

EFFECT OF LEARNING PREFERENCE ON PERFORMANCE IN AN ONLINE  
LEARNING ENVIRONMENT AMONG NUTRITION PROFESSIONALS

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Emily Laura Myatt

Effect of Learning Preference on Performance in an Online Learning  
Environment among Nutrition Professionals

**Background:** Online courses in healthcare programs like Dietetics have increased in availability and popularity.

**Objective:** The purpose of this study was to investigate the connections between online learning environments and Myers-Briggs Type Indicator (MBTI) dimensions among Nutrition Professionals. This research will add to the knowledge base of educators responsible for the design and development of online nutrition courses and will enhance Nutrition Professionals' academic and professional outcomes.

**Design:** Semi-experimental study design.

**Subjects/Setting:** Thirty-one Nutrition Professionals with mean age of 29 years old. All elements of the study were done online.

**Statistical Analysis:** MBTI dimension summaries were done for descriptive statistics. Fisher's Exact Test was used to compare frequency of MBTI dimensions in the learning modules (LM) and to analyze learning modality preference based on MBTI dimensions. Two-Sample T-Tests compared test scores for LM groups and test scores for extraverts and introverts. Paired T-Test assessed improvement in test scores related to LM preference. Chi-Square Test compared preferences for the second learning module for both LM groups.

**Results:** The majority of participants' MBTIs were ESFJ at 35% or ISFJ at 19%. There were more extraverts (71%) compared to introverts (29%). Both LM groups had similar MBTI dimensions. Extraverts and introverts had similar improvements in scores and LM preferences. LM groups performed similarly and in general participants preferred the second learning module they were assigned. Preference for the second LM could be because participants enjoyed the first LM and wanted to learn more information. Both LM groups significantly improved their scores ( $P < .0001$ ) in their first and second learning modules regardless of learning module design. Participants were highly motivated to learn as evidenced by their enrollment in this study and completion of 10 hours of learning modules. Motivation to learn may have been the strongest reason performance significantly improved.

**Conclusion:** LM groups significantly improved their LM scores and learned similar amounts. MBTI dimensions extravert and introvert and preferred learning modality had limited impact on performance for this sample of Nutrition Professionals. These results indicate that motivation may be the key to increasing performance in online nutrition courses.

Judith A. Ernst, D.M.Sc., RD, Chair

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## Definition of Terms

These five terms: Nutrition Professional, learning style, learning modality, Myers-Briggs Type Indicator, and Myers-Briggs Type Indicator dimensions appear throughout the research study. Below these terms are defined by how they are used in the study.

- Nutrition Professional refers to someone who at a minimum has a undergraduate degree with a major in Dietetics and/or is a Registered Dietitian.
- Learning modality refers to the design and delivery of course or module content.
- Learning style refers to how students begin to concentrate, process, and internalize new academic information.<sup>13</sup>
- Myers-Briggs Type Indicator is a questionnaire designed to measure psychological preferences in how people perceive the world and make decisions.<sup>9</sup>
- Myers-Briggs Type Indicator dimensions are the individual preferences: extraversion, introversion, sensing, intuition, thinking, feeling, judging, and perceiving that make up the Myers-Briggs Type Indicator.<sup>9</sup>



## **Chapter One**

### **Introduction**

The learning landscape for Nutrition Professionals has changed for primary professional and continuing professional education that are mandated for registration and licensure. Online courses in healthcare programs, like dietetics, are becoming a new standard for course delivery in higher education systems. Online delivery of continuing professional education (CPE) hours is also popular among Registered Dietitians. This change toward an online learning environment resulted in the inquiry of effectiveness and preference of online learning modalities for Nutrition Professionals. Prior to the investment of significant human and monetary resources into the design of complex online course components, it is prudent to determine whether tailoring online course design to learning style preferences will improve learning.

Those employed in the delivery of health services tend to be compassionate care givers and therefore may logically prefer and excel in one type of learning modality. The Myer-Briggs Type Indicator (MBTI) provides a reliable method of identifying personality traits. Dietetic students, both nationally (USA) and locally (Indiana), who took the MBTI, were categorized predominately as sensing, feeling, judging personality types with a fairly even split between introversion and extraversion. The study, which is the focus of this report, was designed to determine if Nutrition Professional's personality traits such as extraversion or introversion can be linked to learning preferences and performance when presented with differently designed online learning modules.

The results of this study will add to the knowledge base of educators responsible for online nutrition course design and development and will enhance academic and professional outcomes for Nutrition Professionals.

## **Review of the Literature**

### **Online Learning Opportunities for Nutrition Professionals**

Dietetic students have opportunities to obtain their undergraduate degree and graduate degree using online or distance education programs. There are currently five universities, accredited by Accreditation Council for Education in Nutrition and Dietetics, that offer partial or complete online degree programs in Dietetics.<sup>1</sup> These programs started in the late 1990's to early 2000's to accommodate the increasing interest and popularity of distance education.

Registered Dietitians are required to complete 15 CPE hours each year to achieve 75 CPE hours every five years in order to maintain licensure and registration. Prior to the development of online resources, Registered Dietitians attended conferences, lectures, and journal clubs to complete the majority of their CPE hours. Online resources such as online exhibits, webinars, online journal clubs, online professional reading, and pre-approved online materials offer a larger variety of topics and can be completed from work or home.<sup>2</sup> The Professional Development Portfolio that Registered Dietitians use to track and submit CPE hours has also changed to an online format.

### **Online Courses in Higher Learning Establishments**

Online courses have secured a role in higher learning establishments. Approved Colleges did a study from 2012 to 2013 on online education opportunities and reported that there are 1,243 schools that offer online degree programs.<sup>3</sup> Online programs for Master's degrees were 29% of the total

programs available.<sup>3</sup> This was the largest percentage and indicates a natural match of degree offering to the demographic best served by online education: the adult student.<sup>3</sup>

Online courses are attractive for students and professors because they offer flexibility and are not restricted by time or place. An online venue has made it possible for an entirely new student population to learn a subject and obtain a degree with less reliance on traditional classroom settings. *Going the Distance: Online Education in the United States, 2011*, is a collaborative effort between the Babson Survey Research Group and the College Board based on responses from over 2,500 academic leaders. According to this survey<sup>4</sup>:

- “Sixty-five percent of all reporting institutions said that online learning was a critical part of their long-term strategy, a small increase from sixty-three percent in 2010.”<sup>4(p.4)</sup>
- “Online enrollment as a percentage of total enrollment has increased from 9.6% to 31.3% from 2002 to 2010.”<sup>4(p.11)</sup>

Health and Medicine education programs make up the second largest percentage of online programs at 16% of the total.<sup>3</sup> Online enrollment in healthcare related programs, like Dietetics, has remained fairly stable at 31% in 2010 and 30.8% in 2011.<sup>4</sup>

### **Effectiveness of Online Courses**

The majority of academic leaders believe that online courses are effective. Two-thirds of academic leaders surveyed in 2011 reported online courses were “just as good” as face-to-face courses and perceived student satisfaction for

online course and face-to-face courses to be about the same.<sup>4</sup>

Online instruction for health professionals is effective and comparable to traditional style instruction. A meta-analysis by Cook, et al. called *Internet-Based Learning in Health Professions*, considered studies on Internet based instruction for health profession students compared to no intervention and with non-Internet interventions.<sup>5</sup> Studies that compared Internet intervention with no intervention essentially asked if an Internet based course on a particular topic would be effective. The answer to this question was yes; results showed that Internet based instruction was associated with large positive effects compared to no intervention.<sup>5</sup>

Studies that compared Internet based courses to traditional courses to determine if one was thought to be superior, provided varied results. Some studies favored the Internet and others favored traditional.<sup>5</sup> On average there was little difference between the effectiveness of the two formats.<sup>5</sup> These findings support that internet based instruction for health professionals is effective, but neither superior nor inferior to traditional methods.<sup>5</sup>

### **Online Learning and the Adult Student**

Older adults may perform better and have more positive perceptions of online courses. A study by Irani T, et al. in 2003 assessed 39 graduate students' course perceptions and performance in an online agricultural leadership course.<sup>6</sup> The age of the subjects ranged from 21 years to 54 years, with the mean age being 33 years old.<sup>6</sup> Age showed a strong correlation with both performance

indicators and course perceptions.<sup>6</sup> Older adult students tended to have more positive perceptions of the course and performed better than younger adult students.<sup>6</sup> Two possible explanations for this is that older adults have a stronger intent to learn and are accustomed to learning in a variety of ways, whereas younger adult students are familiar with more traditional course settings.

### **Improving Student's Intent to Learn in an Online Environment**

Increasing student's intent to learn will improve their ability to learn in online courses. Randall S. Davies wrote a chapter called, *Learner Intent and Online Learning* in the book *Research on Enhancing Interactivity of Online Learning*.<sup>7</sup> Davies reported that online courses tend not to produce learning unless the participating student's main intention was to learn.<sup>7</sup>

“When the design of an online course deliberately or inadvertently promotes course completion as a primary goal, students often abandon any real intention of learning. To increase learning from students the course needs to focus on learning as the primary goal with course completion dependent on student learning instead of task completion.”<sup>7(p.5)</sup>

To obtain additional information on increasing learning, Davies interviewed students who recently completed an online course. The interviews suggested that reflection on why a particular course was important increased the intent to learn.<sup>7</sup> Other important findings from Davies's interviews were that learning was enhanced when: 1) the instructor was available via chat, email, or phone, 2) video clip technology was used to explain complicated information, 3) guest speaker presentations were added to the class, 4) a variety of formats were used for assignments.<sup>7(p.6)</sup>

Increasing student engagement in online courses also improves learning. Cook, et al. 2006 compared two differently designed online learning modules completed by 121 medical residents.<sup>8</sup> The medical residents significantly preferred online learning modules that utilized self-assessment questions that provided feedback over online learning modules that utilized web-pages of text and tables with hyperlinks to additional online resources.<sup>8</sup> Medical residents who answered the self-assessment questions also performed better in the learning modules.<sup>8</sup> Engaging students in “active” learning improved their retention of material and how much they learned.

Designing a course based on students’ learning preferences can improve learning. Education researchers hypothesize that people have different learning styles and therefore an understanding of how different students learn could significantly improve learning from online courses. One method of understanding how students prefer to learn is to understand their personality type.

### **Myers-Briggs Type Indicator: an Assessment of Personality Type**

The Myers-Briggs Type Indicator (MBTI) is a valid and reliable instrument for assessment of personality type. The MBTI assessment is a questionnaire designed to measure psychological preferences related to how people perceive the world and make decisions.<sup>9</sup> The psychological preferences were extrapolated from C. G. Jung’s theory of psychological type and developed by Isabel Briggs Myers and Katharine Briggs. The MBTI has four dichotomous preferences: extraversion/introversion, sensing/intuition, thinking/feeling, and

judgment/perception. The personality types identified indicate a person's preference on each of the four categories<sup>9,10,11</sup>:

- Extraversion (E) / Introversion (I): Focused on where a person concentrates their attention and how they re-energize. Extraverts focus on the outer world of people and being around other people re-energizes them. Introverts focus on their inner world of ideas and prefer alone time to re-energize.
- Sensing (S) / Intuition (N): Focused on how a person takes in information. A sensing person prefers to absorb information from the five senses. An intuitive person processes information by seeing the "big picture" and adding meaning.
- Thinking (T) / Feeling (F): Focused on how a person makes decisions. A thinking preference will look at logical consequences of a decision. A feeling preference considers what is most important to the people involved and potential impact on other people.
- Judging (J) / Perceiving (P): Focused on how a person orients toward the outer world. The judging preference prefers to live in a planned, orderly way, wanting to regulate and control life. The perceiving type prefers to live in a flexible, spontaneous way. Perceiving types seek to experience and understand life rather than control it.

Based on these four personality categories there are 16 possible psychological types.<sup>10</sup>



MBTI preferences help predict learning preferences. “Most learning style inventories simply assess how the student is behaving or how the student believes they perform best.”<sup>11(p.182)</sup> The shortcoming of these learning style inventories is that it is hard to tell if the student’s behavior is truly their learning style.<sup>11</sup> The MBTI takes a well-rounded approach to determining how personality type affects learning preferences.

### **Learning Preferences related to Myers-Briggs Type Indicator**

Jenson wrote a chapter called *Learning Styles* in the book *Applications of the Myers-Briggs Type Indicator in Higher Education*.<sup>12</sup> Jenson reports that the four dichotomous MBTI preferences are associated with learning preferences<sup>12</sup>:

- Extraversion (E) / Introversion (I): Extraverts tend to learn best in situations filled with movement, action, and talk. They prefer to learn in groups with group collaboration and discussion. They leap into assignments with little “forethought” relying on a trial-and error rather than expectation to solve problems. Introverts tend to be quieter and less active in classroom discussion. They prefer lecture or reading based learning. They are willing to share ideas in the classroom when given advance notice and time to think about how they will become active in the classroom.
- Sensing (S) / Intuition (N): Sensing types prefer to focus on concrete material and then slowly to abstract material in a step-by-step progression. They value knowledge that is practical and want to be precise and

accurate in their work. They excel at memorizing factual information.

Intuitive types prefer to focus on conceptual information. They value quick flashes of insight, but are often careless about detail. They excel at imaginative tasks and theoretical topics.

- Thinking (T) / Feeling (F): Thinking types are motivated by logical rationale for each project and when teachers acknowledge and respect their competence. They prefer topics that help them understand cause-and-effect relationships. Their thought process tends to be analytical. Feeling types are motivated when given personal encouragement and when shown the human angle of the topic. They think to clarify their values and to establish networks of values. Even when their expression seems syllogistic it usually evolved from some personally held belief.
- Judgment (J) / Perception (P): Judging types gauge their learning by completion of tasks. They prefer structured learning environments that establish goals for them to meet. Perceiving types view learning as a freewheeling, flexible quest. They care less about deadlines and completion of tasks. They prefer open and spontaneous learning environments.

## **Learning Styles**

Learning style refers to how students begin to concentrate, process, and internalize new academic information.<sup>13</sup> There are four main learning styles: reading & writing, auditory, visual, and kinesthetic. Instructors can incorporate a

variety of these learning style designs into their online delivery methods to help meet student's learning preferences. Presenting material in a variety of modes will also encourage students to develop a more versatile approach to their learning.<sup>14</sup> Mayer reports that students have a better understanding of material when they are able to utilize words and images in their learning.<sup>15</sup>

“When only narration is presented, the learner is likely to construct a verbal model, but may not be able to form a corresponding pictorial model. When both narration and animation are presented, the learner can construct representations in both channels, resulting in corresponding verbal and pictorial representations. The learner is more likely to integrate verbal and pictorial models and thereby engage in deeper learning when the presentation consists of narration and animation rather than narration alone.”<sup>15(p.302)</sup>

### **Reading and Writing Learning Style**

Reading and writing learning style design may work well for introvert and intuitive types.<sup>16,17</sup> Reading and writing learners learn well by doing just that, reading and writing. Most traditional university courses are primarily taught by this format. Reading and writing learners re-read notes and textbooks, re-write text and lecture notes, and use lists to assist learning. “Introverted intuitive students are generally more comfortable with a heavy load of reading assignments.”<sup>16 (p.121)</sup>

### **Auditory Learning Style**

Auditory learning style design may work well for extraverts and introverts.<sup>17</sup> Auditory learners find it easy to learn by listening and they prefer verbal instructions.<sup>17</sup> They often do well working out solutions by talking out loud

so they can hear their solution, this is similar to MBTI extravert preference.<sup>17</sup>  
This type of learning style can also be appealing to MBTI introvert preference because of the listening component. “This learning style type may respond well to video conferencing and synchronous online activities.”<sup>17(p.1335)</sup>

### **Visual Learning Style**

Visual learning style design may work well for introverts, sensing, and thinking types.<sup>17</sup> Visual learners like to acquire knowledge through descriptions and demonstrations. They use lists to organize thoughts and often have well-developed imaginations.<sup>17</sup> They tend to learn better in lectures by watching them and remember information that is written down.<sup>17</sup> Computer based instruction, video conferencing, synchronous or asynchronous activities generally work well for this style.<sup>17</sup>

### **Kinesthetic Learning Style**

Kinesthetic learning style design may work well for extraverts, introverts, sensing, and thinking types.<sup>17</sup> Kinesthetic learners can be thought of as discovery learners.<sup>17</sup> They gain realization through doing, rather than thinking before initiating action.<sup>17</sup> They generally struggle to learn by reading or listening and prefer group work.<sup>17</sup>

## **Online Learning Preferences and Performance related to Myers-Briggs Type Indicator**

MBTI dimensions (sensing, introvert, thinking, and perceiving types) feel more comfortable using computer-assisted instruction (CAI).<sup>18</sup> McNulty, et al. studied personality preference using MBTI to determine if MBTI dimensions influenced individual utilization of CAI in an undergraduate medical course with 116 students.<sup>18</sup> Researchers found that sensing types utilized CAI more frequently than intuitive types.<sup>18</sup> One of the CAI components was a discussion forum; interestingly, of those that logged in (97%), relatively few (34%) contributed to the discussion.<sup>18</sup> When data was sorted by MBTI dimensions, the strongest associations between frequency of logins and posting to the discussion forum were for introvert, thinking, and perceiving types.<sup>18</sup> The results indicate that sensing types log in and read through the discussions, but are less likely to post to the discussion. Based on the results, introvert, thinking, perceiving, and sensing types are more receptive to utilizing online discussion forums as a learning modality.

Researchers found that those with particular MBTI dimensions exhibited better performance in online courses. O'Brien and colleagues studied MBTI and academic achievement in an undergraduate engineering course of 83 students.<sup>19</sup> Results showed that students with intuitive types achieved significantly higher end-of-course grades than sensing types despite being a much smaller percentage of the population at only 28% compared to sensing at 72%.<sup>19</sup>

Irani, et al. 2003 researched 39 graduate student's perceptions of instructional technique in an online agricultural leadership course.<sup>6</sup> Researchers found that students' perceptions of instructional technique were strongly correlated to students' scores in the following MBTI dimensions: extravert, introvert, sensing, feeling, and judging.<sup>6</sup> The application of these results is limited because frequency of MBTI dimensions and how MBTI relates to performance may differ depending on the academic area being studied.

### **Learning Style Based Instruction**

There is debate over the idea that tailoring the design of online courses to meet student's learning preferences improves learning. In general, educators agree that students have different strengths and respond differently to the learning environment, resources, and delivery method. It would be reasonable to conclude that the better matched the student's preferences are with the learning environment, the higher the potential for learning to occur.<sup>17</sup>

“The increasing use of multimedia in teaching has provided many opportunities to present multiple representations of content (video, audio, images, interactive elements) to cater more effectively to the different learning styles and modal preferences of an increasingly diverse student body.”<sup>20 (p.852)</sup>

There is research that does not support learning style based instruction. Pashler, et al. did a literature review of learning style concepts in education.<sup>21</sup> Researchers found that many studies did not use experimental methodology capable of testing the validity of learning styles applied to education.<sup>21</sup> Researchers concluded that there was not adequate evidence to base justifying

incorporating learning styles assessments into general education practices.<sup>21</sup>

Romanelli, et al. in their literature review also concluded that there was limited research correlating learning styles to learning outcomes.<sup>22</sup>

Therefore the evidence that a student's learning style will correlate to a preferred learning modality varies. Cook, et al. assessed 121 medical residents' learning module preference using two differently designed learning modules.<sup>8</sup> Medical residents took an Index of Learning Styles Survey to determine learning style and then completed a survey on learning module preference.<sup>8</sup> Researchers found that a designated learning style was not associated with any preferred learning module.<sup>8</sup>

### **Myers-Briggs Type Indicator Trends among Nutrition and Healthcare Professionals**

There are particular MBTI dimensions that select healthcare related fields. The MBTI combination sensing/feeling (SF) are likely to choose healthcare as an occupation.<sup>23</sup> Pacheco and George used Index of Learning Styles Questionnaire to assess learning style preferences of 3,024 undergraduate and graduate students in healthcare professions.<sup>24</sup> Researchers found that more students had sensing preference compared to an intuitive preference.<sup>24</sup> These results indicate that more students in health related fields are sensing or SF types and therefore individuals with these types might also be common in Dietetics.

In 1999 Hagan and Taylor wrote *The Personality of Dietetics* and analyzed the frequency of MBTI types in 84 dietetic interns.<sup>25</sup> The largest percentages of

MBTI types were ESFJ and ISFJ.<sup>25</sup> These two types only differ by the first dimension, extravert versus introvert, and both contain the SF combination. The SF combination was the largest percentage in the sample. The descriptive statistics from the Hagan and Taylor MBTI analysis are below<sup>25</sup>:

- ESFJ-Extrovert/Sensing/Feeling/Judging at 16.7% of the total
- ISFJ-Introvert/Sensing/Feeling/Judging at 11.9% of the total
- SF-Sensing/Feeling combination at 33% of the total

Significant percentages ISFJ, ESFJ, and SF combinations were also found in more recent dietetic interns enrolled in the Indiana University School of Health and Rehabilitation Sciences Dietetic Internship Certificate Program. Information from 109 dietetic intern students who completed the MBTI as they began their internship in 2002, 2007, 2009, 2010, 2011, 2012, and 2013, showed that the highest percentages of dietetic interns were:

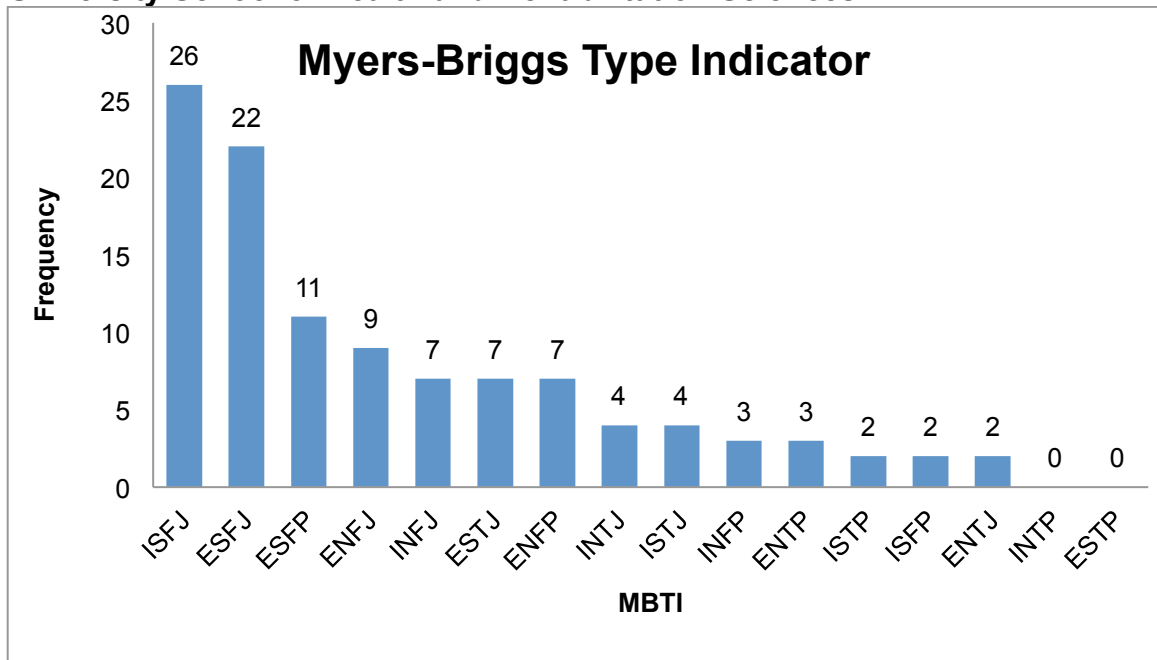
- ISFJ-Introvert/Sensing/Feeling/Judging at 24% of the total
- ESFJ-Extrovert/Sensing/Feeling/Judging at 20% of the total
- SF-Sensing/Feeling combination at 56% of the total

Results from these two dietetic intern samples indicate that MBTI types ISFJ and ESFJ were commonly found. If indeed the MBTI type correlates with learning preference then, the similarities of MBTI types among Nutrition Professionals suggests that similar learning preferences may also be common.



Complete MBTI results for the dietetic interns enrolled at Indiana University School of Health and Rehabilitation Sciences Dietetic Internship Certificate Programs are presented in Figure 1.

**Figure 1. Myers-Briggs Type Indicator (MBTI) Determined in 109 Dietetic Interns from Seven Dietetic Internship Certificate Programs at Indiana University School of Health and Rehabilitation Sciences**



**Personality Traits of ISFJ (Introvert/Sensing/Feeling/Judging) and ESFJ (Extravert/Sensing Feeling/Judging/Feeling) Types**

*Introduction to Type*, by Myers describes the characteristics of ISFJ's and ESFJ's<sup>9</sup>:

“ISFJ ‘s are known as quiet, friendly, responsible, and conscientious. They work devotedly to meet their obligations and lend stability to any project or group. In their work they are thorough to the point of being painstakingly accurate. Their interests are usually not technical. They are loyal, considerate, perceptive, and concerned with how other people feel.”<sup>9 (p. 7)</sup>

“ESFJ’s are warm-hearted, talkative, popular, conscientious, born cooperators, active in committees. They need harmony and are good at creating it. They are always doing something nice for someone. They work best with encouragement and praise. Their main interest is in things that directly and visibly affect people’s lives.”<sup>9(p. 7)</sup>

## **Statement of the Problem and Hypothesis**

The purpose of this study was to investigate the connections between the online learning environment and MBTI dimensions in Nutrition Professionals. This research will add to educator's knowledge base and be used in the design of online nutrition courses to enhance Nutrition Professionals' academic and professional outcomes.

Hypotheses:

- 1) Nutrition Professionals who are extraverts will prefer and perform better in the Video Conference Module when compared to introverts.
- 2) Nutrition Professionals who are introverts will prefer and perform better in the Forum Module and PowerPoint Module when compared to extraverts.

The outcome variables are: (1) The MBTI indicator, (2) responses from a survey that indicated participant preference for a specific learning module, (3) the change in score that quantitatively assessed performance from completion of the learning modules.

## **Chapter Two**

### **Methodology**

#### **Introduction to Research**

This research study examined the relationship between Nutrition Professionals' MBTI dimensions, their learning module preference, and their performance in differently designed learning modules. Participants completed two online learning modules focused on Nutrition in Developing Countries that differed in learning module design. There were pre-tests and post-tests for each of the two learning modules. At the end of the learning modules participants completed a Learning Module Preference Survey that provided information on their learning module preference along with general feedback.

Two rounds of this study were completed utilizing a semi-experimental design. Two rounds allowed the first group of participants to begin while recruitment continued for the second group in order to meet the goal for participation while minimizing dropouts.

The Indiana University Institutional Review Board (IRB) approved this study and content materials. The participants and researchers knowing each other were relatively small risks for the participants. No repercussions would have resulted from the researchers knowing the participants and the information given by the participants did not place them at any risk for criminal or civil liability, nor would it have been damaging to the participants financial standing, employability, insurability, or reputation.

## **Population of Interest**

This study was designed for Nutrition Professionals; the content of the learning modules required the participant to have a basic understanding of nutrition. Participants met criteria for selection into the study if they minimally had their Bachelor's degree with a major in Dietetics and/or were a Registered Dietitian. The Commission of Dietetic Registration (CDR) approved the learning module content for 10 hours of continuing professional education (CPE) for Registered Dietitians. There was no incentive for participants who were not Registered Dietitians, beyond learning about the topic of Nutrition in Developing Countries.

Participants were recruited by emailing a Study Information Sheet that described the study to multiple Dietetic Internship sites and healthcare organizations around the country, as well as posting it to the LinkedIn Group Young Dietitians of the Academy of Nutrition & Dietetics.

Thirty-seven participants enrolled into the study, six dropped out, leaving 31 to finish the study. The participants ranged from 23 years to 49 years of age with the median age of 29 years. There was one male in the study. Twenty-nine of the participants were Registered Dietitians and the other two participants had their Bachelor's degree with a major in Dietetics. Ten out of the 31 participants had their Master's Degree and one had a Ph.D. The years of experience for the Registered Dietitian ranged from zero to 23 years with a median of five years experience. Twenty of the participants reported taking the MBTI previously, but only eight remembered their type. Most participants were from Indiana, but other

representation included participants from Illinois, Georgia, Connecticut, Colorado, and Montreal, Canada.

## **Methodology & Procedures**

Each participant independently took the MBTI online provided by Consulting Psychologist Press, Inc. (CPP). MBTI results were not disclosed to participants to avoid bias.

Participants were matched according to MBTI preference extraversion or introversion and then randomly assigned to either Learning Module 1 (LM1) or Learning Module 2 (LM2) by flipping a coin. MBTI's were matched so that each group had a similar representation of extraverts and introverts.

Participants in both learning module groups completed the same first online module called the Forum Module. This module reflected the reading and writing learning style. Participants took a pre-test, read three references related to module content, answered 12 discussion questions and provided feedback on other participant's answers, completed two written case studies, and then completed a post-test. The second module differed for each learning module group, however the information covered and the tests were the same for both learning module groups.

LM1's second learning module was called PowerPoint Module. This module reflected the visual and auditory learning styles. The PowerPoint Module involved a pre-test, two PowerPoint presentations with written, visual and auditory components, and then a post-test on the material.

LM2's second learning module was called Video Conference Module. This module reflected the kinesthetic learning style. The Video Conference Module included a pre-test, a case study question that the participants completed and presented their answers in PowerPoint design to the group using an video conference software called *Jabber Video* (version 4.6, Cisco, San Jose, CA). *Jabber Video* allowed the participants to see everyone online, to share their PowerPoint to the group, to listen and view the other presentations, to ask questions, and participate in discussion. After the video conference, the participants' PowerPoints along with answer keys the researchers made were available for participants to review. Participants then completed a post-test.

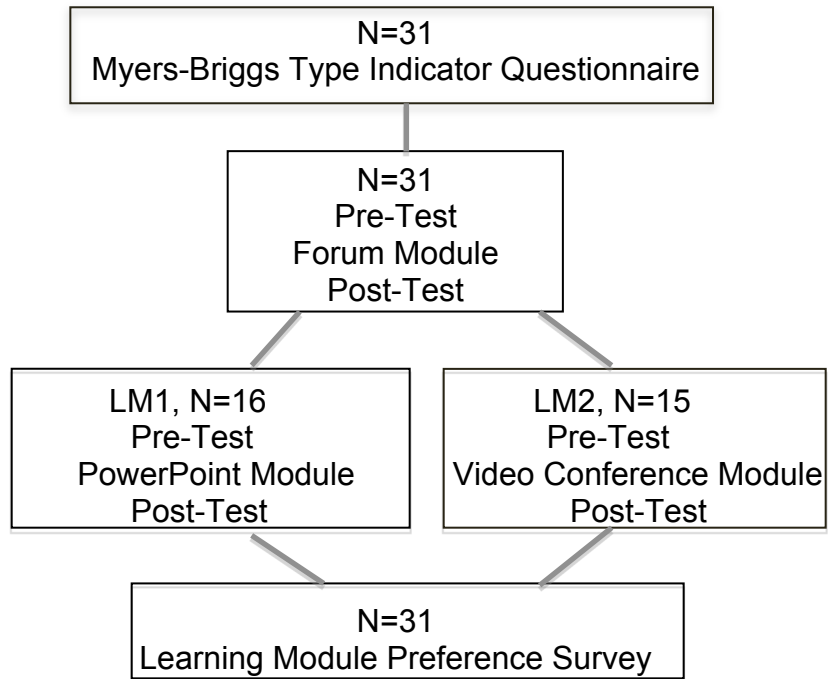
After participants completed their two learning modules, they completed a Learning Module Preference Survey that provided feedback on their learning module preference, quality of content, design of modules, learning, etc.

References for the module content were made available electronically to all participants and included select chapters from:

- King FS & Burgess A. *Nutrition for Developing Countries, Second Edition*. Oxford, NY: Oxford University Press;1993.
- Latham MC. *Human Nutrition in the Developing World*. Rome: Food and Agriculture Organization of the United Nations; 1997.
- Schroeder DG. *Nutrition and Health in the Developing Countries, Second Edition*. R.D. Semba, M.W. Bloem, P. Pivot (Ed.). Totowa, NJ: Humana Press; 2008.

See Figure 2 for the structure of the research design, which includes both rounds of the study.

**Figure 2. Flow of Activities and Participant Grouping During a Research Study Focused on Myers-Briggs Type Indicator (MBTI) Dimensions, Performance, and Learning Module Preference for Nutrition Professionals**





## **Module Design**

The first module provided a background on the topic Malnutrition in Developing Countries that prepared participants for their second learning modules.

### **Forum Module: Reading & Writing Design**

Completed by Learning Module 1 (LM1) and Learning Module 2 (LM2) Groups

- Topics
  - Causes of Malnutrition
  - Protein Energy Malnutrition: Kwashiorkor and Marasmus
- Design
  - Pre-Test
  - Participants read literature on Protein Energy Malnutrition in Developing Countries
  - Participants discussed the topics with forum discussion questions
  - Participants completed two written case study assignments
  - Post-Test

### **PowerPoint Module: Visual & Auditory Design**

Completed by Learning Module Group 1 (LM1)

- Topics
  - Preventing and Treating Protein Energy Malnutrition in Children
  - Preventing and Treating Protein Energy Malnutrition in Adolescent Girls and Women

- Design
  - Pre-Test
  - Participants viewed two PowerPoint presentations that covered the above topics with visual and auditory aspects
  - Post-Test

### **Video Conference Module: Kinesthetic Design**

Completed by Learning Module Group 2 (LM2)

- Topics
  - Preventing and Treating Protein Energy Malnutrition in Children
  - Preventing and Treating Protein Energy Malnutrition in Adolescent Girls and Women
- Design
  - Pre-Test
  - Participants each received a case study problem and then prepared a PowerPoint with their answers to the case study problem
  - Participants were given access to *Jabber Video*
  - A video conference was conducted using *Jabber Video*
  - Participants were given 10 minutes to present their case question and answers, while the rest of the group provided discussion
  - Participant presentations were made available to others in their group along with an answer keys
  - Post-Test

## **Tests & Surveys**

Pre and post tests and the Learning Module Preference Survey were available for the participants to take through Indiana University-Purdue University Indianapolis (IUPUI) online course management system Oncourse.

Data collected from Oncourse and CPP were only available to the researchers. Data from the study were processed without names attached and made available to the researchers, research committee members, and a contact at IU School of Medicine, Department of Biostatistics for the statistical analysis.

## **Statistical Methods**

Cindy Calley, M.A., Biostatistician III, Indiana University School of Medicine, Department of Biostatistics did the statistical analysis for this study. All statistical analyses were conducted using SAS (version 9.3, SAS Institute Inc., Cary, NC).

MBTI dimension summaries were done to analyze participant MBTI types. The data were then compared to past dietetic intern's MBTIs to assess if the samples had similar MBTIs.

Fisher's Exact Test was used to compare frequency of MBTI dimensions in the learning modules, analyze learning module preference based on MBTI dimensions, and compare learning module preferences between the two rounds of participants.

Two-Sample T-Tests were used to compare test scores of the learning module groups and to compare test scores for extraverts and introverts.

These comparisons tested baseline knowledge, improvement in learning module scores, and of improvement in tests scores for extraverts and introverts in both learning modules groups.

Paired T-Tests were used to analyze change in learning module test scores (post-score minus pre-score) based on learning module preference. This analysis determined if improvement in score was related to learning module preference.

Chi-Square Test was used to compare preferences for the second learning module participants took for both learning module groups.

## **Results**

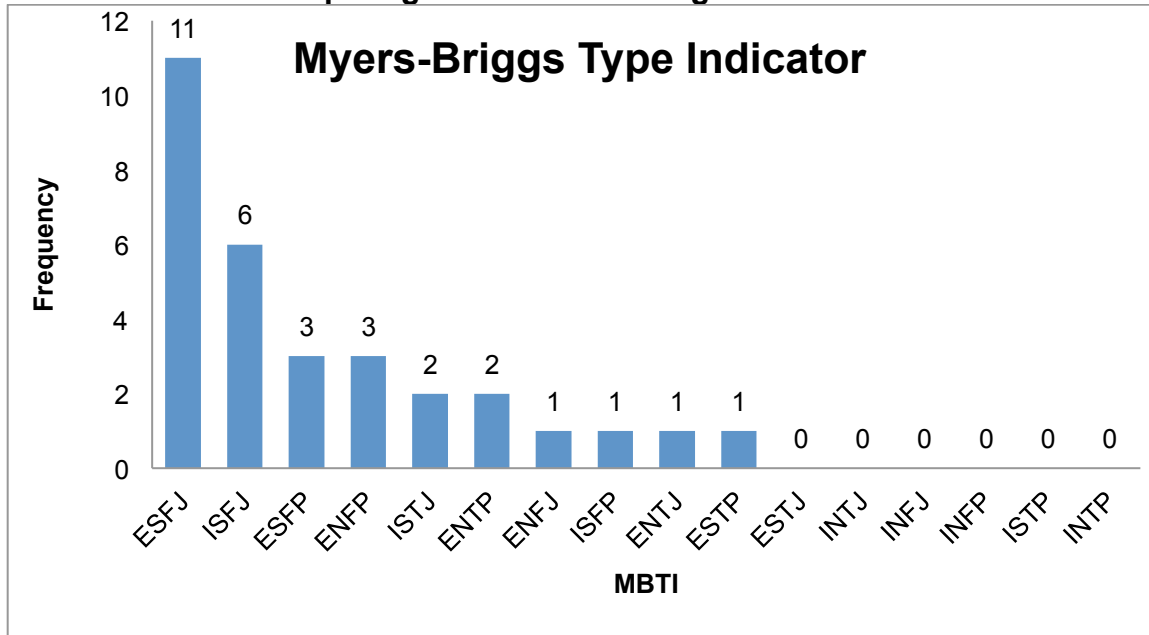
The study had two rounds of enrollment (Round 1 and Round 2) for each learning module group (LM1 and LM2). The results for LM1 Round 1 were compared to those of LM1 Round 2 and the results for LM 2 Round 1 were compared to those of LM2 Round 2. Analysis included comparison of improvement in learning module scores and preferred learning module.

Statistical analysis showed there were no significant differences in the results from the two rounds for the either learning module group. Therefore, the results from both rounds of LM1 were combined and the results from both rounds of LM2 were combined for the rest of the study's analysis. Results are presented in the Appendix, Tables A-1 and A-2.

The majority (55%) of the participant’s MBTIs were found to be ESFJ or ISFJ types. See Figure 3 and Table 1 for complete MBTI results.

- ESFJ-Extravert/Sensing/Feeling/Judging 35% of the total
- ISFJ-Introvert/Sensing/Feeling/Judging 19% of the total
- SF-Sensing/Feeling 68% of the total

**Figure 3. Frequency of Myers-Briggs Type Indicator (MBTI) for Nutrition Professionals Participating in Online Learning Modules**



**Table 1. Frequency of MBTI\* Dimensions for Nutrition Professionals Participating in Online Learning Modules (N=31)**

Dimension Type	Frequency	Percentage
Extravert	22	70.97%
Introvert	9	29.03%
Intuition	7	22.58%
Sensing	24	77.42%
Feeling	25	80.65%
Thinking	6	19.35%
Judging	21	67.74%
Perceiving	10	32.24%

\* Myers-Briggs Type Indicator

Table 2 shows the frequency of participants with similar MBTI dimensions in each of the learning modules and demonstrates equal randomization of participants with similar MBTI dimensions into the PowerPoint Module and Video Conference Module.

**Table 2. Frequency of Nutrition Professionals' MBTI\* Dimensions Represented in Different Online Learning Modules and Comparison of MBTI Dimensions in Second Learning Modules (PowerPoint Module versus Video Conference Module)**

<b>MBTI Dimensions</b>	<b>Forum Module N=31</b>	<b>PowerPoint Module N=16</b>	<b>Video Conference Module N=15</b>	<b>Fisher's Exact Two-Sided P-value (1)</b>
Extrovert	22	12	10	0.7043
Introvert	9	4	5	
Intuitive	7	4	3	1.0000
Sensing	24	12	12	
Feeling	25	13	12	1.0000
Thinking	6	3	3	
Judging	21	12	9	0.4578
Perceiving	10	4	6	

\*Myers-Briggs Type Indicator

(1) Fisher's Exact Two Sided Probability Test with PowerPoint Module and Video Conference Module

The participant's MBTI dimensions and learning module preference data were compared to determine if MBTI dimensions were associated with learning module preferences. Results are shown in Table 3 (three participants with undecided or multiple learning module preferences were excluded from the analysis).

The results show that more introverts (43%) preferred the Video Conference Module compared to extraverts (33%) and more extraverts (24%) preferred the Forum Module compared to introverts (14%). These learning module preferences were the opposite of what was predicted in the hypotheses. The PowerPoint Module was preferred the by extraverts (43%). Introverts preferred both the PowerPoint Module and the Video Conference Module (43%). Even though there were differences, the differences were not significant and in general participants' learning module preferences were similar for all MBTI dimensions with all p-values >0.5.

**Table 3. Comparison of Nutrition Professionals' Learning Module Preference based their MBTI\* Dimensions (three participants with undecided or multiple learning module preferences were excluded from results)**

<b>MBTI Dimensions</b>	<b>Forum Module Preference N=6</b>	<b>PowerPoint Module Preference N=12</b>	<b>Video Conference Module Preference N=10</b>	<b>Fisher's Exact Test P-Value</b>
Extrovert, N=21 Introvert, N=7	24% 14%	43% 43%	33% 43%	1.0000
Sensing, N=22 Intuitive, N=6	18% 33%	41% 50%	41% 17%	0.5979
Feeling, N=23 Thinking, N=5	22% 20%	39% 60%	39% 20%	0.8187
Judging, N=19 Perceiving, N=9	21% 22%	47% 33%	32% 44%	0.8710

\*Myers-Briggs Type Indicator



Each participant's baseline knowledge prior to starting the learning modules was determined from the Forum Module pre-test scores. As shown in Table 4, results from participants in LM1 and LM2 showed that there was no significant difference in baseline knowledge between the groups. Post-test scores were comparable for participants in LM1 and LM2 and were higher than pre-test scores after completion of all learning modules for both groups. Mean change in score (post-score minus pre-score) was not significantly different between LM1 and LM2. These results indicate that both learning module groups had similar baseline knowledge and showed similar improvement in their learning modules. Results are shown in Table 4.

**Table 4. Comparison of Baseline Knowledge and Change in Learning Module Test Scores for Groups of Nutrition Professionals Participating in Two Types of Online Learning Modules**

Test	Mean Test Scores ± SD		Mean Change in Test Scores		Two Sample T-Test
	LM 1	LM 2	LM 1	LM 2	P-Value
LM Group					
First Module Pre-Test	11.8 ± 2.2	11.3 ± 2.8			0.5974
First Module Post-Test	17.6 ± 2.5	18.3 ± 3.1	5.8	7.0	0.2277
Second Module Pre-Test	19.9 ± 2.6	20.2 ± 3.1			0.7516
Second Module Post-Test	25.6 ± 3.6	24.5 ± 3.1	5.7	4.3	0.2613

LM 1= First Module completed was Forum Module and Second Module completed was PowerPoint Module

LM 2= First Module completed was Forum Module and Second Module completed was Video Conference Module

The mean changes in learning module test scores (post-score minus pre-score) for LM1 and LM2 were used to determine if the improvements in scores were significant for either learning module group.

Table 5 results show that participant test scores significantly improved for each of the completed learning modules among both LM1 and LM2 groups with all p-values <0.0001. Table 5 also shows that the average mean of improvement was similar for both learning module groups, this can also be seen in Table 4.

**Table 5. Mean Improvement in Test Scores in Learning Modules for LM1\* and LM2\* groups of Nutrition Professionals Participating in Online Learning Modules**

Group and Module	Change Test Scores			Paired T-Test P-value
	Mean ± SD	Least Improvement	Most Improvement	
<b>LM 1*</b>				
Forum	5.8 ± 2.5	0	8	<0.0001
PowerPoint	5.7 ± 3.6	0	12	
Average	5.75 ± 2.5	0	10	
<b>LM 2*</b>				
Forum	7.0 ± 3.1	2	12	<0.0001
Video Conference	4.3 ± 3.1	-1	11	
Average	5.65 ± 3.1	0.5	11.5	

\* LM1 = Learning Module 1, \*LM2 = Learning Module 2

Test score improvement was analyzed based on learning module preference to determine if there was an association between a participant's learning module preference and how they performed within a particular learning module. Results are shown in table 6. Three participants with undecided or multiple learning module preferences were excluded from the analysis.

Results shown in Table 6 indicate that improvement in scores for the Forum Module and the second learning modules (PowerPoint Module and Video Conference Module) were similar for all participants regardless of learning preferences. Participants who preferred a specific learning module did not perform significantly better than other participants in their preferred learning module. For example, participants who preferred the Forum Module had a mean improvement in score of 6.0 points. This improvement was similar to the mean improvement scores achieved by other participants who preferred different learning modules.

**Table 6. Improvement in Learning Module Test Scores based on Learning Module Preference for Nutrition Professionals Participating in Online Learning Modules (three participants with undecided or multiple learning module preferences were excluded from analysis)**

Learning Module Preference	Improvement in Learning Module Test Scores			
	Mean ± SD	Least Improvement	Most Improvement	Paired T-Test P-value
<b>Forum Module</b>				
Forum N=6	6.0 ± 2.4	2	6	0.0900
PowerPoint N=12	5.5 ± 2.7	0	8	
Video Conference N=10	8.1 ± 2.8	2	12	
<b>Module 2 (PowerPoint &amp; Video Conference)</b>				
Forum N=6	5.5 ± 3.0	1	9	0.4990
PowerPoint N=12	6.2 ± 3.4	3	12	
Video Conference N=10	4.5 ± 3.4	-1	11	

Improvement in learning module test scores (post-score minus pre-score) for extraverts and introverts were analyzed to compare performance in learning modules. Results shown in Table 7 suggest that extraverts and introverts improved similarly well in all learning modules.

**Table 7. Comparison of Mean Improvement in Learning Module Scores for Extrovert and Introvert Nutrition Professionals Participating in Online Learning Modules**

Learning Module	Mean Change in Test Scores $\pm$ SD		Two-Sample T-Test
	Extravert	Introvert	P-Value
<b>MBTI* (Extravert, Introvert)</b>			
<b>Forum Module</b> N= 22 Extraverts N=9 Introverts	5.9 $\pm$ 3.0	7.6 $\pm$ 2.2	0.1354
<b>PowerPoint Module</b> N=12 Extraverts N=4 Introverts	6.2 $\pm$ 3.6	4.3 $\pm$ 3.7	0.3672
<b>Video Conference Module</b> N= 10 Extraverts N=5 Introverts	4.3 $\pm$ 3.4	4.4 $\pm$ 2.5	0.9551

\*Myers-Briggs Type Indicator

Learning module preference was analyzed to determine if participants preferred their second learning module to their first learning module. Participants in LM1 took PowerPoint Module for their second learning Module and participants in LM2 took Video Conference for their second learning module.

Results from Table 8 show that the majority of participants (71%) preferred their second learning module regardless of LM group, however this preference was not significant.

**Table 8. Frequency of Nutrition Professionals who Preferred their Second Learning Module in LM1\* and LM2\* groups of Nutrition Professionals Participating in Online Learning Modules**

<b>Group and 2<sup>nd</sup> Learning Module Completed</b>	<b>Preferred 2<sup>nd</sup> Module</b>	<b>Did not Prefer 2<sup>nd</sup> Module</b>	<b>Chi-Square for Preferred 2<sup>nd</sup> Module</b>
LM 1 N=16 (PowerPoint Module)	12 75%	4 25%	0.6095
LM 2, N=15 (Video Conference)	10 66.67%	5 33.33%	
Total	22 71%	9 29%	

\* LM1 = Learning Module 1, \*LM2 = Learning Module 2

## Discussion

### MBTI Trends among Nutrition and Healthcare Professionals

Myers-Briggs Type Indicator's ESFJ and ISFJ were predominate among dietetic intern samples. The MBTI's ESFJ and ISFJ made up the largest percentage in this sample of Nutrition Professionals, Indiana University dietetic interns, and dietetic interns from the Hagan and Taylor study. The main difference between the samples was the percentage of extraverts versus introverts. The sample of 31 Nutrition Professionals had a larger percentage of ESFJ's (35%) than ISFJ's (19%). The reverse was observed in the Indiana University dietetic interns sample that consisted of more ISFJ's (24%) compared to ESFJ's (20%). The Hagan and Taylor study that analyzed 84 dietetic intern's MBTIs in 1999 found their sample of dietetic interns consisted of more ESFJ's than ISFJ's (16.7% versus 11.9%). These results indicate that ESFJs and ISFJs made up a large percentage of MBTI's in these three nutrition samples and that the current sample studied is representative of what would be expected.

Students in healthcare professions are likely to have sensing and feeling preferences. Pacheco and George found that numbers of sensing types were significantly greater than intuitive types in healthcare students.<sup>24</sup> Although Pacheco and George used the Index of Learning Styles Questionnaire, their sensing and intuitive preferences are very similar to the sensing and intuitive preferences in the MBTI. The *MBTI Manual* written by Myers, et al. reported people with the MBTI combination Sensing/Feeling (SF) are likely to be in the healthcare professions.<sup>23</sup> This sample of Nutrition Professionals followed these

trends, 68% were SF's and an even larger percentage (77.42%) had a sensing preference.

### **Learning Preferences of Extraverts and Introverts**

Extraverts focus their attention on the outer world and find being around people re-energizing.<sup>10</sup> Jenson reported that extraverts tend to learn best in situations filled with movement, action, and talk.<sup>12</sup> They prefer to learn in groups with group collaboration and discussion.<sup>12</sup> Based on these characteristics it was hypothesized that extraverts would prefer to learn using an online video conference, because it was interactive, social, collaborative, and provided a group discussion.

Introverts focus on their attention to their inner world of ideas and prefer alone time to re-energize.<sup>10</sup> Jenson reported that introverts tend to be quieter and less active in classroom discussion.<sup>12</sup> They prefer lecture or reading based learning.<sup>12</sup> Based on these characteristics it was hypothesized that introverts would prefer to learn using a forum discussion and PowerPoints for online learning, because they were more independent and contained reading based learning.

In this study, more participants were extraverts 71% compared to introverts 29%. This differed from the Indiana University dietetic interns sample that contained 55% extraverts and 45% introverts. Thus, the recruitment of more extraverts than introverts in the current study may have been due to the possibility of being randomized to the Video Conference Module that required the

development of a presentation and real time participation in a virtual environment with strangers. This type of learning environment was hypothesized to be more appealing to extraverts.

### **Nutrition Professionals' Learning Module Preference**

Nutrition Professionals' learning module preferences were similar for all MBTI dimensions. Specifically, the results for extravert and introvert showed introverts were just as likely to prefer the Video Conference Module as extraverts and extraverts were just as likely to prefer the Forum or PowerPoint modules as introverts. The large number of extraverts in the both learning module groups could have affected these results. It is also possible that the small number of introverts in the study enrolled because they felt comfortable using video conferencing if required. These results are similar to Cook, et al. study in 2006 that showed learning style preferences were not associated with learning module preference.<sup>8</sup>

McNulty, et al. showed that introvert, thinking, and perceiving types were more active on posting to discussion forums and sensing types were more comfortable reading through discussion posts.<sup>18</sup> The current study that involved 31 Nutrition Professionals differed from the McNulty, et al. results. Nutrition Professionals with MBTI types of feeling, perceiving, and judging types posted more frequently than other types and made up 50% of the discussion forum posts. Other differences from McNulty, et al. results were that Nutrition Professionals with sensing preferences posted more to the discussion forum



(19% of the posts) compared to intuitive types (8% of the posts). Intuitive types were more likely to read more discussion posts (32% of posts read) compared to sensing types (22% of posts read). However, feeling, perceiving, and judging types that posted more frequently to the discussion forum did not significantly prefer the Forum Module. More participants may have joined in discussion forum if the study was longer and gave participants more time to feel comfortable with the process.

The majority of participants preferred their second learning module (71%). However, this result could be because participants enjoyed learning basic information in their first learning module and were ready for more in depth information that was provided in their second learning module. Participants might have preferred any learning module design that came second if it provided more in depth content.

### **Nutrition Professional's Performance in Learning Modules**

All learning modules were effective for improving learning, but one was not more effective than the another in this sample of Nutrition Professionals. Learning module test scores improved significantly for all learning modules in both groups with all p-values <0.0001. Baseline knowledge of material and improvement in the learning modules were very similar for both learning module groups. Improvement based on learning module preference also showed that participants did well in all learning modules regardless of their preference. Extraverts and introverts performed similarly in all learning modules.

Intuitive types in O'Brien and colleagues research study performed significantly better than sensing types despite being a small percentage of their sample.<sup>19</sup> The results from Nutrition Professional sample differed from the O'Brien and colleagues study. Nutrition Professionals that were intuitive types did not perform as well as sensing types. Sensing types improved by an average of 12.3 points in their learning modules compared to Intuitive types who improved by an average of 8.5 points.

These results indicate that both learning module groups showed significant improvement in test scores, had similar baseline knowledge, and learned comparable amounts regardless of learning module preference or the design of their second learning module. MBTI dimensions extravert and introvert and preferred learning module did not play as large of a role in performance as anticipated. These results are consistent with the Pashler, et al. study<sup>21</sup> that did not support learning style based instruction.

### **Online Learning and the Adult Participant**

The Nutrition Professionals in this study had a mean age of 29 years. They were post undergraduate educated and some had advanced degrees. Their successful experience in education likely increased their ability to learn well in a variety of modalities. Older adults with a mean age of 33 years also performed well in the Irani, et al. study.<sup>6</sup>

## **Nutrition Professionals' Motivation and Intent to Learn**

Motivation to learn may be the biggest factor explaining why there was significant improvement in all learning modules. Nutrition Professionals that enrolled in this study were interested in the topic, Malnutrition in Developing Countries, and this interest likely increased their intent to learn. Nutrition Professionals that were Registered Dietitians received 10 hours of CPE for completing the learning modules, but this incentive was not likely the main reason for enrolling, because there are many ways of earning free online CPE's. Two Nutrition Professionals were not Registered Dietitians and did not receive any incentive for participation so it can be assumed they enrolled because of interest in the topic.

Researchers were available by cell phone, email, and Oncourse mail, this made it easy and fast for participants to get answers to their questions and clarify material. Researchers that were very available likely increased participant intent to learn. Davies's interviews with students who recently completed online courses showed that instructors who were available by multiple means increased student's intent to learn.<sup>7</sup> Video conference participants spent extra time learning to understand how to use *Jabber Video* during a trial video conference with the software. There were also participants who struggled with *Jabber Video* and spent time working through technical issues to participate in the video conference. The timing of the video conference was around the dinner hour and it was obvious many participants had small children at home, but they still made time to participate in the conference. These examples show a strong intent to

learn and integrity to the process, regardless of MBTI type and learning module preference.

### **Participant Feedback**

Participant feedback was obtained from the Learning Module Preference Survey and from comments during the video conference.

In general, participants liked the Forum Module discussion questions. Quite a few participants would have preferred a specific time frame for logging onto Oncourse to have a “real time” discussion with other participants instead of having to check multiple times to see what had been discussed that day. Some participants did not like having to contribute to all discussion questions because they felt some questions had already been answered and discussed adequately. Participants would have preferred to choose what questions to discuss.

PowerPoint Module participants generally enjoyed the visual aspects of the PowerPoints. They liked the concise way information was given to them with links for further information. Some participants in this learning module felt it was hard to remember information because they were not applying the information or writing it down.

Video Conference participants liked the ability to apply their knowledge to a case study. The Video Conference participants, who were required to present their case study, felt that they put more effort into learning the material than they would have otherwise. Bandwidth and connectivity issues for some of the Video Conference participants resulted in difficulties staying connected to the

conference. Two of the Video Conference participants had to participate by phone due to difficulties using *Jabber* Video. During the first video conference participants had trouble showing their computer screen to the other participants online to present their PowerPoint. On the second round all PowerPoint presentations were shown by the researchers to the group to avoid this problem. Many participants reported that they would have been more involved in the discussion during the video conference if they were more familiar with the researchers and other participants on the conference.

### **Limitations**

The duration of this study was short; participants had four weeks to complete the study. Learning module preferences may have been different if the learning modules were carried out over the length of a college semester. Specifically, more participants may have preferred and performed better in the Video Conference Module if they had more time to get used to the video conference software and felt comfortable with what was expected of the people involved.

Given the time requirements of the learning modules participants were only required to complete two out of the three learning modules. If the study was longer and all participants completed all three learning modules this would have enhanced the level of information on learning module preference and performance.

The sample size was small, 31 participants total. If the sample size was considerably larger, whole MBTI types could be used in the analyses for learning module preferences instead of MBTI dimensions extrovert and introvert. A larger sample size would have provided more data on performance to determine any differences in the effectiveness of the modules on learning.

A larger percentage of participants preferred their second learning module. Although this was not significant, it may have been that these participants enjoyed the process of learning and would have preferred any learning module that followed and built on the information delivered from the first.

Irani, et al. and O'Brien, et al. both analyzed MBTI dimensions related to performance in online courses within different academic areas.<sup>6,19</sup> Analysis of all MBTI dimensions, not just extravert and introvert, would have given more information on how MBTI dimensions correlate with improvement in specific learning module designs.

Intent to learn and motivation were not measured. Additional questions could have been added to the Learning Module Preference Survey that addressed these topics. Data on motivation and intent to learn related to performance would have been beneficial to see if this relationship was the reason test scores improved significantly.

This study is limited to a sample of Nutrition Professionals and it would be difficult to compare these results to another population.

## **Future Research**

There is limited research on MBTI, learning preferences, and performance in an online learning environment for Nutrition Professionals. Future research should include multiple learning modalities over a longer duration with a larger sample size. This would help determine trends in MBTI and how MBTI correlates with learning preferences and performance in an online setting.

Measuring motivation and intent to learn should be done to determine if this is the greatest factor in improving learning in online nutrition courses.

## **Conclusion**

The majority of Nutrition Professional's MBTIs were ESFJ and ISFJ which is representative of other populations of clinical nutritionists trained in the US. Despite having a large percentage of these two MBTI types, there was not a learning module that any MBTI dimension significantly preferred. Extraverts and introverts performed similarly well in all learning modules and did not significantly prefer one particular learning module over another.

Learning module groups significantly improved their learning module scores, all p-values were  $<0.0001$ , regardless of the second learning module design. Improvement in learning module scores and baseline knowledge were similar for both learning module groups. There was not one learning module that was more effective or preferred in this sample of Nutrition Professionals.

These results indicate that motivation not learning preference or MBTI type may be the key to increasing performance in online nutrition courses.



## Appendix

Table A-1 shows that the mean change in learning module test score (post-test minus pre-test) for participants in round 1 and round 2 in both learning module groups were similar. This indicates that each round of participants improved similarly well both learning modules.

**Table A-1. Mean Change in Learning Module Scores by Learning Module Group and Round for Nutrition Professionals Participating in Online Learning Modules**

Learning Module Group	Round 1 Mean Change in LM Scores	Round 2 Mean Change in LM Scores	Two-Sample T-Test P-value
LM1 Forum Module	6.6	5.1	0.2687
LM1 PowerPoint Module	5.7	5.7	0.9967
LM2 Forum Module	6.5	7.6	0.5237
LM2 Video Conference Module	5.4	3.1	0.1668

LM1 = Learning Module Group 1, LM2 = Learning Module Group 2

Table A-2 shows that learning module preferences of participants in round 1 were almost the same (p-value of >.9999) as the learning module preferences of participants in round 2.

**Table A-2. Learning Module Preferences for Round 1 and Round 2 Nutrition Professionals Participating in Online Learning Modules (results exclude three participants with multiple of undecided learning preferences)**

Learning Module Preference	Round 1 Participants	Round 2 Participants	Fisher's Exact Test P-value
Forum, N=6	20%	18.8%	>0.9999
PowerPoint, N=12	33.3%	43.8%	
Video Conference, N=10	33.3%	31.3%	

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## **Curriculum Vitae**

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### **Education:**

- 2011-2014 MS, Nutrition and Dietetics  
Indiana University  
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- 2007-2008 RD, Dietetic Internship Certificate Program  
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Sciences  
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- 2002-2006 BS, Applied Health Science  
School of Health, Physical Education, and Recreation  
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### **Employment:**

- 2010-Present Clinical Dietitian,  
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- 2012-2014 Graduate Teaching Assistant  
Department of Nutrition and Dietetics  
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- 2008-2010 Staff Dietitian  
Ball Memorial Hospital  
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**Awards/Honors:**

- 2012 Sheila Ward Graduate Fellowship  
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School of Health and Rehabilitation Sciences  
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- 2002-2006 Partial Academic Scholarship  
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**Professional Presentations:**

- 2013 "Malnutrition in the Hospitalized Patient"  
Physician Presentation  
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- 2012 "Healthy Eating for Youth"  
Community Wellness Presentation  
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- 2010 "Functional Foods for your Health"  
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- 2008 "Applying for Dietetic Internships"  
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