared control. Type of delivery method and behaviorist curriculum/assessment teaching strategies had a significant negative effect on shared control ($β = -.510$, $p < 0.003$). Although these predictor variables indicated a multicollinearity problem, when the files were split, the VIF levels were < 4.0.

Appendix K: Multiple Regression (Student Negotiation)

Table 64

Multiple Regression Analysis of Age, Type of Institution, Type of Delivery Method, Type of

Program, and Teaching Strategies (Constructivist with Interaction Effects) on Student

Negotiation

Dependent Variable = Student Negotiation	Standardized Coefficient β	t	Sig.	VIF
Type of Program and Constructivist Teaching Strategies	.612	12.10	.000	1.00
F	146.33		.000	
Adjusted R^2	.372			

Using the backward method, a significant model emerged ($F_{1, 245} = 146.33$, $p < 0.0005$). R^2

indicates that 37.2% of the variance in student negotiation can be explained by the combined

effect of type of program and constructivist teaching strategies. $F = 2$ independent variables, with

245 total number of responses in this study.

Type of program (coordinated vs. didactic) attended and constructivist teaching strategies

had a significant effect and moderate impact on student negotiation ($p < 0.000$, β = .612).

Appendix K: Multiple Regression (Student Negotiation)

Table 65

Multiple Regression Analysis of Age, Type of Institution, Type of Delivery Method, Type of Program, and Teaching Strategies (Behaviorist Schedules and Rules with Interaction Effects) on Student Negotiation

Dependent Variable = Student Negotiation	Standardized Coefficient β	*t*	Sig.	VIF
Constructivist Teaching Strategies	.567	10.67	.000	1.08
Type of Program and Behaviorist Schedules and Rules Teaching Strategies	.408	2.69	.008	8.84
Type of Institution and Behaviorist Schedules and Rules Teaching Strategies	-.303	-1.99	.048	8.95
F	47.45		.000	
Adjusted R^2	.363			

Using the backward method, a significant model emerged ($F_{3, 245} = 47.45$, $p < 0.0005$). R^2 indicates that 36.3% of the variance in student negotiation can be explained by the combined influence of constructivist teaching strategies and the combined effect of type of program and behaviorist schedules/rules teaching strategies, and the combined effect of type of institution and behaviorist schedules/rules teaching strategies. $F = 3$ independent variables, with 245 total number of responses in this study.

Constructivist teaching strategies has a moderate impact on student negotiation ($β = .567$). Type of program (coordinated vs. didactic) attended and behaviorist schedules and rules teaching strategies had a significant effect on student negotiation ($p < 0.008$). Type of institution (public vs. private) attended and the behaviorist schedules and rules teaching strategies had a significant effect on student negotiation ($p < 0.048$).

Appendix K: Multiple Regression (Uncertainty)

Table 66

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, and Teaching Strategies (Constructivist with Interaction Effects) on Uncertainty

Dependent Variable = Uncertainty	Standardized Coefficient β	t	Sig.	VIF
Behaviorist Schedule and Rules Teaching Strategies	.134	2.29	.023	1.06
Type of Program	.117	2.05	.041	1.01
Type of Delivery Method and Constructivist Teaching Strategies	.396	6.77	.000	1.06
F	22.83			
Adjusted R^2	.211			

Using the backward method, a significant model emerged ($F_{3, 245} = 22.83$, $p < 0.0005$). R^2 indicates that 21.1% of the variance in uncertainty can be explained by the combined influence of behaviorist schedules and rules teaching strategies, type of program, and the combined effect of type of delivery method and constructivist teaching strategies. $F = 3$ independent variables, with 245 total number of participants in this study. Even though the predictor variables are correlated with each other, the common rule of thumb is that only when VIF > 4.0 does it indicate a multicollinearity problem.

Type of program had a significant effect on the constructivist scale of uncertainty ($p < 0.000$). Behaviorist schedules and rules teaching strategies had a significant effect on uncertainty ($p < 0.023$). Type of delivery method (on-line or on-campus) and constructivist teaching strategies had a significant effect on uncertainty ($p < 0.000$).

Appendix K: Multiple Regression (Uncertainty)

Table 67

Multiple Regression Analysis of Age, Type of Institution, Type of Delivery Method, Type of Program, and Teaching Strategies (Behaviorist Schedules and Rules Interaction Effects) on Uncertainty

Dependent Variable = Uncertainty	Standardized Coefficient β	t	Sig.	VIF
Constructivist Teaching	.353	6.04	.000	1.09
Type of Program and Behaviorist Schedule and Rules Teaching Strategies	.692	4.22	.000	8.61
Age and Behaviorist Schedule and Rules Teaching Strategies	-.542	-3.35	.001	8.37
F	25.88			
Adjusted R^2	.233			

Using the backward method, a significant model emerged ($F_{3,245}$ = 25.88, p <0.0005). R^2 indicates that 23.3% of the variance in uncertainty can be explained by the combined influence of constructivist teaching strategies and the combined effect of type of program and behaviorist schedules and rules teaching strategies, and the combined effect of age and behaviorist schedules and rules teaching strategies. F = 3 independent variables, with 245 total number of responses in this study.

Constructivist teaching strategies had a significant effect on uncertainty (p <0.000). Type of program (coordinated vs. didactic) attended and behaviorist schedules and rules teaching strategies had a significant effect and strong impact on uncertainty (p <0.000, β = .692). Age and behaviorist schedules/rules teaching strategies had a significant effect on uncertainty (p <0.001).

Appendix K: Multiple Regression (Uncertainty)

Table 68

Multiple Regression Analysis of Age, Type of Institution, Type of Delivery, Type of Program, and

Teaching Strategies (Behaviorist Curriculum and Assessment Interaction Effects) on Uncertainty

Dependent Variable = Uncertainty	Standardized Coefficient β	*t*	Sig.	VIF
Type of Program	.124	2.18	.030	1.01
Behaviorist Curriculum and Assessment Teaching Strategies	.804	2.49	.013	32.13
Constructivist Teaching Strategies	.405	6.97	.000	1.04
Type of Delivery Method and Behaviorist Curriculum and Assessment Teaching Strategies	-.748	-2.31	.022	32.33
F	16.61			
Adjusted R^2	.202			

A significant model emerged ($F_{4,246} = 16.61$, $p < 0.0005$). R^2 indicates that 20.2% of the

variance in uncertainty can be explained by the combined influence of type of program,

behaviorist curriculum and assessment teaching strategies, constructivist teaching strategies and

the combined effect of type of delivery method and behaviorist curriculum and assessment

teaching strategies.

Constructivist teaching strategies had a significant effect on uncertainty ($p < 0.000$). Type of

program had a significant effect on uncertainty ($p < 0.030$). Behaviorist curriculum/assessment

teaching strategies had a significant effect on uncertainty ($p < 0.013$). Type of delivery method

(on-line vs. on-campus) and behaviorist curriculum/assessment teaching strategies had a

significant effect and strong negative impact on uncertainty ($p < 0.022$, $β = -.748$).

Appendix K: Multiple Regression (Behaviorist Environment)

Table 69

Multiple Regression Analysis of Age, Type of Program, Type of Delivery Method, Type of Institution, and Teaching Strategies (Constructivist with Interaction Effects) on Behaviorist Environment

Dependent Variable = Behaviorist Environment	Standardized Coefficient β	t	Sig.	VIF
Type of Institution	-.120	-1.99	.048	1.00
Behaviorist Curriculum and Assessment Teaching Strategies	.166	2.76	.006	1.02
Type of Institution and Constructivist Teaching Strategies	-.295	-4.92	.000	1.02
F	13.56		.000	
Adjusted R^2	.133			

Using the backward method, a significant model emerged ($F_{3, 245} = 13.56$, $p < 0.0005$). R^2 indicates that 13.3% of the variance in behaviorist environment can be explained by the combined influence of type of institution, behaviorist curriculum/assessment teaching strategies, and the combined effect of type of institution and constructivist teaching strategies. $F = 3$ independent variables, with 245 total number of participants in this study.

Type of institution (public vs. private) attended had a significant negative effect on behaviorist environment ($p < 0.048$). Behaviorist curriculum/assessment teaching strategies had a significant effect on behaviorist environment ($p < 0.006$). Type of institution (public vs. private) attended and constructivist teaching strategies had a significant negative effect on behaviorist environment ($p < 0.000$).

Appendix K: Multiple Regression (Behaviorist Environment)

Table 70

Multiple Regression Analysis of Age, Type of Delivery Method, Type of Program, Type of

Institution, and Teaching Strategies (Behaviorist Curriculum and Assessment with Interaction

Effects) on Behaviorist Environment

Dependent Variable = Behaviorist Environment	Standardized Coefficient β	t	Sig.	VIF
Constructivist Teaching Strategies	-.285	-4.74	.000	1.02
Type of Program with Behaviorist Curriculum and Assessment Teaching Strategies	.190	3.16	.002	1.02
F	18.93			
Adjusted R^2	.127			

Using the backward method, a significant model emerged ($F_{2, 246} = 18.93$, $p < 0.0005$). R^2

indicates that 12.7% of the variance in behaviorist environment can be explained by the

combined influence of constructivist teaching strategies, and the combined effect of type of

program and behaviorist curriculum/assessment teaching strategies. $F = 2$ independent variables,

with 246 total number of participants in this study. Even though the predictor variables are

correlated with each other, the common rule of thumb is that only when VIF > 4.0 does it

indicate a multicollinearity problem.

Constructivist teaching strategies had a significant negative effect on behaviorist

environment ($p < 0.000$). Type of program (coordinated vs. didactic) and behaviorist

curriculum/assessment teaching strategies had a significant effect on behaviorist environment (p

< 0.002).

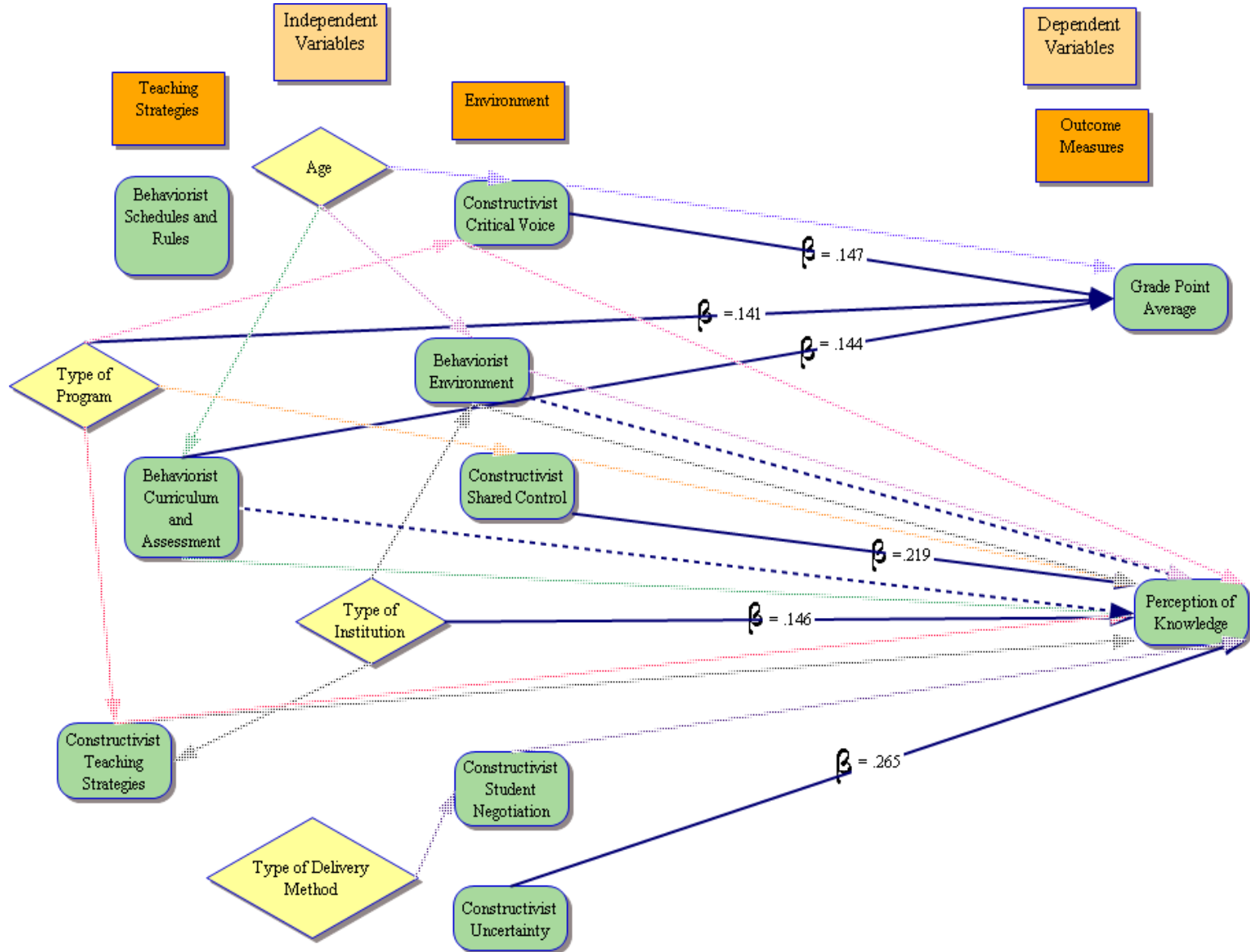Appendix L: Multiple Regression Analysis with Interaction Effects on Perception of Knowledge and GPA

Figure 6. Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery, Teaching Strategies, and Environment (With Interaction Effects) on Perception of Knowledge and Grade Point Average

Appendix M: Multiple Regressions (Perception of Knowledge)

Table 71

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Environment, and Teaching Strategies (Constructivist with Interaction Effects) on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	t	Sig.	VIF
Shared Control	.202	2.37	.019	2.06
Uncertainty	.269	4.08	.000	1.24
Type of Institution	.163	2.70	.007	1.03
Type of Institution and Constructivist Teaching Strategies	.412	2.27	.024	9.37
Type of Program and Constructivist Teaching Strategies	-.393	-2.16	.032	9.42
F	11.12		.000	
Adjusted R^2	.178			

Using the backward method, a significant model emerged ($F_{5, 233} = 11.12$, $p < 0.000$). R^2 indicates that 17.8% of the variance in perception of knowledge can be explained by the combined influence of shared control, type of institution, and uncertainty, the combined effect of type of institution and constructivist teaching strategies, and the combined effect of type of program and constructivist teaching strategies.

Shared control had a significant effect on perception of knowledge ($p < 0.019$). Uncertainty had a significant effect on perception of knowledge ($p < 0.000$). Type of institution (public vs. private) had a significant effect on perception of knowledge ($p < 0.007$).

Appendix M: Multiple Regressions (Perception of Knowledge)

Table 72

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Environment, and Teaching Strategies (Behaviorist Curriculum and Assessment with Interaction Effects) on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	t	Sig.	VIF
Shared Control	.243	3.85	.000	1.19
Uncertainty	.271	4.37	.000	1.16
Type of Institution	.147	2.55	.012	1.01
Age and Behaviorist Curriculum and Assessment Teaching Strategies	-.499	-2.18	.031	15.76
Type of Delivery Method and Behaviorist Curriculum and Assessment Teaching Strategies	.542	2.35	.019	15.92
F	11.79		.000	
Adjusted R^2	.180			

A significant model emerged ($F_{5, 246} = 11.79$, $p < 0.000$). R^2 indicates that 18% of the variance in perception of knowledge can be explained by the combined influence of shared control, type of institution, uncertainty, the combined effect of age and behaviorist curriculum and assessment teaching strategies, and the combined effect of type of delivery method and behaviorist curriculum and assessment teaching strategies. Shared control had a significant effect on perception of knowledge ($p < 0.000$). Uncertainty had a significant effect on perception of knowledge ($p < 0.000$). Type of institution (public vs. private) had a significant effect on perception of knowledge ($p < 0.012$).

Appendix M: Multiple Regressions (GPA)

Table 73

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment (Constructivist Critical Voice with Interaction Effects) on Grade Point Average

Dependent Variable = Grade Point Average	Standardized Coefficient β	t	Sig.	VIF
Behaviorist Curriculum and Assessment Teaching Strategies	.143	2.24	.026	1.00
Type of Program	.143	2.23	.027	1.00
Age and Critical Voice	.152	2.37	.019	1.01
F	5.16		.002	
Adjusted R^2	.051			

Using the backward method, a significant model emerged ($F_{3, 233} = 5.16$, $p < 0.002$). R^2 indicates that 5.1% of the variance in grade point average can be explained by the combined influence of behaviorist curriculum and assessment teaching strategies, type of program and the combined effect of age and critical voice. $F = 3$ independent variables, with 233 total number of participants in this study. Even though the predictor variables are correlated with each other, the common rule of thumb is that only when VIF > 4.0 does it indicate a multicollinearity problem.

Behaviorist curriculum and assessment teaching strategies had a significant effect on grade point average ($p < 0.026$). Type of program (coordinated vs. didactic) had a significant effect on grade point average ($p < 0.027$).

Appendix M: Multiple Regressions (Perception of Knowledge)

Table 74

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment (Constructivist Critical Voice with Interaction Effects) on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	t	Sig.	VIF
Uncertainty	.282	4.52	.000	1.09
Type of Institution	.141	2.36	.019	1.01
Type of Program and Critical Voice	.221	3.54	.000	1.01
F	16.90		.000	
Adjusted R^2	.170			

Using the backward method, a significant model emerged ($F_{3, 233} = 16.90$, $p < 0.000$). R^2 indicates that 17% of the variance in perception of knowledge can be explained by the combined influence of uncertainty, type of institution and the combined effect of type of program and critical voice. $F = 3$ independent variables, with 233 total number of participants in this study. Even though the predictor variables are correlated with each other, the common rule of thumb is that only when VIF > 4.0 does it indicate a multicollinearity problem.

Uncertainty had a significant effect on perception of knowledge ($p < 0.000$). Type of program (coordinated vs. didactic) had a significant effect on perception of knowledge ($p < 0.019$).

Appendix M: Multiple Regressions (Perception of Knowledge)

Table 75

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment (Constructivist Shared Control with Interaction Effects) on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	t	Sig.	VIF
Uncertainty	.283	4.60	.000	1.09
Type of Institution	.147	2.48	.014	1.00
Type of Program and Shared Control	.221	3.59	.000	1.09
F	17.23		.000	
Adjusted R^2	.170			

Using the backward method, a significant model emerged ($F_{3, 237} = 17.23$, $p < 0.000$). R^2 indicates that 17% of the variance in perception of knowledge can be explained by the combined influence of uncertainty, type of institution and the combined effect of type of program and shared control. $F = 3$ independent variables, with 237 total number of participants in this study. Even though the predictor variables are correlated with each other, the common rule of thumb is that only when VIF > 4.0 does it indicate a multicollinearity problem.

Uncertainty had a significant effect on perception of knowledge ($p < 0.000$). Type of program (coordinated vs. didactic) had a significant effect on perception of knowledge ($p < 0.014$).

Appendix M: Multiple Regressions (Perception of Knowledge)

Table 76

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment (Constructivist Uncertainty with Interaction Effects) on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	t	Sig.	VIF
Shared Control	.221	3.58	.000	1.13
Type of Institution	.149	2.55	.011	1.01
Age and Uncertainty	.276	4.46	.000	1.13
F	18.12		.000	
Adjusted R^2	.173			

Using the backward method, a significant model emerged ($F_{3, 245} = 18.12$, $p < 0.000$). R^2 indicates that 17.3% of the variance in perception of knowledge can be explained by the combined influence of shared control, type of institution, and the combined effect of age and uncertainty. $F = 3$ independent variables, with 245 total number of participants in this study. Even though the predictor variables are correlated with each other, the common rule of thumb is that only when VIF > 4.0 does it indicate a multicollinearity problem.

Shared control had a significant effect on perception of knowledge ($p < 0.000$). Type of institution (public vs. private) had a significant effect on perception of knowledge ($p < 0.011$). Age and uncertainty had a significant effect on perception of knowledge ($p < 0.000$.)

Appendix M: Multiple Regressions (Perception of Knowledge)

Table 77

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery

Method, Teaching Strategies, and Environment (Constructivist Student Negotiation with

Interaction Effects) on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	*t*	Sig.	VIF
Shared Control	.200	3.21	.001	1.17
Uncertainty	.253	4.08	.000	1.16
Type of Institution	.145	2.51	.013	1.00
Type of Delivery Method and Student Negotiation	.143	2.44	.016	1.03
F	14.87		.000	
Adjusted R^2	.184			

Using the backward method, a significant model emerged ($F_{4, 246} = 14.87$ $p < 0.000$). R^2 indicates that 18.4% of the variance in perception of knowledge can be explained by the combined influence of shared control, uncertainty, type of institution, and the combined effect of type of delivery method and student negotiation. $F = 4$ independent variables, with 246 total number of participants in this study. Even though the predictor variables are correlated with each other, the common rule of thumb is that only when VIF > 4.0 does it indicate a multicollinearity problem.

Shared control had a significant effect on perception of knowledge ($p < 0.001$). Uncertainty had a significant effect on perception of knowledge ($p < 0.000$). Type of institution (public vs. private) had a significant effect on perception of knowledge ($p < 0.013$).

Appendix M: Multiple Regressions (Perception of Knowledge)

Table 78

Multiple Regression Analysis of Age, Type of Program, Type of Institution, Type of Delivery Method, Teaching Strategies, and Environment (Behaviorist with Interaction Effects) on Perception of Knowledge

Dependent Variable = Perception of Knowledge	Standardized Coefficient β	t	Sig.	VIF
Shared Control	.210	3.38	.001	1.20
Uncertainty	.256	4.19	.000	1.17
Behaviorist Environment	.616	2.79	.006	15.22
Type of Institution	.158	2.70	.007	1.07
Type of Institution and Behaviorist Environment	.157	2.41	.017	1.33
Age and Behaviorist Environment	-.756	-3.43	.001	15.16
F	12.05		.000	
Adjusted R^2	.212			

Using the backward method, a significant model emerged ($F_{6, 246} = 12.05$ $p < 0.000$). R^2 indicates that 21.2% of the variance in perception of knowledge can be explained by the combined influence of shared control, uncertainty, behaviorist environment, type of institution, and the combined effect of type of institution and behaviorist environment, and the combined effect of age and behaviorist environment. Shared control had a significant effect on perception of knowledge ($p < 0.001$). Uncertainty had a significant effect on perception of knowledge ($p < 0.000$). Type of institution (public vs. private) had a significant effect on perception of knowledge ($p < 0.013$).

Appendix N: Registration Examination for Dietitians

Test Specifications for the Registration Examination for Dietitians

Content of the Examination	Percent of Exam
I. Food and Nutrition	15%
A. Food Science, Food Safety, Nutrient Composition of Foods	
B. Nutrition and Supporting Sciences	
II. Clinical and Community Nutrition	40%
A. Nutrition Screening and Assessment	
B. Normal Nutrition/Health Promotion/Disease Prevention	
C. Medical Nutrition Therapy	
III. Education and Research	7%
A. Counseling	
B. Education and Training	
C. Research	
IV. Food and Nutrition Systems	18%
A. Menu Planning	
B. Purchasing, Production, Distribution and Service	
C. Safety and Sanitation	
D. Facility Planning	
V. Management	20%
A. Human Resources	
B. Finance and Materials	
C. Marketing Products and Services	
D. Functions and Characteristics	
E. Quality Improvement	