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**EXPLORING THE RELATIONSHIP BETWEEN PSYCHOLOGICAL TYPES AND
COGNITIVE STYLES AND THEIR CONTRIBUTIONS TO PROPOSED SOCIAL
LEARNERS' LEARNING STYLES THROUGH THE DEVELOPMENT AND
IMPLEMENTATION OF SOCIAL LEARNERS LEARNING STYLES SURVEY**

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Abstract

The purpose of this study was to determine if psychological types as described by Jung, Myers and Briggs, and cognitive styles, defined by Riding and Cheema, can be used to support the existence and definition of the learning styles of a group described by the researcher as social learners. From the psychological type and cognitive style theories, the researcher made assumptions about how they can be used to predict the learning styles of the social learners. A researcher developed survey was used to test the underlying assumptions and validate the prediction of the social learner learning styles. The results are intended to help instructors design and prepare courses to support and challenge learners of this type by recognizing individual differences of social learners.

Two sets of secondary data were used in this study: 1) 141 undergraduate students who enrolled in an online course, 2) 22 graduate students who enrolled in an online course offered in two different semesters but taught by the same instructor. Data from all 163 students were included in a factor analysis designed to identify social learner characteristics and to test the reliability of the learning style survey. However, data from only the 132 participants from data pool I who completed the online learning styles survey, Myers-Briggs Type Indicator (MBTI) and Cognitive

Styles Analysis (CSA) (all three) were included to examine the relationships among psychological types, cognitive styles and learning styles.

Exploratory factor analysis and expert reviews were used to see how the groupings of items on the researcher developed learning styles survey match the prediction of the theoretical model based on Type theory and Cognitive Styles. Four factors, including group work, structure, concrete and conceptual were extracted from the factor analysis and experts review. Group work and structure factors were combined as the main model. Although one of the proposed learning styles (harmonious factor) was dropped from the main model, statistical result showed that the remaining main model supported the existence of the social learner group. No significant difference was found between Analytic Non-FJ, Wholist Non-FJ, Analytic FJ and Wholist FJ on the main model. There was also no significant difference found for the two sub-groups, SFJ/NFJ and EFJ/IFJ on the concrete/conceptual factors and the main model respectively.

Chi-Square was used to test the independence of Type Theory and Cognitive Style by testing whether any of the MBTI dichotomies was related to the Wholist-Analytic dimension of the cognitive style. An independent t-test was used to find out if the FJ and non-FJ types respond differently on the predicted social learner learning styles (factors from the learning style survey). Kruskal-Wallis (K-W) test was used to examine whether the Wholist-Analytic dimension of cognitive styles affects

one's social learner learning. Mann-Whitney test was utilized to test the difference between SFJ-NFJ and EFJ-IFJ types to determine if there are two sub-groups of social learner.

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Chapter 1

Introduction

Problem Statement

In studying how individual differences relate to learning and instruction, Jonassen and Grabowski (1993) defined several assumptions about how individuals learn. The first was "...individuals differ in their....aptitudes, and preferences for processing information, constructing meaning from it, and applying it to new situations..." (p.3). Understanding the individual differences and how the differences affect learning and teaching is an important yet often ignored issue by educators when designing courses and instruction. The one-size-fits-all method may accommodate some learners but discriminate against those who have different preferences.

Researchers have demonstrated that learners with different learning preferences can succeed in the online learning environment (Dille & Mezack, 1991; Oxford, Young, Ito, and Sumrall, 1993). However, it was found that successful distance education students tend to prefer an independent learning environment (Gee, 1990; Diaz, 1999) and are not as collaborative as learners in the traditional classroom (Diaz, 2000). In other words, online learners who are

more dependent and collaborative might struggle in the online learning environment and need more guidance throughout the learning process. Yet, most research emphasizes laying out the characteristics of successful online learners and fails to recognize the characteristics of learners who are more dependent and prefer having social interaction.

Dilon and Greene noted that "...one important difference between distance and traditional learners is the fact that distance learners typically learn in more independent environments..." (2003, p.235). It is also harder for the instructor to provide immediate feedback in the online environment. As a result of this, individual differences become more obvious and attention to individual differences more critical to designers of online environments.

The researcher and a course instructor have observed that some online learners appear to rely on social interaction to develop understanding. This includes understanding of the actual assignment as well as understanding of the assigned content. These learners prefer group work, are good team members, and talk a lot about their personal experiences. They appear to be less analytic in their efforts to understand the nature of a task, and prefer more structure and guidance throughout the course. It was observed that the limited social cues of the on-line environment appear to give them problems. The researcher suspects that these characteristics are representative of a social learner group that exists

not only in the online environment but also in a traditional setting, and hypothesizes a set of learning styles to describe this group of learners. The characteristics of the social learner group, as described above, are more pronounced in the online learning environment and the social learners that have been observed tend to need additional instructor support when assignments are not clearly structured.

The studies of learning styles started as a result of the interest in individual differences and various learning styles theories have been developed since the 1960's. In an attempt to organize the various learning styles theories, Curry (1983) constructed a three layered onion model to organize learning style theories. The onion's core consisted of cognitive personality style, the middle is information processing style and the outermost layer represented instructional preference. The cognitive personality style was defined as "the individual's approach to adapting and assimilating information..." and Curry claimed that the innermost (core) layer is "...an underlying and relatively permanent personality dimension..." (p.3). She also suggested that models in this layer all intend to "have wide applicability in predicting behavior" (p.9-10). She grouped field dependent and field independent and personality type research in this layer. In her model, observable learning behaviors are "...fundamentally controlled by the central personality dimensions" (p.7). The outermost layer

instructional preference is viewed as an extension of cognitive personality style in the learning environment. Based on Curry's model, the innermost layer is of vital importance in understanding individual differences because cognitive personality style is the fundamental element in explaining observable learning behaviors. This framework has been adapted and used by researchers in explaining approaches to learning styles (Cassidy, 2004; Claxton & Murrell, 1987; Sadler-Smith & Smith, 2004).

Cognitive Styles

In an attempt to organize and unite the many scattered schools of thought on cognitive/learning styles, Riding and Cheema (1991) studied over 30 labels of styles and suggested that cognitive/learning styles may be grouped into two fundamental yet independent dimensions (Riding & Rayner, 1998):

Wholist-Analytic dimension and Verbal-Imagery dimension. The

Wholist-Analytic dimension relates to one's tendency to organize information into wholes or parts. It describes "...the habitual way in which an individual

processes and organizes information" (Riding, 1999, p.357). The Verbal-Imagery

dimension describes "...an individual's habitual mode of representation of

information [verbally or in mental pictures] in memory during thinking" (p.358).

The Wholist - Analytic dimension applies directly to this study, so only this dimension was used.

The Wholist-Analytic dimension is related to structure and organization of information. Analytics prefer structured approach to learning and tend to impose order on information. They perceive information as a collection of parts and tend to focus on how different parts are exclusive of others. They are good at analyzing information based on its parts and get to the heart of a problem quickly. However, they might enlarge the importance of parts for not looking at the whole picture of a situation.

Wholists tend to be able to see a broader perspective and the overall relevance of all aspects of the information. They tend to perceive information as a whole and appreciate the overall context. The strength of the Wholists is that they have a balanced view in considering the situation by looking at the whole picture. Yet, Wholists might find it difficult to separate out parts of the situation.

Psychological Types

Using his lifetime of observation, Carl Jung (1875 - 1971), a noted Swiss psychologist, theorized we could analyze psychological types into eight major groups by classifying behavior according to three sets of dichotomous variables. The main classification is what Jung called attitudes as "...a readiness of the

psyche to act or react in a certain way...having an attitude is synonymous with an *a priori* orientation to a definite thing" (Jung, 1971, p.414). Two of the attitudes describes one's orientation to the world and are called extraversion and introversion.

Table 1.1: Basic attitude dimension: Extraversion & Introversion

Attitude	
Extraversion	Introversion

Extraversion/introversion represented in Table 1.1, is the basic attitude dimension. This attitude dimension describes where a person directs his/her energy. Extraverts direct energy to the outer world. Therefore, they prefer to act on and influence the environment. In contrast, introverts would rather use energy for their own inner experience and reflection (direct energy to the inner world). For example, an extravert directs energy outwardly, would find it easy to talk to most people for a long period of time in social occasions while introverts, direct energy inwardly would find it hard to start and maintain the conversation.

The second major classification is called function. A function is "...a particular form of psychic activity that remains the same in principle under varying conditions" (p.436). Two of the functions describe differences in perceiving the world, through direct experience with the senses, or through

intuitive interpretation. The other two functions describe how we make judgments or decisions, based on consideration of the impact of the decision on self and others vs. a rational and impartial approach to decision making. In Jung's theory, each individual has one perceiving function (sensing or intuition) and one judging function (thinking or feeling). See Table 1.2

Table 1.2: Basic functions: Perceiving & Judging

Function	
Perceiving	Judging

The Perceiving Functions

The Sensing/iNtuition function refers to the way a person attends to and perceives information. A sensing person perceives things by his/her five senses while an intuitive person perceives things through the overall impression. The intuitive person sees the relationships and meanings through insight. People with a sensing preference focus more on the immediate experiences available because the senses make them aware of only what is happening at the moment. As a result, they often develop associated characteristics such as practicality and are more attuned to the practical value of things. By contrast, those who rely on intuition perceive things beyond what is visible to the senses, including possibilities (Myers et. al, 2003). As a result, sensing people are usually more

aware of the observed things and attend to facts and details while intuitive people tend to prefer learning concepts and principles.

The Judging Functions

Thinking and Feeling are called judging functions because they describe how one evaluates information to make a decisions. A thinking type will evaluate or decide based on logical principles that can be applied to the situation, which tends to make their decisions or judgments objective and impersonal. A feeling type uses personal and group values as well as feelings of others in coming to a decision. In making decisions, a thinking person would prefer to use analytical judgment to evaluate the situation while a feeling person would tend to weight the relative values.

While Jung called sensing and intuition functions of perception, he also called them irrational functions, or more properly non-rational. What he meant by irrational was that these functions are "...not grounded on reason..." (1971, p.454). According to Jung, elementary facts such as "earth has a moon" belong to the irrational category because they are not based on logical deduction. In contrast, he called thinking and feeling judging and rational functions. To summarize, the focus of sensing and intuition is purely perception, and the focus

of thinking and feeling is reason. Table 1.3 shows the basic attitude dimension and the four functions.

Table 1.3: The four functions

Function			
Perceiving (perception)		Judging (reason)	
Sensing	iNtuition	Thinking	Feeling

In Jung's theory, the major psychological types could be understood in terms of the combination of attitude (extraversion or introversion) and a dominant function, Sensing, iNtuition, Thinking, or Feeling. The dominant function refers to the function that is used most often with the greatest confidence. This function dominates personality. In Jung's words, the dominant function has the "absolute sovereignty" that goes to one and only function (1971, p.405). Table 1.4 shows how the attitudes combine with the four functions to produce 8 psychological types. Table 1.5 summarizes the description of the 8 types.

Table 1.4: Jung's eight types

		Attitude									
		Extraversion				Introversion					
		Judging		Perceiving		Judging		Perceiving			
		Function									
dominant		Thinking	Feeling	Sensing	iNtuition	Thinking	Feeling	Sensing	iNtuition	dominant	

Table 1.5: Description of Jung's 8 types (Myers et al, 1998, p.23)

ET	Dominant Extraverted Thinking	Seek logical order to the external environment by applying clarity, goal-directedness, and decisive action
EF	Dominant Extraverted Feeling	Seek harmony through organizing and structuring the environment to meet people's needs and their own values
ES	Dominant Extraverted Sensing	Direct energy outwardly and acquiring information by focusing on a detailed, accurate accumulation of sensory data in the present
EN	Dominant Extraverted Intuition	Direct energy outwardly to scan for new ideas, interesting patterns, and future possibilities
IT	Dominant Introverted Thinking	Seek accuracy and order in internal thoughts through reflecting on and developing a logical system for understanding
IF	Dominant Introverted Feeling	Seek intensely meaningful and complex inner harmony through sensitivity to their own and others' inner values and outer behavior
IS	Dominant Introverted Sensing	Direct energy inwardly and storing the facts and details of both external reality and internal thoughts and experiences
IN	Dominant Introverted Intuition	Direct energy inwardly to focus on unconscious images, connections, and patterns that create inner vision and insight

In addition to the identification of 8 major psychological types, Jung also described the existence of the auxiliary function (second function). The auxiliary function "...is always one whose nature is different from...the primary [dominant] function..." (1971, p.406). Whenever a judging function (thinking or feeling) is dominant, a function of perception (sensing or intuition) is auxiliary, and vice versa.

Though Jung described thinking and feeling functions as judging functions and sensing and intuition as functions of perception, it was Katharine Briggs (Myers & Myers, 1980) who introduced the fourth dichotomy, judging and perceiving, to explain Jung's theory. The J/P dichotomy adds a second attitude to the classification describing one's orientation (attitude) to the outer (extraverted) world. A person with judging attitude usually gets to conclusion and closure quickly while someone with perceiving attitude tends to keep gathering information before comfortably reaching closure. One characteristic of a J person is s/he likes to set up a schedule and follow the schedule. Conversely, a P person usually goes with the flow. Table 1.6 shows the four attitudes and four functions.

Table 1.6: The four attitudes and four functions

Attitude		Function	
Extraversion	Perceiving	Sensing	Thinking
Introversion	Judging	iNtuition	Feeling

Briggs used perceiving/judging as an attitude, but also used it as a predictor of the function that is turned outward. People with the perceiving attitude turn the perceiving function outward and those with the judging attitude turn this function outward. Once the outward directed function is decided using the perceiving/judging attitude, the inward directed function will be the complement. For example, if a judging function (thinking or feeling) is outwardly directed (extraverted), then the complement, a perceiving function (sensing or intuition) will be directed inward (introverted).

The dominant function will be either the outward directed function or the complement. For extraverts, the dominant function is the outwardly directed (extraverted) function. For introverts, the dominant function is the inwardly directed (introverted) function. Extraverts show the dominant function to the outside world. In contrast, an introvert's dominant function is the introverted function which is used in the inner world.

The adding of the J/P dimension not only revealed what was an implicit yet undeveloped aspect in Jung's theory but also refined the theory from 8 types to 16 types. Table 1.7 shows the combination of the 16 types based on the interaction of the two attitude dimensions and two function dimensions.

Table 1.7: The 16 types

		Attitude																	
		Extraversion								Introversion									
		Judging				Perceiving				Judging				Perceiving					
		Function																	
dominant auxiliary		Thinking		Feeling		Sensing		iNtuition		Thinking		Feeling		Sensing		iNtuition		dominant auxiliary	
		S	N	S	N	T	F	T	F	S	N	S	N	T	F	T	F		
		ESTJ	ENTJ	ESFJ	ENFJ	ESTP	ESFP	ENTP	ENFP	ISTJ	INTJ	ISFJ	INFJ	ISTP	ISFP	INTP	INFP		

Suppose John is an ESFJ (see Table 1.8). He has a judging attitude; this means his judging function (Feeling) is outwardly directed (extraverted). And because he has E attitude, feeling would be dominant and used to the outer world. His perceiving function (S) would be inwardly directed (introverted) and serve as the auxiliary function toward his inner world. On Jung’s 8-type interpretation, John would be Dominant Extraverted Feeling.

Table 1.8: ESFJ – John’s classification

		Attitude																	
		Extraversion								Introversion									
		Judging				Perceiving				Judging				Perceiving					
		Function																	
dominant auxiliary		Thinking		Feeling		Sensing		iNtuition		Thinking		Feeling		Sensing		iNtuition		dominant auxiliary	
		S	N	S	N	T	F	T	F	S	N	S	N	T	F	T	F		
		ESTJ	ENTJ	ESFJ	ENFJ	ESTP	ESFP	ENTP	ENFP	ISTJ	INTJ	ISFJ	INFJ	ISTP	ISFP	INTP	INFP		
				John															

Then we look at Mary, who is an ISFJ (see Table 1.9). She shares the same judging attitude with John so her feeling function is outwardly directed (extraverted) and S function inwardly directed (introverted). However, she has I attitude that means her inwardly directed (introverted) function should be the dominant function (S) and the outwardly directed (extraverted) function (F) become auxiliary. Mary is then Dominant Introverted Sensing on Jung’s 8-type grouping. In summary, the interaction of the E/I and J/P attitude decides one’s outwardly directed (extraverted) function and whether this function is dominant or auxiliary.

Table 1.9: ISFJ – Mary’s classification

		Attitude																	
		Extraversion								Introversion									
		Judging				Perceiving				Judging				Perceiving					
dominant auxiliary		Function																dominant auxiliary	
		Thinking		Feeling		Sensing		iNtuition		Thinking		Feeling		Sensing		iNtuition			
		S	N	S	N	T	F	T	F	S	N	S	N	T	F	T	F		
		ESTJ	ENTJ	ESFJ	ENFJ	ESTP	ESFP	ENTP	ENFP	ISTJ	INTJ	ISFJ	INFJ	ISTP	ISFP	INTP	INFP		
				John								Mary							

Learning Styles

This study proposes that psychological type as defined by Jung, Myers & Briggs, and cognitive style, as defined by Riding can be used as the theoretical basis for a learning style that will be called social learner. Jonassen & Grabowski

defined learning styles as "...learner preferences for different types of learning and instructional activities" (1993, p.5). Curry, in the Onion Model, referred to learning styles as "...the general area of interest concerning individual differences in cognitive approach and process of learning" (1983). In this study, learning styles refer to observable learner preferences in the learning environment. This is different from psychological types or cognitive styles. The personality types described by Jung or Myers & Briggs are concerned with the differences of the human psyche. These types are more than "...idiosyncrasies of character peculiar to individuals..." or "...isolated individual instances..." (Jung, 1971, p.331). Cognitive style describes individual's habitual ways of organizing and processing information and experience, which can affect learning preferences in the learning environment but are more fundamental and stable. In this study, learning styles are seen as extensions of psychological types and cognitive styles in the learning environment.

Use of psychological Types in Explaining Learning Styles

Dillon & Green noted that type theory, as described by Myers & Briggs, is one of three commonly used measures of learning styles in distance education (2003). Lawrence (1984) stated that the psychological types described by Myers & Briggs can be used to predict one's preferred or habitual ways of learning. Jensen

further suggested that it can be used to predict “what kind of behaviors, instructional tools, and environments facilitate or hinder learning for that student” (1987, p.183). One shortcoming of the research that studied relationships of learning styles and psychological types as defined by Jung and Myers-Briggs is that they studied one dichotomy at a time instead of studying the interactions with attitudes and functions. Lawrence did a review examining research that used type theory to study learning, teaching, and academic aptitudes (1984). The result of his review showed that “...80 percent of the studies analyzed learning style differences by examining the four MBTI [Myers-Briggs Type Indicator] scales separately rather than by using the 16 preference types” (1993, p.39). This trend has continued in recent years where researchers who have used the psychological type theory to study online learners still use only the four separate attitudes/ functions (Owen & Liles, 1999; Palloff & Pratt, 1999; Bail, 1993; Dewar & Whittington, 2000). Researchers who had used psychological type theory to study the learning styles of learners acknowledged the interactions of functions and attitudes, yet most examined the four dichotomies separately. Lawrence mentioned that the limitation comes from finding the appropriate sample size to test all the 16 types since the 16 types are not equally represented in the population.

Lawrence also summarized the research result based on the learning styles associated with combined type theory functions. Among the few studies done combining attitudes and functions, Sensing Feeling people were found to prefer instruction with personal involvement and like having a study schedule (McCaulley & Natter, 1974). Intuitive Feeling people were found to prefer learning through personal relationships, dislike impersonal instruction, highly value faculty feedback (Otis, 1972) and appreciate the opportunity to be creative and original (McCaulley & Natter, 1974). Apparently, there is the social component needed by F learners. However, it is not clear from Lawrence's account whether a theoretical explanation of this behavior has been developed. Nevertheless, Lawrence did point out an important point that interactions of the dichotomies do play an important role in explaining learning styles. Considering that the interaction in the online learning environment is less than that of the traditional classroom, the F learners might struggle in the independent online learning environment. Yet no empirical studies have been established to discover the issue.

Use of Cognitive Styles in Explaining Learning Styles

In studying the relationship between cognitive styles and learning styles, Riding and Douglas found that wholists learn better with structured learning

materials because they don't habitually take the structured approach (1993). In contrast, analytics tend to organize information themselves because they are good at analyzing information based on its parts. Riding suggested that wholists tend to be socially dependent (1998). Sadler-Smith and Riding also found that "Wholists expressed a stronger preference for collaborative methods" (1999, p.364). In addition, Riding and Rayner (1998) discovered that wholists tend to be sociable and outward, while analytics are more solitary, which might be an indication that wholists would prefer group work and analytics would choose to work independently.

Summary of Theoretical Framework

Cognitive styles and interactions of psychological types identify five main dimensions that can be used as a theoretical basis for predicting learning style in this study:

- Processing and organizing information is described by the wholist-analytic dimension.
- Orientation of effort is described by extraversion-introversion.
- Orientation to closure is described by perceiving-judging.
- Preference for an analytic approach is described by thinking-feeling.
- Preference for perception is described by sensing-intuition.

Purpose of Study

The purpose of this study was to determine if two theoretical constructs, 1) psychological types as described by Jung, Myers and Briggs, and 2) cognitive styles, defined by Riding and Cheema, can be used to support the existence and definition of the learning styles of a group that will be called social learners. The researcher has made assumptions about how the psychological types and cognitive styles can be used to predict the learning styles of the social learners. To validate the predicted learning styles of the social learners, a researcher developed survey was used to test these assumptions about the learning styles of the social learners. In sum, the researcher was interested in understanding whether 1) the Wholist-Analytic dimension of the cognitive styles, as defined by Riding and Cheema (1991), and 2) the interactions of attitudes and functions of psychological types as defined by the theories of Carl Jung, Katherine Briggs and Elizabeth Myers can be used to predict the existence of the social learner learning styles. The results are intended to help instructors design and prepare courses to support and challenge learners of this type; respond to their individual needs more efficiently and effectively, and facilitate the learning process of team projects by recognizing individual differences and help learners obtain better learning outcomes. The study also provided the insights for conducting similar research with other types.

Based on the theoretical framework described above, the logical prediction of the relationship between psychological type, cognitive styles and learning styles is summarized in Figure 1.1

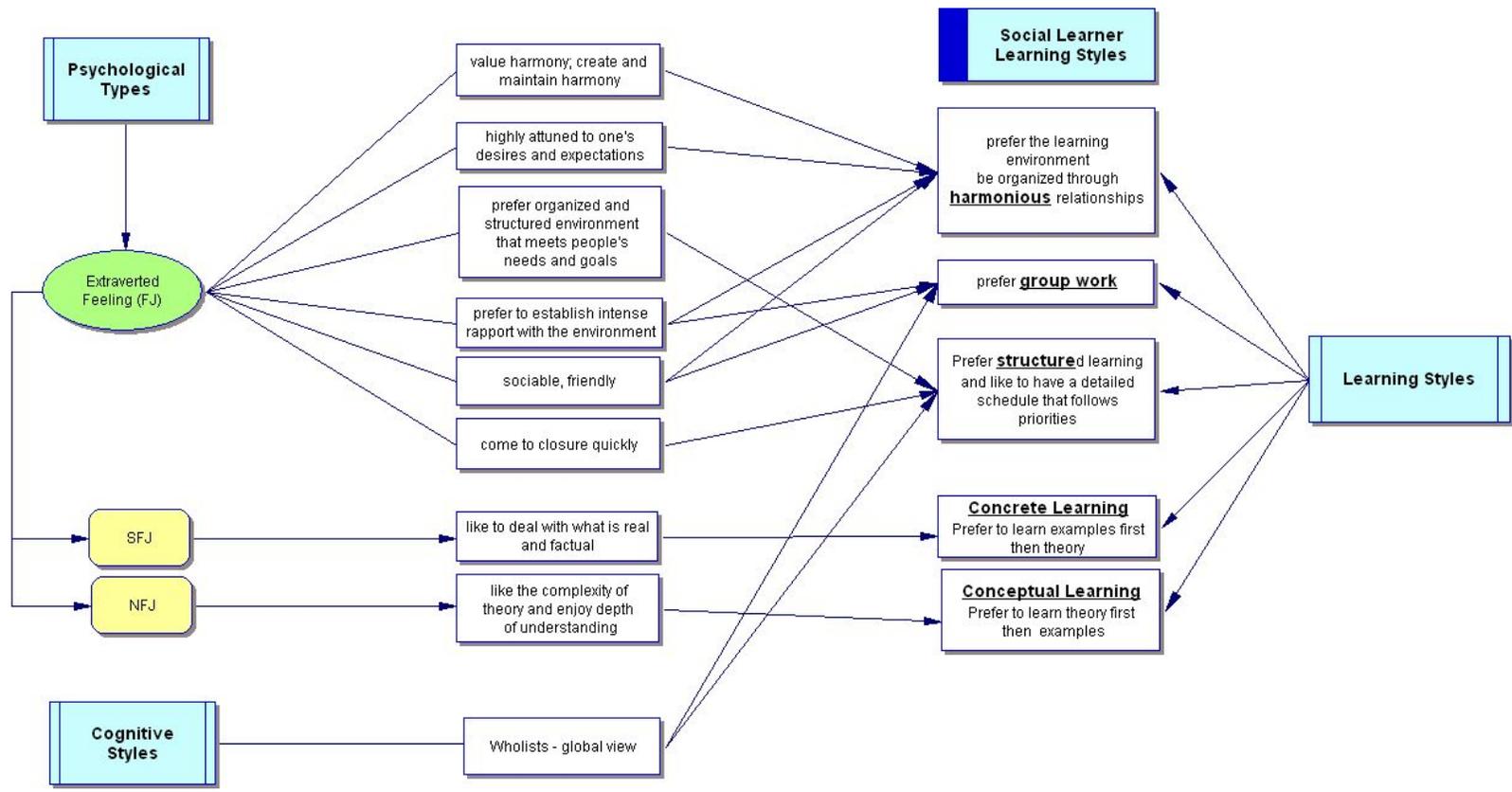


Figure 1.1: Theoretical Framework

The hypothesized social learners are Feeling-Judging (FJ) persons. FJs extravert the feeling function and value harmony and are highly attuned to other's needs which makes them prefer organizing and maintaining the harmony in the learning environment. They also make decisions based on group or personal values. They like structured learning environments, which helps them come to closure quickly and like to know what is expected and have a detailed schedule that follows priorities in the learning environment. The wholist-analytic dimension of the cognitive styles would strengthen-weaken the characteristics of social learners. Wholists are more sociable and outwardly engaged in group work. The wholist nature of their cognitive style makes them perceive things in a more global way and might cause them to struggle in the unstructured learning environment.

Two sub-groups under social learners, SFJ and NFJ, are also hypothesized to be different in the way they prefer to learn. SFJs introvert the sensing function and prefer to learn examples first before they learn the concepts and theory. In contrast, NFJs prefer to learn concepts and theories first before they are given examples.

Research Questions

1. What is the relationship between psychological types and cognitive styles?

Are they independent predictors of learning styles, or do they predict the same learning styles because they are related?

2. Can psychological types and cognitive styles be used to predict the learning styles of a particular group called social learners who have a stronger preference for group work, need structure in the learning environment and prefer organizing and maintaining harmony in the learning environment?
 - a. Do people who extravert feeling function (FJs) have a stronger preference for group work than non FJ's?
 - b. Do people who extravert feeling function (FJs) have a stronger preference for a structured learning environment than non FJ's?
 - c. Do people who extravert feeling function (FJs) have a stronger preference for organizing and maintaining harmony in the learning environment than non FJ's?
 - d. Does wholists-analytic dimension of cognitive style affect one's preference for the above three?
3. Do SFJs prefer learning examples first and NFJs prefer learning concepts and theories first?
4. Is there difference between those whose extraverted feeling function is dominant (ESFJ/ENFJ) than those whose is not (ISFJ/INFJ)?

Hypotheses

Ho1: There is no relationship between psychological types and cognitive styles.

Ho2: There is no difference between FJ and non-FJ on the proposed social learner learning styles (prefer group work, prefer a structured learning environment and prefer to organize and maintain harmony in the learning environment).

Ho3: There is no difference between Analytic Non-FJ, Wholist Non-FJ, Analytic FJ and Wholist FJ on the proposed social learner learning styles.

Ho4: There is no difference between SFJ and NFJ on their preference for learning examples first or concepts and theories.

Ho5: There is no difference between EFJ and IFJ on the proposed social learner learning styles.

Definition of Terms

- Analytic: People who habitually deconstruct information to its component parts. Analytics prefer structured approach to learning and tend to impose structure on information. Also see Wholist (Riding & Rayner, 1998).

- Attitude: a readiness of the psyche to act or react in a certain way (Jung, 1971).
- Auxiliary function: The second function in type theory that serves the dominant function and helps balance the extraverted and introverted functions (Jung, 1971; Myers et al., 1998).
- Cognitive style: consistent individual differences in preferred ways of organizing and processing information and experience. According to Riding and Cheema, it can be grouped into two dimensions: wholist-analytic and verbal-imagery (1991).
- Dominant function: In type theory, the function that is used often with greatest confidence (Jung, 1971).
- Extraversion: The attitude that identifies the direction of energy mainly toward the outer world of people and objects. Also see Introversion (Myers et al., 1998).
- Feeling: One of the opposing judging type functions by which one makes decisions based on personal values. Also see Thinking (Myers et al., 1998).
- Function: a particular form of psychic activity that remains the same in principle under varying conditions (Jung, 1971).
- Introversion: The attitude that identifies the direction of energy mainly toward the inner world of experiences (Myers et al., 1998).

- Intuition: One of the perceiving type functions that focuses mainly on meanings, patterns, relationships and possibilities (Myers et al., 1998).
- Judging: The attitude that indicates either Thinking or Feeling is the preferred way of dealing with the outer world (Myers et al., 1998).
- Learning style: observable learner preferences in the learning environment.
- Perceiving: The attitude that indicates either Sensing or iNtuition is the preferred way of dealing with the outer world (Myers et al., 1998).
- Psychological types: the psychological differences in the way individuals prefer to perceive information and make judgments. It is fundamental and stable compared to learning style. It is more general than learning style in that it explains human behaviors but is not necessarily limited to learning related behaviors.
- Sensing: One of the perceiving type functions that focuses mainly on what can be perceived by the five senses (Myers et al., 1998).
- Social Learner: learners who value harmony and are highly attuned to other's needs which makes them prefer organizing and maintaining the harmony in the learning environment. They also make decisions based on group or personal values. They like structured learning environments, which helps them come to closure quickly and like to know what is expected

and have a detailed schedule that follows priorities in the learning environment.

- Thinking: One of the opposing judging type functions by which one makes decisions based on logical analysis and focuses on objectivity and detachment (Myers et al., 1998).
- Wholist: People who habitually keep a global view of information. Wholists tend to be able to see a broader perspective and the overall relevance of all aspects of the information(Riding & Rayner, 1998).

Chapter 2

Literature Review

Introduction

This study proposed that psychological types as defined by Jung, Myers & Briggs, and cognitive styles, as defined by Riding can be used as the theoretical basis for the learning styles of a group that will be called social learners. In this chapter, the relationships between psychological types, cognitive styles and learning styles was presented.

Cognitive Styles

Messick described cognitive style as "...consistent individual differences in preferred ways of organizing and processing information and experience" (1984, p.5). Cognitive style describes individual's habitual ways of organizing and processing information and experience, which can affect learning preferences in the learning environment but are more fundamental and stable.

The Wholist-Analytic dimension of the cognitive style was derived from the work of Witkin and others on field-dependence and field-independence. Riding and Buckle (1990) defined analytic as equivalent to field-independence

and Wholist as equivalent to field-dependence. One major criticism of Witkin's field dependent and independent theory was that it assesses ability rather than style because it measures field-independence or its absence. Riding and Pearson (1995) proposed it is important to measure the cognitive styles from both directions and then decide which side is one's preference (from which they do better).

Riding and Wigley studied the relationships between personality sources and cognitive styles and found the correlations between them approximate to zero for college students (1997). They further suggested that the combination of personality type sources and cognitive styles affect behaviors and cognitive styles might "...add to or decrease the effect of [personality] sources" (p.388). Riding also claimed that the tasks used to assess Wholist-Analytic dimension are different from basic personality dimensions such as introversion-extroversion. However, researchers didn't study relationships between cognitive styles and psychological dimensions based on the Myers-Briggs Type theory.

Learning Styles

Learning style is "...a very broad and relatively fuzzy concept" (Sims & Sims, 2006, p.20). Researchers started to use the term in the early 1960's and some tried to conceptualize it (Claxton and Murrell, 1987; Coffield et. al., 2004; Curry,

1983; Lawrence, 1993). Jonassen & Grabowski defined learning styles as “learner preferences for different types of learning and instructional activities” (1993, p.5).

Curry, in the Onion Model, referred to learning styles as “...the general area of interest concerning individual differences in cognitive approach and process of learning” (1983, p.3). She categorized learning styles into three layers, with cognitive personality as the center layer, then information processing, and instructional preference as the outer layer. Claxton and Murrell (1987) further expanded the model into four layers: personality, information processing, social interaction, and instructional preference. The additional social interaction layer describes how students tend to interact and behave in the learning environment.

In 1993, Lawrence identified learning styles to cover the following four aspects of psychological makeup.

- A. Cognitive style in the sense of preferred or habitual patterns of mental functioning: information processing, formation of ideas, and judgments.
- B. Patterns of attitudes and interests that influence what a person will attend to in a potential learning situation.
- C. A disposition to seek out learning environments compatible with one’s cognitive style, attitudes and interests, and to avoid environments that are not congenial.
- D. Similarly, a disposition to use certain learning tools, to use them successfully, and to avoid other tools (p.39).

Coffield et al (2004) suggested a new framework of learning styles as a result of an international review of the literature on learning styles and pedagogy in the post-compulsory sector funded by the Learning and Skills Development

Agency. This new framework of learning styles claimed that learning styles include the following five families.

- Learning styles and preferences are largely **constitutionally based**.
- Learning styles reflect deep-seated features of the **cognitive structure**.
- Learning styles are one component of a relatively **stable personality type**.
- Learning styles are **flexibly stable learning preferences**.
- Move on from learning styles to **learning approaches, strategies, orientations and conceptions of learning (p.9)**.

Coffield et al's framework is similar to the onion model and pointed out that some learning styles are rooted in more deep and stable cognitive style and personality type. The framework proposed by Lawrence covers mostly instructional preferences as defined by the onion model. From both frameworks, it is obvious that cognitive styles and personality types are highly related to learning styles and were viewed as more stable. As a result, learning styles reflected from cognitive styles and personality types are seen to persist across situations.

In this study, learning styles refer to observable learner preferences in the learning environment. They are seen as extensions of personality types and cognitive styles in the learning environment.

Use of Psychological Types in Explaining Learning Styles

“The MBTI [Myers-Briggs Type Indicator] was designed to indicate not only one’s separate preferences on each of four dichotomies but one’s whole type as well. Unfortunately, much research on the MBTI in education has solely reported patterns of correlation between a single dichotomy and other variables” (Myers et al, 1998, p.254). There is also misconception that the Myers-Briggs Type theory can be used to directly measure learning style (Cano, 1998; Chang and Chang, 2000; Persaud, 2003). Although psychological type can be used to help explain learning, it was not designed specifically for learning. Rather, it was designed to explain the differences of human behaviors, which is not necessarily learning related. While type theory has provided implications for education, it is not a learning style theory. As stated by Jensen (1987), The Myers-Briggs Type theory assesses personally type and can help predict how students learn best and suggest alternative methods of study. He further suggested that the type theory can be used to predict “...what kind of behaviors, instructional tools, and environments facilitate or hinder learning for students” (p.183).

Coffield et al. (2004) compiled a review of 13 learning styles and listed Myers-Briggs Type theory as one of the learning styles models. In the review, the authors concluded that one weakness of Myers-Briggs Type theory was “...not specifically about learning” (p.51) and pointed out that MBTI was designed for

use as a personality type instrument. Psychological types and learning styles are not the same. The psychological types described by Jung or Myers & Briggs are concerned with the differences of the human psyche. These types are more than "...idiosyncrasies of character peculiar to individuals..." or "...isolated individual instances..." (Jung, 1971, p.331). One's psychological types do affect one's learning styles and some learning habits come from type. This might be called instinct ways of learning (Lawrence, 1983). Yet, psychological types should not be used directly as learning styles.

Kolb developed four basic learning styles in his experiential learning theory (1984) and attributed part of his theory to Jung's psychological types. These four learning styles are Accommodation, Divergence, Convergence, and Assimilation. He examined the relationships among the four learning styles and the types from the Myers-Briggs Type theory and found "...sensing type is associated with the accommodative learning style...intuitive type falls in the assimilative quadrant; the feeling personality type is divergent in learning, and thinking types are convergent" (p.81, p83). Although Kolb's learning styles were shown to be related to the psychological types, its focus is on learning process through four modes: concrete experience, reflective observation, abstract conceptualization, and active experimentation, which does not directly relate to the predicted social learner learning styles in this study. Nonetheless, Kolb has

helped to prove that psychological types can be used as foundations to explain learning styles.

Previous Studies using a single dichotomy of Myers-Briggs Type Theory

Extraversion/Introversion

Study results suggest that introverts enjoy the online environment because it creates the space and privacy they don't usually find in regular face to face environment. Palloff & Pratt suggest that introverts feel more comfortable thinking about information before responding to it in a virtual community while extraverts find it more difficult because they may have trouble establishing a sense of social presence (1999). On the other hand, Owen & Liles observed that extraverts are more likely to use the Internet because "...the Internet facilitates the extravert's inclination to be connected with large numbers of individuals and accommodates their need for group work, cooperative projects, and discussion." (Dewar & Whittington, 2000, p. 388) They suggest that introverts prefer to work individually or with small groups and use group communications technologies less.

Sensing/iNtuition

The main difference between sensing and intuitive students is how they direct their perception. From the results of their study, Wankat & Oreovicz implied that sensing students learn best deductively while intuitive students learn best inductively (1993). In other words, sensing types prefer to learn through step-by-step instructions and start with practical experiences. Jensen pointed out that sensing students like teachers who give clear directions and are concise about the tasks (1987). He also found that the greatest strength for intuitive students would be learning concepts and mastering abstract theories. Lawrence's summaries of 130 studies of type and learning also concluded that sensing students like to learn concrete facts first. On the contrary, intuitive students prefer to start with concepts then examples (1983).

Thinking/Feeling

Jensen commented that the thinking-feeling dimension is "...most useful for providing insights into the affective domain of learning styles" (1987, p.184). Thinking students tend to work toward a clear set of criteria. However, feeling students look for learning that is consistent with their personal values. They might find learning boring and unrewarding if the content doesn't match their personal values. They also appreciate personal encouragements from others.

This is consistent with what Lawrence suggested that feeling types would prefer that instructors appreciate who they are and not just the quality of their work, value the warmth and friendliness of a learning environment, and prefer to learn based on interpersonal values (1983).

Judging/Perceiving

Dewar and Whittington studied the learning strategies used by learners with different types and found perceiving types like "...open-ended, free-flowing, almost structureless environment" while Judging types like "...things definite, settled, and organized" (2000, p.3). Bail's study also shows that more requests for clarification of requirements through email were written by Js (1993). This is also consistent with Jensen's comments that the judging-perceiving dimension is most useful in deciding whether students prefer structured learning environments or not (1987). The judging students like to set goals and deadlines during the learning process. They have a tendency to reach for closure. Table 2.1 summarizes the studies that are related to this research but were completed based on a single dichotomy.

Table 2.1: Summary of Studies based on one dichotomy

E - I	Preference for online environment (Owen & Liles, 1999; Palloff & Pratt, 1999)	T - F	Value logical or personal criteria (Jensen, 1987; Lawrence, 1983)
S - N	Learning process (Wankat & Oreovicz, 1993) Prefer learning facts or concepts (Lawrence, 1983)	J - P	Preference for structure (Bail, 1993; Dewar & Whittington, 2000; Jensen, 1987)

Use of Cognitive Styles in Explaining Learning Styles

It is not uncommon for researchers to describe cognitive style as learning style or use the two interchangeably (Wilson, 1998). However, these two are not the same. Cognitive style describes individual's habitual ways of organizing and processing information and experience, which can affect learning preferences in the learning environment but are more fundamental and stable. Sadler-Smith conducted a study among second year undergraduate students in the UK and examined the relationships between cognitive style and learning style and found them to be independent from each other (2001).

Riding suggested that wholists might need help from the instructor to impose structure in their learning because they habitually don't take the structured approach like analytics (1999). In addition, wholists tend to be more dependent and like group work while analytics tend to be more self-reliant.

Summary of Literature Review

Understanding psychological types and cognitive styles helps us to recognize the natural motivations for learning that will lead to better learning results. The learning environment might change and thus affect one's learning styles. Yet, psychological types and cognitive styles are more stable and tend to stay unchanged. Learners might learn to adjust and adapt through environmental change, their true types are most likely to stay the same. As a result, it is believed that the aspects of learning styles that are based on psychological types and cognitive styles are more likely to persist across situations. Teachers and instructional designers who understand psychological types and cognitive styles can use this knowledge to accommodate individual differences among their learners.

Type theory has been used to explain learning styles yet mostly at the dichotomy level, ignoring interactions of attitudes and functions. Lawrence did summarize studies concerning the combination of the four dichotomies. However, his summary didn't include studies that investigated interactions of the S-N dichotomy with the social learning type (FJ) predicted in Figure 1.1.

Cognitive styles have also been used to explain learning style but no research had used it and type theory together to explain learning styles. The purpose of this research was to determine whether type theory and cognitive

styles together can be used to support the learning styles of social learners based on the theoretical framework outlined in Figure 1.1.

Chapter 3

Research Design

The purpose of the study was to concurrently validate a learning style survey and determine if two theoretical constructs, 1) Psychological types as described by Jung, Myers, and Briggs, and 2) cognitive styles, defined by Riding and Cheema, can be used to predict the five learning styles described in the theoretical model represented in Figure 1.1. The learning styles describe the characteristics of a group defined as social learners. Two sets of secondary data were used: 1) 141 undergraduate students who enrolled in an online course, 2) 22 graduate students who enrolled in an online course offered in two different semesters but taught under the same instructor.

Measurement Instruments

The theoretical model was tested by analyzing students' psychological types measured by the Myers-Briggs Type Indicator, cognitive styles measured by the Cognitive Styles Analysis, and the results of a learning styles survey developed by the researcher and a faculty member.

Myers-Briggs Type Indicator (MBTI)

Said to be one of the three commonly used instruments in distance education on types (Dillon & Green, 2003), MBTI was developed by Myers and Briggs based on Carl Jung's theory of psychological types. Form M, developed in 1998, and containing 93 items was used in this study. MBTI measures four psychological dimensions: Extraversion/Introversion (E/I); Sensing/iNtuition (S/N); Thinking/Feeling (T/F); & Judging/Perceiving (J/P). Instead of measuring variation along a continuum, the MBTI "...seeks to identify a respondent's status on either one or the other of two opposite personality categories, both of which are regarded as neutral..." (Myers et al, 1998, p.5). As a result, the four dimensions are measured as four dichotomies making a total of 16 different combinations (4x4). There are 21 items on E/I dichotomy; 26 on S/N; 24 on T/F; and 22 on J/P. Each person gets scores for the 8 categories and the higher score within each dichotomy decides his/her psychological type on that dichotomy. The tie-breaking rule if E=I or S=N or T=F or J=P would be I N F P. For example, if Elaine's scores are E=21, I=0, S=21, N=5, T=12, F=12, J=14, P=8, then she is an ESFJ.

In addition to the two opposing categories on each dichotomy, a numerical preference clarity index is also provided for each dichotomy to reflect "...only how sure the respondent is that she or he prefers one pole of the

dichotomy over its opposite” (Myers et al, 1998, p.121). A larger preference clarity index means that one is clearer about what she or he prefers when forced to choose. The preference clarity index for each dichotomy is shown in

Table 3.1.

Table 3.1: Preference Clarity Category (Myers et. al., 1998)

Dichotomy	Preference Clarity Index	Preference Clarity Category
E/I	11-13 14-16 17-19 20-21	Slight Moderate Clear Very Clear
S/N	13-15 16-20 21-24 25-26	Slight Moderate Clear Very Clear
T/F	12-14 15-18 19-22 23-24	Slight Moderate Clear Very Clear
J/P	11-13 14-16 17-20 21-22	Slight Moderate Clear Very Clear

Those who report clear preference may exercise the attitude/function more often and are more likely to have developed the associated skills or habits and traits. However, preference clarity index does not determine one’s

inadequacy or excellence in using an attitude/function. Preference clarity should be taken into consideration especially for those with "Slight" on the index because a change of one or two questions might change their preference (Myers et al., 1998).

According to Myers et al., The internal consistency of Form M is greater than .82; The 4-weeks interval test-retest reliability of it is greater than .83 on all four dimensions (1998, p.163).

Cognitive Styles Analysis (CSA)

The Cognitive Styles Analysis (CSA) was used to measure participants' cognitive styles dimensions. Though only the Wholist-Analytic dimension of CSA will be included in this study, data on the Verbal-Imagery dimension was also collected because of the format of the CSA program. The CSA is a computer administered test developed by Richard Riding. The first set of questions asks the subject to compare two words based on color or perceived categories on the Verbal-Imagery dimension. The second set tests Wholist style by asking the subject to decide if two sets of figures are the same. The third set asks subject to decide if one figure is contained in another. The last section is similar to Witkins' Group Embedded Figures Test, testing the Analytic dimension. Here are some example questions for the three sets.

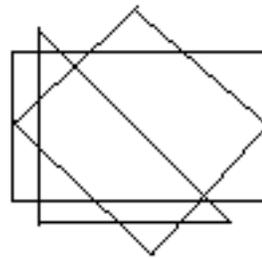
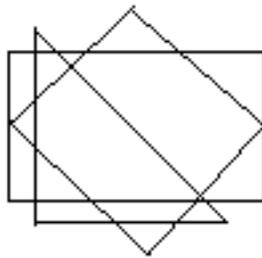
1. Verbal-Imagery questions

- GOLF and JUG are the same TYPE.
- SKIING and BASEBALL are the same TYPE.
- BREAD and BUTTER are the same COLOR.
- ONION and POTATO are the same TYPE.
- LETTUCE and LAWN are the same COLOR.
- CORNFLAKES and MILK are the same COLOR.

2. Wholist questions

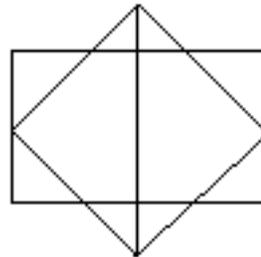
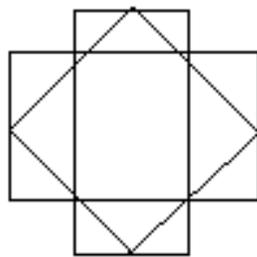
Is this

the same as



Is this

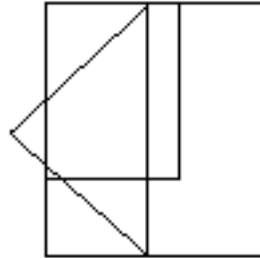
the same as



3. Analytic questions

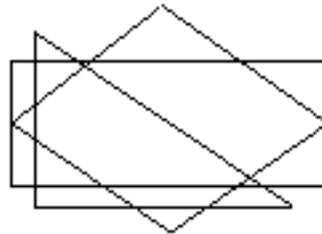
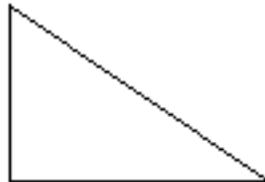
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For both dimensions, the computer records the time the subjects take to respond. The times are used to make inferences about preferred cognitive processes used to determine the answer by calculating the ratio of Wholist by Analytic. The CSA uses the ratio to indicate the position of an individual on the dimension. The ratios typically range from 0.4 to 4.0 for Wholist-Analytic

dimension with a standard mean ratio of 1.25. Depending on the ratio one gets, one will be able to find his/her position on the Wholist-Analytic dimension and Verbal-Imagery dimension as shown in Table 3.2 .

Table 3.2: The dimension of cognitive styles

WHOLIST-ANALYTIC DIMENSION	>1.35	ANALYTIC VERBALISER	ANALYTIC BIMODAL	ANALYTIC IMAGER
	>1.02 and <=1.35	INTERMEDIATE VERBALISER	INTERMEDIATE BIMODAL	INTERMEDIATE IMAGER
	<=1.02	WHOLIST VERBALISER	WHOLIST BIMODAL	WHOLIST IMAGER
		<=0.98	>0.98 and <=1.09	>1.09
VERBAL-IMAGERY DIMENSION				

Peterson et al. reported test-retest reliability of CSA for the Wholist-Analytic dimension as 0.69 (2003). This study was conducted at the University of Edinburgh. 50 students took the CSA twice, with the second time one week later. Riding criticized that the sample size was rather small and the test-retest interval was rather short. He expected that a higher reliability might be obtained yet no further studies were pursued (2003).

Learning style survey

This study used concurrent validation of a self developed survey to test that the learning styles of social learners can be predicted through the theory of Psychological types as described by Jung, Myers, and Briggs, and cognitive styles, defined by Riding and Cheema. Concurrent validity was assessed by the extent the learning style survey was found to be able to distinguish social learners and non-social learners.

The learning style survey was used to measure students' learning styles that were believed to relate to psychological types. The learning styles survey contains 37 items (see Appendix A). Participants were asked to respond according to their agreement or disagreement on the statements with a scale of 1 to 5 where 1 stands for strongly disagree and 5 stands for strongly agree. After laying out the prediction model based on psychological types and cognitive styles and an extensive literature review, the self-developed survey was believed to best serve the purpose of the research topic. However, the self-developed learning style survey was not validated prior to the study. Data collected during the study were used to validate the instrument.

Factor analysis showed that the self-developed learning style survey items fall into factors similar to the predicted variables. This study used the learning style survey to measure the predicted social learner learning styles and validated

the learning style survey concurrently. The following procedures were used to validate this instrument.

Design and Development of the survey

The learning style survey was generated based on the behavioral descriptions from Myers-Briggs & Jung's typological descriptions and Riding's Cognitive Styles theory as well as from the researcher and a faculty member's observations of student behaviors and online discussions.

The researcher used an inductive approach suggested by Hinkin (1998) to generate survey items because "...the conceptual basis for a construct may not result in easily identifiable dimensions for which items can then be generated" (p.107). During the survey development process, the researcher conducted anonymous message board discussions in two online courses offered in Spring 2004 and Summer 2004 where students anonymously shared their learning experiences in the course without knowing their psychological types and cognitive styles. Specifically, they were asked about what worked and didn't work for them in the course; perceptions of the group work and experiences learning with peers; perceptions of the course structure; preferred approach to learning course content through examples or concepts. These discussions were then used to create 30 learning styles questions.

Pilot Study

A pilot study was conducted in Fall 2004. Participants were 11 students from an online course called "Internet in the Classroom" at a research university in northeastern United States. Participants were given 5 extra points for participating in the study. Participants were asked to complete the MBTI Form M. There were difficulties in obtaining license of CSA at the time of data collection, so the Group Embedded Figured Test (GEFT) was used to measure cognitive styles. Participants were also asked to complete the learning style survey. All instruments were delivered in the paper format through regular mail. Participants completed the instruments, returned them to the researcher, and then received results and explanations on the MBTI and GEFT.

The survey items were grouped based on the outwardly directed (extraverted) function. There were four categories - Extraverted F, Extraverted T, Extraverted S, and Extraverted N. From the results of the learning style survey, each participant got a predicted category. The predicted results were then compared to their actual MBTI results. Among the 11 participants, 5 of them have the same actual and predicted categories. As a result of the pilot study, 6 items from the original learning style survey were deleted based on how the items differentiated among participants of the types. In addition, 13 items were added from the answers students responded on the type-related reflection

questions as well as descriptors from the theory. The finalized survey used in this study contains 37 items.

No relationship was found between the learning style survey and the GEFT as well as between MBTI and GEFT. However, the sample size was small and literature had supported relationships between cognitive styles and learning styles. In addition, the researcher intended to use the CSA instead of GEFT due to the criticism on GEFT being an instrument measuring ability instead of cognitive styles. The researcher was able to obtain license to use CSA through a course instructor, the cognitive styles aspect was kept in the study.

Factor Analysis and Internal Consistency Reliability

Principal component factor analysis was used to see how the survey items grouped together and whether these factors match the 5 predictors in the theoretical model outlined in Figure 1.1. Results of the factor analysis and internal consistency reliability data are presented in chapter 4.

Validity

The purpose for checking validity is to ensure that the instrument measures what it is intended to measure. To explore the validity of the survey,

several dimensions of validity were examined: content validity, construct validity and concurrent validity.

Content validity is established by showing that the test items are a sample of a universe in which the investigator is interested (Fink, 2003). The items in the learning style survey were generated inductively based on message board discussions. The survey was then pilot tested and revised.

Carmines and Zeller stated that, "Construct validity is concerned with the extent to which a particular measure relates to other measures consistent with theoretically derived hypotheses concerning the concepts that are being measured" (1979, p. 23). To ensure the construct validity of the self-developed learning style survey, experts in the field were asked to review the items and group them based on factors of the proposed theoretical model. They were also asked to rate the relevancy of the items to the factors. Experts asked to review the items were learning consultants who are experienced with student learning styles and content experts who are familiar with the Myers-Briggs & Jung's psychological type theory. The results of the factor analysis and internal consistency reliability also provided evidence for the construct validity of the learning style survey.

The concurrent validity of the instrument was established by comparing the survey results to the predictions of the theoretical model of social learners.

Trochim concluded that concurrent validity is established when “...we assess the operationalization’s *ability to distinguish between groups that it should theoretically be able to distinguish between*” (2005, Concurrent validity, para 1). In this study, concurrent validity was assessed by the extent the learning style survey was found to be able to distinguish social learners and non-social learners as predicted in the proposed theoretical model.

Participants

Participants were recruited from two pools of students. The first pool was a group of undergraduate students and the second a group of graduate students. Both groups were enrolled in online courses at a research university in northeastern United States. There were no pre-set criteria, all students enrolled in the courses were invited to participate in the study.

In compliance with the university’s regulations, the purpose of the study, a brief description of the procedure, and the benefits for participating in the study were explained to all students in an email in order to obtain their consent (see Appendix B for informed consent form). Students were given 2% extra credit for participating in the study. The researcher and other investigators explained to students that participation in the study was totally voluntary and participants were given alternative activities to obtain the extra credit if they didn’t want to

participate in this study. Participants from pool I also completed the Classroom Community Scale (CCS , Rovai, 2002) in addition to MBTI and CSA. After completion of the instruments, all participants were given results for their MBTI and CSA with explanations and resources (see Appendix C for sample report sent to students).

Data from a total of 163 students (141 from pool I, 22 from pool II) were included to run the factor analysis and test the reliability of the learning style survey. However, data from only the 132 participants from pool I who completed online survey, MBTI and CSA (all three) were used to examine the relationships between psychological types, cognitive styles and learning styles (seven students didn't complete CSA; one student didn't complete MBTI; one student didn't complete CSA nor MBTI).

Procedure

Participants were recruited first by the instructors of the courses. The researcher then contacted students to get consent. Participants from pool I who agreed to participate were asked to do the researcher developed learning style survey online and signed up a time slot to come to a classroom to complete the MBTI, CSA and CCS in the presence of the researcher (or other investigators). Since the CSA was a timed test, all participants were asked to complete the CSA

first before they took their own time to finish MBTI in the classroom. Participants from pool II who agreed to participate were asked to do the researcher developed learning style survey online.

Data Analysis

As described above, exploratory factor analysis was used to see how the groupings of items match the prediction of the theoretical model. Chi-Square was used to test if any of the MBTI dichotomies is related to the Wholist-Analytic dimension of the cognitive styles. Independent t-test was used to determine if FJ and non-FJ subjects responded differently on the predicted social learner learning styles (factors from the learning style survey). Due to the small sample size, the Kruskal-Wallis (K-W) test was used to examine whether Wholist-Analytic dimension of cognitive style affects one's social learner learning styles. K-W test is a nonparametric test that is used to decide if several independent groups come from a population with a common median (Pett, 1997). The Mann-Whitney test was utilized to test the difference between SFJ-NFJ and EFJ-IFJ because of the sample size and violation of the normality assumption. It is a nonparametric test for two independent groups (Field, 2005). In addition, factor analysis was employed to validate the learning style survey.

Chapter 4

Results

The purpose of this study was to investigate whether psychological types as defined by Jung, Myers & Briggs and cognitive style, as defined by Riding can be used to explain the social learner learning styles defined by the theoretical framework proposed by the researcher as well as to validate a self-developed survey instrument. This chapter reports concurrent validation of an instrument and the results of the statistical analysis that were used to test the hypothesis proposed in chapter 1. Evidence for the model was first tested using the factor analysis results and then hypotheses testing related to the sub-groups.

Validation of the Learning Styles Survey

There were 37 items on the learning styles survey and five items were re-coded in reverse order to correctly align the responses for data analysis purpose. A total of 163 participants completed the online learning style survey. Although 31 of them didn't complete either MBTI or CSA, all of their learning style survey data was included for factor analysis. Table 4.1 shows how the items correspond to the proposed learning styles as described in Figure 1.1.

Table 4.1 Predicted factors and corresponding items in the learning styles survey

Predicted Learning Styles (factors)	Item number	Explanation
Harmonious	13, 15, 18, 19, 21, 29, 31, 35	Value harmony; attuned to other's needs; prefer organizing and maintaining harmony in the learning environment; make decision based on group or personal values
Group Work	8, 26, 34	Sociable; enjoy working with others
Structure	3, 4, 5, 6, 11, 12, 14, 16, 17, 23, 24, 36	Like structured learning environment; come to closure quickly; like to know what is expected; have a detailed schedule that follows priorities.
Concrete	2, 10, 20, 25, 27, 30, 32, 33	Prefer learning examples first; inductive
Conceptual	1, 7, 9, 22, 28, 37	Prefer learning concepts first; deductive; innovative

Factor Analysis and Internal Consistency Reliability

Principal component factor analysis was used to see how the items grouped together and whether these factors match the 5 predictors in the theoretical framework. Two criteria were used to determine the number of factors to be extracted. First, only factors with eigenvalues greater than 1.0 were considered in the analysis. Second, a scree plot of the factor eigenvalues was used to identify breaks or discontinuity in determining the number of factors (Cattell, 1966). The factors were rotated using a varimax rotation method with Kaiser Normalization to aid in the interpretation of the factors. Based on the sample size, loadings of .40 absolute was used when determining which items

are significant in loading on a factor (Stevens, 1992). All the items that had loadings of .40 did not load higher than .4 on any other factor and were at least .1 higher than loadings on the other factors. Figure 4.1 is the scree plot showing the eigenvalues of each factor. Table 4.2 reports the factor loading of the survey items. The six factor model accounts for 42.7% of the variance.

Figure 4.1: Scree Plot

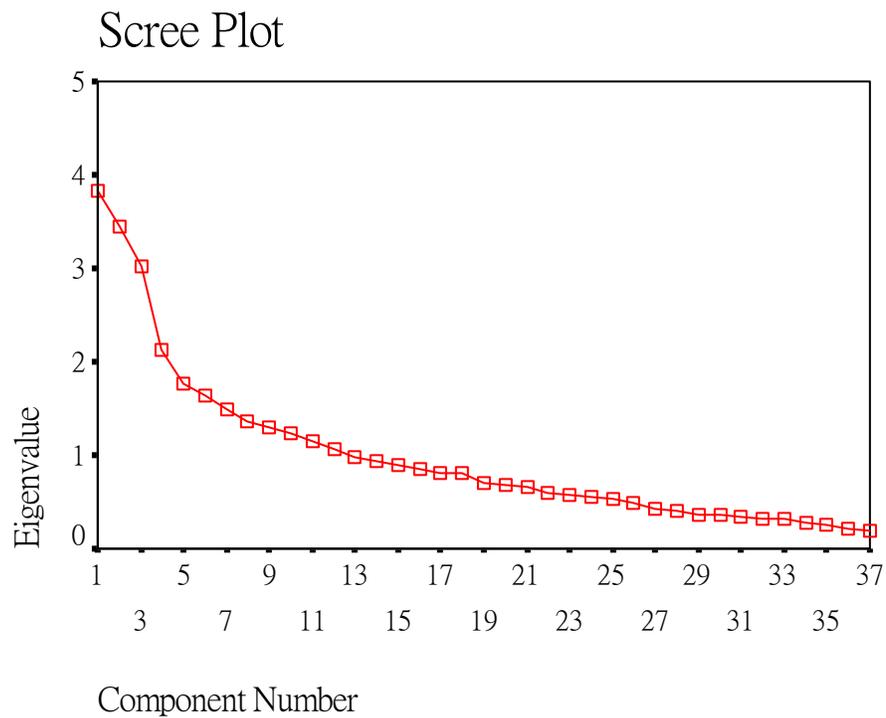


Table 4.2: Rotated Factor Matrix of Learning Style Factors using Varimax Rotation with Kaiser Normalization (Item with factor loading ≥ 0.40 , n=163)

Item / factor	Factor 1	Group WK	Structure	Concrete	Conceptual	Factor 6
1					0.539	
2					0.613	
3			0.757			
5	0.464					
7					0.607	
8		0.803				
10				0.688		
12	0.661					
16			0.766			
17						0.642
19						0.702
21					0.671	
22					0.485	
23			0.686			
24			0.519			
25				0.749		
26		0.632				
27				0.567		
28					0.429	
31	0.536					
34		0.740				
35		0.518				
36	0.822					
Eigenvalue	3.0	1.8	3.8	2.1	3.4	1.6
% total variance	8.1	4.8	10.4	5.7	9.3	4.4

The result of the principal component factor analysis identified 6 factors.

Five of the six factors contained three to six items. Factor six, had only two

items. Factors two to five corresponded to four of the five proposed factors of the theoretical model represented in Figure 1.1. Factor one and factor six both included items related to the harmonious factor in the model.

To estimate the internal consistency reliability of the items in each factor, Cronbach alpha coefficient was calculated for each of the six factors. The coefficient reliability for the factors ranged from 0.52 to 0.7. Table 4.3 shows the loading of the items on each factor and its coefficient reliability.

Table 4.3: Cronbach alpha coefficient for the six factors

Factor	Items	Reliability
Factor 1	5, 12, 31, 36	0.6900
Group WK	8, 26, 34, 35	0.6587
Structure	3, 16, 23, 24	0.7034
Conceptual	1, 2, 7, 21, 22, 28	0.6625
Concrete	10, 25, 27	0.5864
Factor 6	17, 19	0.5205

Validity

As described in chapter three, content validity, construct validity and concurrent validity were examined to ensure the validity of the instrument. Content validity was established through the inductive development of the items from message board discussion, pilot testing and revisions. To ensure the construct validity of the learning style survey, three experts were asked to review the learning style survey items and the results compared to the factor analysis

output. Among the three reviewers, two were learning consultants who are experienced with student learning styles and one was a content expert who is familiar with the Myers-Briggs & Jung's psychological type theory. Reviewers were instructed to group the items based on the model predictors and rate their relevancy (a number of 5 indicates highest relevancy). Items with at least two reviewers indicating a relevancy of 4 and above were identified in table 4.4.

Table 4.4: Grouping from factor analysis and Expert review

Item	Factor Analysis	Experts Review	Combined
1	Conceptual	Conceptual	Conceptual
2	Conceptual	n/a	not included
3	Structure	Structure	Structure
5	Factor 1	Structure	Structure
7	Conceptual	Conceptual	Conceptual
8	Group WK	Group WK	Group WK
10	Concrete	Concrete	Concrete
12	Factor 1	Structure	Structure
16	Structure	Structure	Structure
17	Factor 6	n/a	not included
19	Factor 6	harmonious	harmonious
21	Conceptual	n/a	not included
22	Conceptual	Conceptual	Conceptual
23	Structure	Structure	Structure
24	Structure	Structure	Structure
25	Concrete	Concrete	Concrete
26	Group WK	Group WK	Group WK
27	Concrete	Concrete	Concrete
28	Conceptual	Conceptual	Conceptual
31	Factor 1	harmonious	harmonious
34	Group WK	Group WK	Group WK
35	Group WK	n/a	not included
36	Factor 1	Structure	Structure

To enhance construct validity, only items that were consistent from factor analysis results and expert review were included in the final version of the instrument. Items 2, 17, 21 and 35 were deleted as a result. There were three items (5, 12, 36) grouped in the harmonious factor from the factor analysis but were categorized into the structure factor by the reviewers. After further review of the theoretical framework, it was decided to use the experts' classifications and move items 5, 12 and 36 to the structure factor and item 19 was added to the harmonious factor. The decision was made for the reason that experts were familiar with the theories and their categorizations on these items fit the proposed framework. After regrouping the items, Cronbach alpha coefficient for all factors was generated to check for internal consistency. Tables 4.5 and 4.6 show the updated coefficient reliability for the factors of the main model and the sub-factors.

The main model consists of learning styles of social learners predicted from the extraverted feeling type (FJ) characteristics and includes the group work and structure factors. Table 4.7 provides coefficient alpha reliability when any one item was deleted for each factor. The results in table 4.7 show that removing any item from each factor didn't result in significantly higher coefficient alpha reliability so all the items were retained. The coefficient reliability of the harmonious factor was lower than .5 and was removed from the main model. At

the conclusion of the validation, the main model consisted of the structure factor and group work factor. The conceptual factor and concrete factor were the sub-factors in the theoretical framework.

Table 4.5: Cronbach alpha for the main model

Factor	Items	Reliability
Harmonious	19, 31	0.4269 (removed)
Group WK	8, 26, 34	0.6727
Structure	3, 5, 12, 16, 23, 24, 36	0.7098
Overall reliability of the main model = 0.5896		

Table 4.6: Cronbach alpha for the sub-factors

Factor	Items	Reliability
Concrete	10, 25, 27	0.5864
Conceptual	1, 7, 22, 28	0.5946

Table 4.7: Reliability alpha for each factor if any item was deleted.

Factor	Item #	Reliability alpha if deleted
Group Work Alpha = .6727	8	.4508
	26	.6590
	34	.6010
Structure Alpha = .7098	3	.6618
	5	.6995
	12	.6723
	16	.6993
	23	.6550
	24	.6831
	36	.6631
Main Model Alpha = .5896	3	.5379
	5	.5663
	8	.5909
	12	.5367
	16	.5697
	23	.5182
	24	.5619
	26	.5293
	34	.5965
	36	.6151
Concrete Alpha = .5864	10	.5275
	25	.4178
	27	.5262
Conceptual Alpha = .5946	1	.5047
	7	.4312
	22	.6204
	28	.5201

George and Mallery provided scale for Cronbach alpha coefficient as follows: Excellent > .9 > Good > .8 > Acceptable > .7 > Questionable > .6 > Poor > .5 > Unacceptable. However, Tuckman (1999) suggests that an alpha of 0.5 or greater is acceptable for attitude assessments considering that attitudes (learning

style preferences) are not necessarily more pronounced with training or maturation. Kline (1999) indicated that alpha less than 0.7 can be expected for psychological constructs. Sax also suggested that for first generation instrument, coefficient reliability at 0.5 is acceptable (1997).

As stated in chapter three, concurrent validity of the learning style survey was assessed by the extent the survey was found to be able to distinguish social learners (FJ) and non-social learners (non-FJ) as well as SFJ/NFJ and Wholist/Analytic as predicted in the proposed theoretical model. FJ and non-FJ were compared on the main model (structured learning and group work) and the result showed that social learners scored higher on their preference for the predicted social learner learning styles than non-social learners. In other words, the learning style survey was able to “distinguish between groups that it should theoretically be able to distinguish between” (Trochim, 2005, Concurrent validity, para 1). However, the conceptual and concrete learning factors did not seem to distinguish between SFJ and NFJ (more details are described later).

Descriptive Statistics

There were 132 participants who completed MBTI, CSA and online learning style survey. The distributions of the FJ and Non-FJ, SFJ and NFJ, EFJ and IFJ on the MBTI and the Analytic-Wholist dimension for the CSA, mean

scores and standard deviation for each factor and the main model are presented in Table 4.8. Distributions of participants' MBTI types and clarity index for each dichotomy are included in Appendix D.

Table 4.8: Means and standard deviation of the four learning style factors by MBTI types and CSA Wholist-Analytic dimension (Strongly Agree = 5 to Strongly Disagree = 1).

		N	Group WK		Structure		Main Model		Concrete		Conceptual	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
FJ- Non FJ	FJ	25	2.96	.741	3.67	.534	3.46	.429	3.77	.525	3.57	.614
	Non FJ	107	2.98	.866	3.29	.650	3.19	.499	3.83	.617	3.74	.526
Wholist-Analytic & FJ Non-FJ*	Analytic Non-FJ	25	2.79	.912	3.36	.712	3.19	.472	-	-	-	-
	Wholist Non-FJ	44	3.06	.960	3.21	.642	3.16	.532	-	-	-	-
	Analytic FJ	10	2.77	.485	3.83	.754	3.51	.486	-	-	-	-
	Wholist FJ	8	3.13	.678	3.46	.815	3.36	.457	-	-	-	-
SFJ- NFJ	SFJ	12	3.17	.351	3.82	.628	3.63	.314	3.83	.522	3.29	.714
	NFJ	13	2.77	.643	3.53	.809	3.30	.473	3.72	.542	3.82	.376
EFJ- IFJ	EFJ	16	2.83	.578	3.59	.699	3.36	.424	-	-	-	-
	IFJ	9	3.19	.440	3.81	.801	3.62	.409	-	-	-	-

* Note: The intermediates on the wholist-analytic scale were not included in the analysis

Testing of Hypothesis

Ho1: There is no relationship between psychological types and cognitive styles.

Chi-Square was used to decide if any of the MBTI dichotomies is related to the Wholist Analytic dimension (the Intermediate was excluded in the

analysis). Table 4.9 presented the distribution of participants' MBTI types and Wholist-Analytic dimension. The result in Table 4.10 showed that none of the MBTI dichotomies was associated with the Wholist-Analytic dimension. Null hypotheses one was retained.

Table 4.9: Contingency table showing the distribution of participants' MBTI types and Wholist-Analytic dimension

		MBTI dichotomy							
		EI		SN		TF		JP	
		E	I	S	N	T	F	J	P
W-A dimension	Wholist	41	11	20	32	19	33	17	35
	Analytic	22	13	15	20	9	26	15	20

Table 4.10: Pearson Chi-Square results

		MBTI dichotomy			
		EI	SN	TF	JP
Pearson Chi-Square		2.68	.17	1.12	.93
df		1	1	1	1
Sig. (2-tailed)		.102	.682	.289	.335
N		87	87	87	87

Ho2: There is no difference between FJ and Non-FJ on the proposed social learner learning styles.

Hypothesis 2 was designed to test the main model for the social learner learning styles, combining preference for structured and harmonious learning environment and group work. However, the harmonious learning environment

factor was dropped from the factor analysis results as mentioned earlier. As a result, the main model score was composed of only the preference for structured learning and group work. Independent t-test was used to examine if there was significant difference between FJ and Non-FJ on the social learner learning styles.

Testing of Assumptions

Homogeneity of Variance: Testing of homogeneity of variances among groups used Levene's test of equality of error variances. Levene's tests indicated that the variances were equal among groups for the main model at .05 alpha level, $F(1, 132) = 1.459, p = .229$.

Normality: Normality of dependent variables was examined using z-score of Skewness and Kurtosis as well as graphical representations. Z-scores of skewness and kurtosis were calculated by subtracting mean of the distribution and dividing by the standard deviation of the distribution: $Z_{skewness} = (\text{Skewness statistics} - 0) / \text{Standard Error of Skewness}$; $Z_{Kurtosis} = (\text{Kurtosis statistics} - 0) / \text{Standard Error of Kurtosis}$ (Field, 2005). The absolute value of skewness index was less than 3.0 and the absolute value of kurtosis index was smaller than 10.0, the assumption of normality was met (Kline, 2005).

FJ vs. Non-FJ

The result of the independent t-test indicated that there was significant difference between the two groups, $t(130) = -2.42, p < .05$. FJs score higher on the social learner learning styles main model ($M = 3.45, SE = .429$) than Non-FJs ($M = 3.19, SE = .489$). Null hypothesis 2 was rejected.

Ho3: There is no difference between Analytic Non-FJ, Wholist Non-FJ, Analytic FJ and Wholist FJ on the proposed social learner learning styles.

Due to the smaller sample size in two of the groups, the Kruskal-Wallis test was used to examine the difference between Wholist FJ, Analytic FJ, Wholist Non-FJ and Analytic Non-FJ on their preference for the proposed social learner learning styles. This non-parametric test was used to test the differences between several independent groups. The scores of all groups on the dependent variable are combined and ranked from the lowest to the highest. Then the mean rank for each group is calculated and tested for difference. The sample size is considered sufficient if every group has more than five subjects (Pett, 1997). The result in Table 4.11 showed that the four groups did not differ on their preference for the proposed social learner learning styles ($H(3)=4.30, p=.231$).

Table 4.11: Mean rank of the four groups

	N	Mean Rank
Analytic Non-FJ	25	41.22
Wholist Non-FJ	44	41.20
Analytic FJ	10	57.05
Wholist FJ	8	51.75
Total	87	

An independent t-test was performed to examine the difference between Wholist and Analytic on the main model as well as the individual group work and structure factors. No significant difference was found for the main model and the factors. Table 4.12 presents the means and standard deviation of Wholist and Analytic on the main model as well as the group work and structure factors.

Table 4.12: Means and standard deviation of the main model and group work and structure factor for Wholist and Analytic

		N	Group WK		Structure		Main Model	
			Mean	SD	Mean	SD	Mean	SD
Wholist-Analytic	Wholist	52	3.07	.932	3.25	.648	3.20	.522
	Analytic	35	2.78	.859	3.49	.683	3.28	.492

Ho4: There is no difference between SFJs and NFJs on their preference for learning examples or concepts and theories first.

Due to the smaller sample size in both groups and the violation of the normality assumption in one of the dependent variables, the non-parametric

Mann-Whitney test was used to examine the difference between SFJs and NFJs on their preference for conceptual learning and concrete learning. The Mann-Whitney test is used to test if two independent groups with an ordinal scale dependent variable are from the same population when the assumptions of parametric test are not met (Field 2005). Similar to the Kruskal-Wallis test, the scores of the two groups on the dependent variable are combined and ranked from the lowest to the highest. Then the mean rank for each group is calculated and tested for difference. Neter and associates (1993) indicated that the distribution approaches a normal distribution with a mean and standard deviation when the sample size of both groups is 10 or more. Table 4.13 demonstrated the mean rank and sum of ranks for SFJ and NFJ on the sub factors. The result showed that SFJ and NFJ did not differ on their preference for conceptual learning ($U=48.5$, $p=.103$, $r=-.33$) and concrete learning ($U=69.5$, $p=.637$, $r=.09$). Null hypothesis four was retained.

Kramer & Rosenthal recommended presenting the effect size in small sample research because it can "...lead to results that do not reach the conventional level of significance..." (1999, p.64). Effect size information helps "uncover potential...relationship that might have yielded more significant result if only more subjects were added to the study." The American Psychological Association (APA) also suggests reporting the effect size in the results section

(2010, p.34). The effect size (Cohen’s d) for comparing SFJ and NFJ on conceptual learning was 0.75 and on concrete learning was 0.19. According to Cohen (1988) an effect size of .20 is small; .50 is medium; and .80 is large.

Table 4.13: Mean rank of SFJ and NFJ on the conceptual and concrete factors

	N	Conceptual factor		Concrete factor	
		Mean Rank	Sum of Ranks	Mean Rank	Sum of Ranks
SFJ	12	10.54	126.50	13.71	164.50
NFJ	13	15.27	198.50	12.35	160.50
Total	25				

Ho5: There is no difference between those whose extraverted feeling function are dominant (EFJ) and those who are not (IFJ).

The Mann-Whitney test was used to examine the difference between EFJs and IFJs on their preference for the proposed social learner learning styles due to sample size. Table 4.14 demonstrated the mean rank of EFJ and IFJ on the preference for social learner learning styles. The result showed that SFJ and NFJ did not differ on their preference for the proposed social learner learning styles ($U=51.5$, $p=.244$, $r=-.23$). The effect size (Cohen’s d) was .52. Null hypothesis five was retained.

Table 4.14: Mean rank of EFJ and IFJ on the main model

	N	Mean Rank	Sum of Ranks
EFJ	16	11.72	187.50
IFJ	9	15.28	137.50
Total	25		

Summary

In this chapter, five hypotheses were tested to investigate the effects of cognitive style and interactions of psychological types on learning styles. Table 4.15 provides a summary of the hypotheses and corresponding results.

Table 4.15: Summary of Results

Null Hypotheses		Results
Ho1	There is no relationship between psychological type and cognitive style.	Not significant, null hypothesis was retained.
Ho2	There is no difference between FJ and Non-FJ on the proposed social learner learning styles.	Significant, FJs score higher on the social learner learning styles main model, null hypothesis was rejected.
Ho3	There is no difference between Analytic Non-FJ, Wholist Non-FJ, Analytic FJ and Wholist FJ on the proposed social learner learning styles.	Not significant, null hypothesis was retained.
Ho4	There is no difference between SFJs and NFJs on their preference for learning examples first or concepts and theories.	Not significant, null hypothesis was retained.
Ho5	There is no difference between those whose extraverted feeling function are dominant (ESFJ/ENFJ) and those who are not (ISFJ/INFJ).	Not significant, null hypothesis was retained.

Chapter 5

Discussions and Implications

The purpose of this study was to determine if psychological types as described by Jung, Myers, and Briggs and cognitive styles, defined by Riding and Cheema can be used to predict the learning styles of social learner presented in the theoretical model in Figure 1.1. This study used a concurrent validation of a learning style survey to measure the proposed social learner learning styles in the model, and statistical analysis of the results to test the predictions of the model.

Discussions of Findings

The main model

The main research question in this study was: can psychological types and cognitive styles be used to predict the learning styles of a particular group called social learners who prefer group work, need structure in the learning environment and prefer organizing and maintaining harmony in the learning environment? Factor analysis results and experts review retained only the group work and structure factors proposed in the theoretical model but not the

harmonious factor. As a consequence, only those two factors were included in the main model as indicators of the social learner learning styles. The results from the independent t-test showed that FJs did score significantly higher than non-FJs on their preference for group work and a structured learning environment, which indicated the existence of social learners proposed in this study.

The harmonious factor was dropped out of the main model due to factor analysis result and expert reviews. Seeking smooth and harmonious relationships is one of the major characteristics of FJs because they extravert the feeling function and are highly attuned to people's needs and expectations. However, the way it impacts how people learn might be hard to measure because it does not seem to directly relate to learning as much as the structure and group work factor. Although online observations and discussions showed FJ students talk about the importance of maintaining harmonious relationship of the learning environment, further research to explore its effects on learning styles through interviews or focus group is recommended.

Effect of Wholist-Analytic dimension of cognitive style

The result didn't reveal difference between Analytic Non-FJ, Wholist Non-FJ, Analytic FJ and Wholist FJ. One possible explanation was Type II error

due to the small sample size (Of the 132 students in the complete sample, 52 were classified as Analytics, and 35 as Wholists. The remaining 45 subjects were intermediate on the Analytic-Wholist continuum and were not expected to contribute to any measurable effects. Of the 87 Analytics and Wholists, there were only ten Analytic FJs and eight Wholist FJs). Type II error happens when we fail to reject the null hypothesis while there is a genuine effect in the population (Field, 2005).

Another reason might be that analytics also prefer structured learning even though they could impose order on information. Results from the independent t-test used to test the difference between the 35 Wholists and 52 Analytics on the structure factor provided some insights. Although the difference was not found to be significant at .05 level, Analytics did score higher on the structure factor and the sig. value was .096. Riding suggested that wholist might need help from the instructor to impose structure in their learning because they don't usually take the structural approach like analytic does (1999). This can be interpreted as evidence that Wholists may prefer a structured learning environment so they can learn better. Yet, Analytics could also claim that they prefer a structured learning environment because that's their habitual way of learning. In other words, Wholists need structure because they don't habitually take this approach while Analytics like structure but don't need help. For future

research, it is suggested the survey items be modified to be able to distinguish preference or need to find out the possible differences between Wholists and Analytics.

Conceptual or Concrete

No difference was found between SFJ and NFJ on their preference for learning examples or concepts and theories first. It seems the concurrent validity of the learning style instrument was not established for these factors because the instrument was not able to distinguish between the two groups. However, examination of the items within factors showed that while the concrete learning factor contains items pertaining learning through examples, the conceptual factor contains items pertaining to more than just preference for a deductive learning approach. The conceptual factor included items that are general descriptions for intuitive people, such as innovation, new ideas, etc.

This was further verified by running independent t-test for S and N comparing their score on the conceptual factor. The result of the independent t-test indicated that there was significant difference between the S and N on the conceptual factor, $t(130) = -2.85, p < .05$. N score significantly higher on the conceptual factor ($M = 3.81, SE = .489$) than S ($M = 3.53, SE = .600$). The intuitive participants scored higher on the conceptual factor than sensing participants.

To find out more about the relationships between the conceptual and concrete factors, item correlation was performed. The results showed that two items (one from conceptual factor, one from concrete factor) were negatively correlated. The two items were “you are a deductive learner who learns best from concepts/principles” and “you are an inductive learner who learns best from examples.” The result provided some insights for the validity of the learning style survey in relation to the conceptual and concrete factors. As mentioned before, type II error could occur with the sample size in this study.

Dominant Extraverted Function

Both EFJ and IFJ extravert the Feeling function, but the Feeling function is dominant for EFJs and auxiliary for IFJs. The dominant function refers to the function that is used most often. However, no difference was found between EFJ and IFJ on their preference for the social learner learning styles.

Results from the independent t-test comparing Extraverts and Introverts on the main model as well as the structure and group work factor didn't show any significant difference. Given the above results, it is possible that extraverted function plays a more important role in explaining learning styles regardless of whether it is dominant or auxiliary. Nevertheless, the sample size in this study is

small. Further research that includes more participants is recommended to verify the effects of the dominant/auxiliary function.

Another reason might be the type development identified in the type theory (Myers et. al, 1998). An important part of Jung's type theory is the development of personality through the life span. This doesn't mean people's types change. Rather, "the hierarchy of dominant, auxiliary, tertiary and inferior functions permits and encourages the kind of development and adaptation that is likely to be most useful for an individual at each stage of life." In other words, the dominant function might be an individual's most comfortable function, s/he might adapt and use the auxiliary function most easily at one stage of life. According to this assumption, it would be hard to detect the difference between those who share the same dominant or auxiliary functions.

Implications for Instructional Design

1. Extraverted Feeling type descriptions seem not directly related to learning. However, this study showed that extraverted feeling types can be categorized as social learners who prefer group work and structured learning environments more than non-FJ types. Due to the independent nature of the online learning environment, social learners might need more support/guidance from the instructor if the learning environment

was not structured well. It might also help for social learners to learn through group work and discuss ideas with others.

2. Understanding psychological types help us to understand how students learn. As shown in Figure 1.1, this study took the characteristics of the FJ type as described in the type theory to come up with the hypothesized social learner learning styles and the results supported the main model in the proposed framework. Myers et al. have mentioned that “Type theory provides a useful model for conceptualizing the multiple processes that students and teachers employ as they go about the tasks of learning and instruction” (p.283). The results from this study supported the idea that psychological types can be used to understand how people learn. Instructors can use this knowledge to provide structural support/ guidance to students and take into consideration students’ preference for group work when assigning students to work together.
3. The importance of these findings could be magnified when designing courses for groups that are disproportionately represented by social learners, such as school teachers and health care professionals.

Limitations of the Study

1. The majority of the participants in this study were undergraduate students taking an online course that fulfilled a general education requirement in the natural science area for non-science major students. Results should be generalized with caution and might not apply to older adult students or students who are in the science majors.
2. This study used categorical/dichotomous (not continuous) information from the psychological type for data analysis because the θ scores were not available in the secondary data. In addition, the clarity indexes of the dichotomies for the psychological types were not considered due to sample size. θ scores are the most precise scores of Form M and the recommended scores used for research purposes in the MBTI Manual (Myers et. al, 1998). If θ scores were available, the research could use other statistical analysis.
3. The reliability alpha for factors in the learning styles survey was low. However, it may not have been a fair estimate of the reliability to run a Cronbach Alpha after combining items from the two factors. The Cronbach Alpha is a measure of internal consistency and is estimated by correlating each item with all of the other items of the test (Nitko, 2004). It is logical to conclude the Cronbach Alpha would decrease for the

overall test when two factors are combined.

In addition, the concurrent validity for two factors was not established.

The instrument has to be modified before it is used in other research. If the reliability of the survey were improved, the differences (or no differences) found between the tested groups would be more consistent across situations.

Recommendations for Future Research

This study used the descriptions in psychological type theory to develop the theoretical framework for the proposed social learners and their learning styles. The results supported the existence of social learners on the main model that includes the structure and group work factors. Recommendations for future research are provided as follows:

1. Use the sixteen types for analysis, which would then require a bigger sample size.
2. Obtain the θ scores because it allows examination of relationships between individual dichotomies and other instruments. However, it was noted that using the continuous scores for research is contradictory to the dichotomous nature of the MBTI so using the whole type or the

preference clarity categories are still the preferred methods as recommended by the MBTI Manual (Myers et. al, 1998).

3. Revise the survey based on the results of this survey and administer it in a course that consists of more FJs, such as education or health care field (see Appendix E for occupational trends of the 16 types). Add or modify items that measure the preference for harmonious relationships in the learning environment.
4. Like any psychological test, MBTI has the same issue that students might answer based on what they think “should be” instead of their true preference (Wankat & Oreovicz, 1993). It is important that when administering the MBTI, remind students to answer based on their first impressions without creating any scenario.
5. Researchers are encouraged to use similar approaches to study other combinations of psychological types and/or cognitive styles and their impact on learning styles. For example, introverted thinking type who take the introverted approach to evaluate and critique information and “...are the most removed from daily social intercourse...” (Myers et al., 1998, p.59) might help understand the learning styles of a group that could be described as solitary learners.

Conclusion

The purpose of this study was to investigate the learning styles of a social learner group through the lens of psychological types and cognitive styles. The main model that includes structure and group work factors supported the existence of the social learner group. Attempts to measure the harmony factor were not successful because items had to be dropped due to reliability issue. Implications and recommendations were provided for future study. It is hoped the results from this study can add insights to the field of individual differences and provide examples to instigate more studies concerning learner characteristics and learning styles. After all, understanding how students learn can help instructors design effective and efficient instruction that improves learning.

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Appendix A: Learning Style Survey

(Response scale: Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree)

1. You like open-ended learning tasks that offer you opportunities to seek new ideas or patterns.
2. You are good at evaluating situations or persons through analytical reasoning.
3. Does it bother you to be in a course that is loosely structured?
4. Within a course, you tend to plan your coursework assignment by assignment.
5. You usually remain focused until you complete a task.
6. When you are reading course content from a Web page, you often get distracted because you follow embedded links.
7. You are innovator who likes to think outside of the box.
8. You learn best when working with other people.
9. You like to work with theoretical approaches to concepts.
10. You prefer to use examples to learn about concepts rather than learn the concepts before the example.
11. When doing an Internet search on a topic, you often find yourself following links to other interesting pages that turn up in the search.

12. You are a good organizer who creates and maintains a learning schedule when taking courses.
13. You are sensitive to the effects of the learning environment on people.
14. You are adaptive and tolerant with situations that are less structured and less defined.
15. When working in a learning group, you will sacrifice your needs to help the group.
16. Working with less-structured instructional materials does not bother you.
17. When doing a group project, you prefer to plan procedures for the whole group and would like to be in charge.
18. You like to use your personal experiences and those of others to make sense of the world.
19. When responsible for a group, you like to facilitate and make sure everything goes smoothly.
20. You prefer to develop patterns or principles from examples.
21. You are a good people reader.
22. You are a deductive learner who learns best from concepts/principles.
23. You need organization and structure in your course design.

24. When planning your learning you prefer clear directions to creating your own plan.
25. You are an inductive learner who learns best from examples.
26. You learn better from discussing ideas with people in a group than reading texts or articles by yourself.
27. You prefer to learn by having someone show you how to do it first.
28. You want to learn new ideas that put you on the "cutting edge."
29. When participating in an online project or online discussion and your group member doesn't contribute, you would report it to the instructor.
30. If you were learning to create a Web page for the first time, you would prefer to have someone show you examples first.
31. When participating in online discussion, you would post the message earlier so that your group members don't get delayed by you.
32. You tend to judge people's ideas on their practical merits.
33. You are keen to reach answers via a logical approach.
34. When learning online, you prefer to work individually on a project than with a group of people.
35. When working in a group, you are more task-oriented than people-oriented.

36. You usually get course assignments done earlier instead of finishing it right on deadline.
37. You prefer to learn concepts first then examples to illustrate the concepts.

Appendix B: Study Consent Form

Informed Consent Form for Social Science Research The Pennsylvania State University

ORP USE ONLY: IRB# 20712 Doc. #1 The Pennsylvania State University Office for Research Protections Approval Date: 4/1/05 - J. Mathieu Expiration Date: 3/29/06 - J. Mathieu Social Science Institutional Review Board

Title of Project: The effects of personality type, cognitive styles, and learners' sense of community on online learning

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- Purpose of the Study:** The purpose of this research study is to explore the effects of personality types and cognitive styles as well as sense of community on students' online learning. The results will help instructors design materials and prepare students for learning in a web-based course and obtain better learning outcomes.
- Procedures to be followed:** You will be asked to do the following:
 - Indicate your informed consent to participate in this study by clicking on the "I agree button" at the end of this informed consent section.
 - Complete the on-line learning styles survey (created by the researchers).
 - Complete the on-line Classroom Community Scale (CCS).
 - Select a time and campus location for the remaining surveys which must be done face to face.
 - Report to a campus location to take the Myers-Briggs Type Indicator (MBTI) personality types test, and a computer-administered Cognitive Styles Analysis

- (CSA), or Group Embedded Figures Test (GEFT). Taking both the CSA and GEFT are not required for participation.
- Allow the investigators to read your postings in the group message board from your collaborative project.
3. **Discomforts and Risks:** There are no risks in participating in this research beyond those experienced in everyday life.
 4. **Benefits:**
 - a. Participants will get an individual report of their personality type as measured by the MBTI, cognitive style as measured by the instrument they used, and learning style as measured by the researchers' instrument.
 - b. Participants might learn more about how their type and cognitive style influences their learning style and group interactions in the web-based environment of this course. They might have a better understanding of how to make the most out of online learning and keep good relationships with the instructor and peers.
 - c. This research might provide a better understanding of how to improve the studied course. This information could help the instructor identify how to utilize various course activities and tools to aid students' learning
 5. **Duration:** It will take 20-30 minutes to complete the MBTI, 10-15 minutes for the CSA, 20 minutes for the GEFT, 10 minutes for the learning styles survey, and 10 minutes for the CCS. You will only take the CSA or GEFT to measure your cognitive style. You will not be asked to take both.
 6. **Statement of Confidentiality:** Only the investigators will know your identity. If this research is published, no information that would identify you will be written. Within a week of taking the research instruments, your name will be replaced with a study code number. At the completion of the course, your name will be removed from all records. Personal identifying information will be stored and secured by the principal investigator in a locked cabinet or password protected folder in a computer. The Office for Research Protections and the Social Science Institutional Review Board (IRB) may review records related to this project Confidentiality will be maintained to the degree permitted by the technology used. Specifically, for an on-line survey, no guarantees can be made regarding the interception of data sent via the Internet by any third party.
 7. **Right to Ask Questions:** You can ask questions about this research at any time. Contact Dr. Dave Popp at 865-0472 with questions. If you have questions about your rights as a research participant, contact The Pennsylvania State University's Office for Research Protections at (814) 865-1775.
 8. **Compensation:** Participants will receive **2 percentage points of extra credit** for their EGEE 101 course. Students who do not wish to participate in the research can receive 2 percentage points of extra credit by writing a four page paper on carbon dioxide sequestration in geologic features. It is estimated that the time required for either activity is similar..

9. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer.

You must be 18 years of age or older to take part in this research study. If you agree to take part in this research study as described in the information outlined above, provide your name and PSU userid in the field below. Then click the "I agree" button.

Radio buttons will appear here.

(radio button) I agree

(radio button) I do not agree.

Date will be added by the computer at this location of the form

Person Obtaining Consent Dr. David Popp

Click this link to print a copy of the Consent Form for your record!! (This will open a new page with a printable version of the consent form.)

Appendix C: Sample Student MBTI and CSA Result Report

Your Myers-Briggs Type Indicator (MBTI) Results

The table below displays the results of the Myers-Briggs Type Indicator test that you took as part of the EDPSY 421 bonus activity. The results are reported as a combination of four letters, E or I, S or N, T or F, and P or J. Examples of results are ENTJ, INFP, ISTP, ESFJ, etc.

Your Myers-Briggs type is E(Clear), N(Moderate), F(Slight), J(Clear)

Type	E (Extravert)			J (Judging)
Clarity	Very Clear	Very Clear	Very Clear	Very Clear
	Clear	Clear	Clear	Clear
	Moderate	Moderate	Moderate	Moderate
	Slight	Slight	Slight	Slight

	Slight	Slight	Slight	Slight
	Moderate	Moderate	Moderate	Moderate
	Clear	Clear	Clear	Clear
	Very Clear	Very Clear	Very Clear	Very Clear
Type		N (iNtuitive)	F (Feeling)	

Interpreting Your Result

The Myers-Briggs Type Indicator (MBTI) is an attempt to classify human temperaments according to four dimensions.

- Extraversion (E) -Introversion (I)

Extraversion/Introversion attempts to measure whether you are outwardly or inwardly oriented. Outwardly (extraverted) oriented individuals tend toward acting on and interacting with the outer world. This desire four outward

interaction can be manifested as an orientation to mentally or physically manipulating the environment or seeking social interaction. Extraverts may be more aware of the environment, rely on the outer world for stimulation, and appear more action oriented.

Inwardly (introverted) oriented people tend to invest energy into understanding the world and how the world is affecting them. The main interests of introverts is the world of concepts, ideas, and inner experiences. Because of this, introverts can seem more reserved, and content to have fewer social interactions.

To many, extravert is seen as sociable and introverts are seen as shy. This can be an oversimplification. While the inward orientation of introverts can result in a quiet demeanor, this does not mean they will be shy. On the other hand, reduced social interaction can lead to lower social confidence and shyness. Be careful not to over generalize.

Introverts are more interested in thinking. Extraverts are more interesting in doing.

Introverts are more interested in how the world affects them. Extraverts are more interested in how they affect the world.

- Sensing (S) - iNtuition (N)

Sensing and iNtuition refer to differences in preference for perceiving. Sensors are attuned to perception through direct experience. This orientation tends to make them attentive to the details of a setting which can lead to the development of acute powers of observation and a practical approach to planning or understanding events.

Intuitives perceive the relationships in a setting more than the details. They would be more likely to think about explanations for what is happening rather than what is happening.

Sensing and iNtuition are complementary, and both can be very useful when combined in an effective team setting. The intuitives will tend to be the dreamers and generate possibilities while the practical nature of the sensors can keep a team focused on achievable goals.

- Thinking (T) - Feeling (F)

Thinking and feeling are not related to mental ability, and it should not be assumed that thinkers as described by type theory have superior cognitive powers. Thinking and feeling refer to decision making. Thinkers tend to be logical when making decisions or judgments while feelers tend place a strong

emphasis on the relative values and merits when making a decision or judgment.

Thinkers are more attuned to the logic of a situation while feelers are more attuned to the personal impact.

- Judging (J) - Perceiving (P)

This orientation is easily misunderstood because a judging orientation is often considered to be judgmental. The judging / perceiving dichotomy is more closely related to the need to make a decision (judgment) or have closure. Judgers don't like loose ends, and tend to be planned and well organized. Perceivers on the other hand are more oriented to spontaneity and are more likely to follow their interests. The J and P orientations are also used to determine which of the functions, S, N, T, or F, are dominant, but that is beyond the scope of this introduction.

Clarity

There were 93 questions on the MBTI you took. Each question attempted to measure your preferred response for a situation in one of the four dimensions, E/I, S/N, T/F, or J/P. There were 21 E/I, 26 S/N, 24 T/F, and 22 J/P questions on the MBTI.

Each question had a dichotomous response. This means that each of the 21 E/I questions had an E response and an I response, each of the 26 S/N questions had an S response and an N response, etc. Most people do not respond completely in one direction when taking the test. This leads to some responses indicating each of the eight possibilities, E, I, S, N, T, F, J, and P. The greater the number of responses you made favoring one variable over the other, the more clear your MBTI result will be.

For example, one of the 22 J/P questions was

In planning a trip would you prefer to

(A) most of the time do whatever you feel like that day, or

(B) know ahead of time what you'll be doing most days?

According to type theory, perceivers like to be more open ended and would choose (A) as their response, while judgers' need for closure results in a structured and well defined experience and would lead them to answer (B).

Each of the 22 J/P questions has a J response and a P response. The test forced you to make a decision between these responses regardless of how strongly you preferred one answer over the other. In some cases both answers may have seemed equally true. If you chose the J response to all 22 J/P questions, then the test is interpreted that you are clearly a J person. The clarity of a J interpretation decreases as you select more P responses. If you selected 11 J and 11 P responses, your interpretation is not clear at all. The MBTI has tie breaker rules, and 11 J responses and 11 P responses is interpreted as P, but the clarity of the interpretation is only slight.

Your MBTI report at the top of this page includes both a letter for each of the four dimensions, and a clarity for each of the dimensions. The greater the clarity of your result, the more you will agree that the type descriptions are accurate in your case. If your clarity is only slight for one of the dimensions, it is very possible that you could take the test again and get a different type classification for that dimension as a change of a single answer could change your type.

The MBTI result reported for you is **E(Clear), N(Moderate), F(Slight), J(Clear)**. Keeping in mind the clarity associated with your classification.

If you want to get a brief description of your type, you can go to the following website: [The Sixteen Types at a Glance](#)

If you would like to know more about Jung's theory and the MBTI, [use this link to open a detailed explanation of the results.](#)

Reference: Myers, I. B., McCaulley, M. H., Quenk, N. L., & Hammer, A. L. (1998). MBTI Manual. Palo Alto, CA: CPP.

Introduction to Type Theory

Using his lifetime of observation, [Carl Jung \(link opens in new window\)](#) (1875 - 1971), a noted Swiss psychologist, theorized we could analyze personality into eight major groups by classifying behavior according to three sets of variables. Jung defined the first dichotomy, attitude, as "...a readiness of the psyche to act or react in a certain way...having an attitude is synonymous with an a priori orientation to a definite thing" (Jung, 1971, p.414). The first set of dichotomous variables used to classify a person's attitude describes his or her orientation to the world and are called extraversion and introversion. Jung described the variables of the remaining two sets of dichotomies as functions. A function is "...a particular form of psychic activity that remains the same in principle under varying conditions" (p.436). One of the dichotomies describes differences in perceiving the world, through direct experience with the senses, or through intuitive interpretation. The other dichotomy describes how we make judgments or decisions, based on consideration of the impact of the decision on self and others vs. a rational and impartial approach to decision making. In Jung's theory, each individual has one perceiving function (sensing or intuition) and one judging function (thinking or feeling).

Extraversion/introversion represented in table 1, is the basic attitude dichotomy. This attitude dichotomy describes where a person directs his/her energy. Extraverts direct energy to the outer world. Therefore, they prefer to act on and influence the environment. In contrast, introverts would rather use energy for their own inner experience and reflection (direct energy to the inner world). For example, an extravert who directs energy outwardly, would find it easy to talk to most people for a long period of time in social occasions while introverts, who direct energy inwardly would find it hard to start and maintain the conversation.

Read David Keirsey's descriptions of extroversion and introversion at <http://keirsey.com/pumII/ei.html> (link opens in new window).

Attitude	
Extraversion	Introversion

Table 1. Basic attitude dimension: Extraversion & Introversion

The Sensing/iNtuition dichotomy refers to the way a person attends to and perceives information. A sensing person perceives things by their five senses while an intuitive person perceives things through the overall impression. The intuitive person sees the relationships and meanings through insight. People with a sensing preference focus

more on the immediate experiences available, thus they are attuned to the practical value of things. They are also more aware of the observed things and attend to facts and details. By contrast, those who rely on intuition generally prefer learning concepts and principles because they perceive things beyond what is visible to the senses. In addition, they tend to pursue possibilities.

Read David Keirsey's descriptions of sensing and intuition at <http://keirsey.com/pumII/ns.html> (link opens in new window).

Thinking and Feeling are called judging functions because they describe how one evaluates information to make a decisions. In making decisions, a thinking person would prefer to use analytical judgment to evaluate the situation while a feeling person would tend to weight the relative values. A thinking type will evaluate or decide based on logical principles that can be applied to the situation. This tends to make their decisions or judgments objective and impersonal. A feeling type uses personal and group values as well as feelings of others in coming to a decision.

Jung called sensing and intuition functions of perception. He also called them irrational functions, or more properly non-rational. What he meant by irrational was that these functions are "...not grounded on reason..." (1971, p.454). According to Jung, elementary facts such as "earth has a moon" belong to irrational category because they are not based on logical deduction. In contrast, he called thinking and feeling judging and rational functions. The focus of sensing and intuition is purely perception. The focus of thinking and feeling is reason. Table 2 shows the basic attitude dimension and the four functions.

Read David Keirsey's descriptions of thinking and feeling at <http://keirsey.com/pumII/tf.html> (link opens in new window).

	Attitude							
	Extraversion		Introversion					
	Function							
	Judging Functions	Perceiving Functions	Judging Functions	Perceiving Functions				
	Thinking	Feeling	Sensing	iNtuition	Thinking	Feeling	Sensing	iNtuition

Table 2. The basic attitude dimension and the four functions

In Jung's theory, the major personality types could be understood in terms of the

combination of attitude (extraversion or introversion) and a dominant function. The dominant function refers to the function that is used often with greatest confidence – the function that dominates personality. In Jung’s words, the dominant function has the “absolute sovereignty” that goes to one and only function. Table 3 shows Jung’s 8 types and table 4 summarizes the description of the 8 types.

	Attitude								
	Extraversion				Introversion				
	Function								
	Judging Functions		Perceiving Functions		Judging Functions		Perceiving Functions		
	Thinking	Feeling	Sensing	iNtuition	Thinking	Feeling	Sensing	iNtuition	
	ET	EF	ES	EN	IT	IF	IS	IN	

Table 3. Jung’s 8 types

ET	Dominant Extraverted Thinking	Seek logical order to the external environment by applying clarity, goal-directedness, and decisive action
EF	Dominant Extraverted Feeling	Seek harmony through organizing and structuring the environment to meet people’s needs and their own values
ES	Dominant Extraverted Sensing	Direct energy outwardly and acquiring information by focusing on a detailed, accurate accumulation of sensory data in the present
EN	Dominant Extraverted Intuition	Direct energy outwardly to scan for new ideas, interesting patterns, and future possibilities
IT	Dominant Introverted Thinking	Seek accuracy and order in internal thoughts through reflecting on and developing a logical system for understanding
IF	Dominant Introverted Feeling	Seek intensely meaningful and complex inner harmony through sensitivity to their own and others’ inner values and outer behavior
IS	Dominant Introverted Sensing	Direct energy inwardly and storing the facts and details of both external reality and internal thoughts and experiences

IN	Dominant Introverted Intuition	Direct energy inwardly to focus on unconscious images, connections, and patterns that create inner vision and insight
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Table 4. Description of Jung's 8 types (Myers et al, 1998, p.23)

In addition to the identification of 8 major personality types, Jung also mentioned the existence of the auxiliary function (second function). The auxiliary function "...is always one whose nature is different from...the primary [dominant] function..." (1971, p.406). Whenever a judging function (thinking or feeling) is dominant, a function of perception (sensing or intuition) is auxiliary, and vice versa.

Though Jung did mention thinking and feeling functions as judging functions and sensing and intuition as functions of perception, it was Katharine Briggs who introduced the fourth dichotomy, judging and perceiving, in explaining Jung's theory. The J/P dimension describes one's orientation (attitude) to the outer (extraverted) world. A person with judging attitude usually get to conclusion and closure quickly while someone with perceiving attitude would keep gathering information before comfortably reaching closure. One characteristics of a J person is s/he likes to set up a schedule and follow the schedule. Conversely, a P person usually goes with the flow.

The adding of the J/P dimension not only revealed what was an implicit yet undeveloped aspect in Jung's theory but also refined the theory from 8 types to 16 types. The following table shows the combination of the 16 types based on the interaction of the two attitude dimensions and two function dimensions.

	Attitude																
	Extraversion								Introversion								
	Judging				Perceiving				Judging				Perceiving				
	Function																
Dominant	Thinking	Feeling	Sensing	iNtuition	Thinking	Feeling	Sensing	iNtuition	Thinking	Feeling	Sensing	iNtuition	Thinking	Feeling	Sensing	iNtuition	Auxiliary
Auxiliary	S	N	S	N	T	F	T	F	S	N	S	N	T	F	T	F	Dominant
	ESTJ	ENTJ	ESFJ	ENFJ	ESTP	ESFP	ENTP	ENFP	ISTJ	INTJ	ISFJ	INFJ	ISTP	ISFP	INTP	INFP	

Table 5. 16 types

Briggs & Myers extended Jung's type theory to explain which function is extraverted/introverted and which function is dominant. They proposed an interaction of Extraversion/Introversion and Judging/ Perceiving to explain Jung's dominant function.

The J/P dichotomy decides which function is extraverted and the E/I dichotomy decides whether the extraverted function is dominant or not. For extraverts, the outward function (extraverted) function dominates personality. For introverts, the inwardly directed function dominates personality. In their interpretation, when one function is extraverted, the complement of the extraverted function is introverted. If a judging function (thinking or feeling) is extraverted, then the complement, a perceiving function (sensing or intuition), will be introverted. The dominant function for extraverts is the extraverted function and the dominant function for introverts is the introverted function. For extraverts, the dominant function is the extraverted function which means extraverts show the dominant function to the outside world. In contrast, an introvert's dominant function is the introverted function which is used in the inner world.

Read David Keirsey's descriptions of perceiving and judging at <http://keirsey.com/pumII/jp.html> (link opens in new window).

Suppose John is an ESFJ (see table 6). He has judging attitude; this means his judging function (Feeling) is extraverted. And because he has E attitude, feeling would be dominant and used to the outer world (extraverted). His perceiving function (S) would then serve as the auxiliary function toward his inner world (introverted). On Jung's 8-type interpretation, John would be Dominant Extraverted Feeling.

		Attitude																
		Extraversion								Introversion								
		Judging				Perceiving				Judging				Perceiving				
		Function																
Dominant		Thinking		Feeling		Sensing		iNtuition		Thinking		Feeling		Sensing		iNtuition		Auxiliary
Auxiliary		S	N	S	N	T	F	T	F	S	N	S	N	T	F	T	F	Dominant
		ESTJ	ENTJ	ESFJ	ENFJ	ESTP	ESFP	ENTP	ENFP	ISTJ	INTJ	ISFJ	INFJ	ISTP	ISFP	INTP	INFP	

Table 6. ESFJ

Then we look at Mary, who is an ISFJ (see table 7). She shares the same judging attitude with John so her feeling function is extraverted and S function introverted. However, she has I attitude that means her introverted function should be the dominant function (S) and the extraverted function (F) become auxiliary. Mary is then Dominant Introverted Sensing on Jung's 8-type grouping. In summary, the interaction of the E/I and J/P attitude decides one's extraverted function and whether this extraverted function is dominant or auxiliary.

	Attitude																
	Extraversion								Introversion								
	Judging				Perceiving				Judging				Perceiving				
	Function																
Dominant	Thinking		Feeling		Sensing		iNtuition		Thinking		Feeling		Sensing		iNtuition		Auxiliary
Auxiliary	S	N	S	N	T	F	T	F	S	N	S	N	T	F	T	F	Dominant
	ESTJ	ENTJ	ESFJ	ENFJ	ESTP	ESFP	ENTP	ENFP	ISTJ	INTJ	ISFJ	INFJ	ISTP	ISFP	INTP	INFP	

Table 7. ISFJ

If you would like to know more about your specific type and how it applies to everyday life, you can access the following links:

- Using Type in
 - [Workplace](#)
 - [Mind, Body, Spirit](#)
 - [Children and Families](#)
 - [Education](#)

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Your Cognitive Styles Analysis (CSA) Results

The two dimensions of cognitive style assessed by the CSA are the Wholist-Analytic mode of processing information and the Verbal-Imagery style of the representation of information during thinking.

- Your ratio on the Wholist-Analytic dimension was **1.17** which places you with the **Intermediate** group.
- Your ratio on the Verbal-Imagery dimension was **1.13** which places you with the **Imager** group.

Interpreting Your Results

When you took the CSA, the computer measured the time you took for each response. One set of questions measured the time you took to answer questions such as:

Are grass and lettuce the same color?

Are tennis and football the same type?

In the first question you use an imaging process to make the comparison. You visualize lettuce and you visualize grass, then you make your decision. In the second type of question, you need to use verbal processes to make your decision. You have to generate a category name for tennis and football, such as sport, to answer the question. Some people answer the imaging questions faster than the verbal questions; others are faster with verbal than imaging questions; while still others are almost equally fast at answering either. Your preference in one direction or the other is your cognitive style. The degree of preference is determined by calculating a ratio of your imaging / verbal times. If you are faster at imaging, your ratio will be greater than 1. If you are faster at verbalizing, the ratio will be less than 1. If you are approximately equal at both, the ratio will be close to 1.

Richard Riding, developer of the CSA, created three categories of equal size from test results. He named them verbaliser, bimodal, and imager. The score ranges are shown in the following table:

Style	Ratio
Verbaliser	ratio < 0.98
Bimodal	0.98 <= ratio < 1.09
Imager	1.09 <= ratio

During the second set of questions, the computer measured the time you took to make decisions about geometric drawings. In one set of question you were asked to determine if two drawings were the same, a process that requires generating representations of the entire drawings and comparing the two, a wholist process. In the other section you were asked to determine if one drawing was contained inside of another, an analytic process. Again your preference for one process over the other is measured by making a ratio of the analytic to the wholist times. As with the verbalizer/imager dimension, the range of ratios was divided into three approximately equal groups.

Style	Ratio
Wholist	ratio <1.02
Intermediate	1.02 <= ratio < 1.35
Analytic	1.35 <= ratio

Cognitive Style Descriptions

An individual's cognitive style affects the manner in which information is processed during learning and thinking. It also influences the manner in which they respond to other people and social situations. Individuals vary in style from one extreme to the other.

Cognitive style describes individual's habitual ways of organizing and processing information and experience. It is different from intelligence or ability where individuals at the higher end of the continuum are good at all the tasks and individuals at the lower end of the continuum are poor at all the tasks. In explaining cognitive style, an individual at one end of the continuum will be good at some tasks and poor at others, while for a person at the other extreme the situation will be the reverse. It is also different from psychological type as measured by the Myers-Briggs Type Indicator (MBTI), which is concerned with the differences of the human behaviors.

Wholists tend to process the big picture or overall context of a situation before making sense of the details while analytics prefer to understand details before constructing the big picture of a situation. Verbalizers prefer thinking with processes that encode words while imagers prefer processes that deal with encoded images.

These two styles are independent of each other, that is, the position of an individual on one dimension of cognitive style does not affect their position on the other. For instance a person may be a Wholist and an Imager, and another an Analytic and an Imager, or another may be a Wholist and a Verbaliser, while someone else may be Analytic and a Verbaliser.

WHOLIST-ANALYTIC COGNITIVE STYLE

Description

The wholist-analytic dimension is related to structure and organization of information. When considering information, Wholists will have a balanced view of the whole, while Analytics will separate it out into its parts, or sections.

Effect on Learning Performance

WHOLIST	ANALYTIC
IS ABLE TO SEE THE WHOLE	ANALYSES MATERIAL INTO ITS PARTS
FINDS DIFFICULTY IN DISEMBEDDING	FINDS DIFFICULTY IN SEEING THE WHOLE

Wholists tend to be able to see a broader perspective and the overall relevance of all aspects of the information. Wholists tend to perceive information as a whole and tend to appreciate the overall context. The strength of the Wholists is that they have a balanced view in considering the situation by looking at the whole picture. However, Wholists might find it difficult to separate out parts of the situation.

Analytics prefer structured approach to learning and tend to impose order on information. Analytics perceive information as a collection of parts and tend to focus on how different parts are exclusive of others. They are good at analyzing information based on its parts and get to the heart of a problem quickly. However, they might enlarge the importance of parts for not looking at the whole picture of a situation.

VERBAL-IMAGERY COGNITIVE STYLE

Description

The verbal-imagery dimension is about one's preference to textual representation or pictorial representation. Basically, when people who are Imagers read, listen to, or consider information they experience fluent, spontaneous and frequent mental representations. In contrast, individuals who are Verbalisers read, listen to, or consider, information in words. The Verbal-Imagery mode of representation is a continuum with individuals placed along it. People in the middle tend to use either mode of representation.

Effect on Learning Performance

VERBALISER	IMAGER
LEARNS BEST FROM VERBAL PRESENTATION	LEARNS BEST FROM VISUAL DISPLAYS
FINDS SPEECH AND TEXT EASIER THAN DIAGRAMS	FINDS PICTURES EASIER THAN WORDS

It also has to do with the location of their representation - verbal has to do primarily with social communication since it is the basic medium of communicating with others, while imagery has to do with a world internal to the individual, which may be constructed with mental pictures. Research showed that verbalisers tend to focus outwardly toward others and prefer joining social groups as they see the groups as extension of themselves (Riding, 1994). In contrast, the imager would focus more inwardly and are more passive and prefer static environment.

For descriptive convenience the dimensions may be divided into groupings and given labels. The CSA does this in terms of the standardization data by dividing the population on each dimension into three similarly sized groups. The cut-off points of the ratios on each dimension are given in the figure, and the results page of the CSA describes a person's Style in terms of one of the nine positions shown below, as well as giving the ratios. Your style is indicated by the colored cell.

THE DIMENSION OF COGNITIVE STYLE

WHOLIST-ANALYTIC DIMENSION	>1.35	ANALYTIC VERBALISER	ANALYTIC BIMODAL	ANALYTIC IMAGER
	>1.02 and ≤1.35	INTERMEDIATE VERBALISER	INTERMEDIATE BIMODAL	INTERMEDIATE IMAGER
	≤1.02	WHOLIST VERBALISER	WHOLIST BIMODAL	WHOLIST IMAGER
		≤0.98	>0.98 and ≤1.09	>1.09
		VERBAL-IMAGERY DIMENSION		

Appendix D: Distribution of MBTI Types and Clarity Index

Distribution by the 16 MBTI Types

	N	%		N	%
ESTJ	11	8.3%	ISTJ	5	3.8%
ESTP	4	3.0%	ISTP	2	1.5%
ESFJ	7	5.3%	ISFJ	5	3.8%
ESFP	12	9.1%	ISFP	1	0.8%
ENTJ	5	3.8%	INTJ	4	3.0%
ENTP	13	9.8%	INTP	2	1.5%
ENFJ	9	6.8%	INFJ	4	3.0%
ENFP	38	28.8%	INFP	10	7.6%

Distribution by Dichotomy and Clarity Index

Dichotomy	Clarity Index	N
Extravert	Very Clear	22
	Clear	33
	Moderate	27
	Slight	17
	Total	99
Introvert	Very Clear	2
	Clear	2
	Moderate	13
	Slight	16
	Total	33
Sensing	Very Clear	3
	Clear	11
	Moderate	23
	Slight	10
	Total	47
iNtuition	Very Clear	12
	Clear	20
	Moderate	35
	Slight	18
	Total	85
Thinking	Very Clear	3
	Clear	15

	Moderate	15
	Slight	13
	Total	46
Feeling	Very Clear	10
	Clear	23
	Moderate	28
	Slight	25
	Total	86
Judging	Very Clear	5
	Clear	19
	Moderate	14
	Slight	12
	Total	50
Perceiving	Very Clear	36
	Clear	22
	Moderate	9
	Slight	9
	Total	82

Appendix E: Occupational Trends of the 16 Types

<p>ISTJ</p> <p>Management Administration Law enforcement Accounting or any other occupations where they can use their experiences and attention to detail to get the task done</p>	<p>ISFJ</p> <p>Education Health care Religious setting or any other occupations where they can draw on their experience base to personally help people in a behind-the-scenes manner</p>	<p>INFJ</p> <p>Religion Counseling Teaching Arts or any other occupations where they can facilitate emotional, intellectual, or spiritual development</p>	<p>INTJ</p> <p>Scientific or technical fields Computer Law or any other occupations where they can their intellectual creativity and technical knowledge to conceptualize, analyze, and get the task one</p>
<p>ISTP</p> <p>Skilled trades Technical fields Agriculture Law enforcement Military or any other occupations where they can use their hands-on, analytical work with data or things</p>	<p>ISFP</p> <p>Health care Business Law enforcement or any other occupations where they can use their gentle, service-related attentiveness to detail</p>	<p>INFP</p> <p>Counseling Writing Arts or any other occupations where they can use their creativity as focus on their values</p>	<p>INTP</p> <p>Scientific or technical fields or any other occupations where they can use their solitary objective analysis of problems based on their technical expertise</p>
<p>ESTP</p> <p>Marketing Skilled trades Business Law enforcement Applied technology or any other occupations where they can use their action-oriented focus to attend to the necessary details</p>	<p>ESFP</p> <p>Health care Teaching Coaching Childcare worker Skilled trades or any other occupations where they can use their outgoing nature and enthusiasm to help people with their practical needs</p>	<p>ENFP</p> <p>Counseling Teaching Religion Arts or any other occupations where they can use creativity and communication to help foster the growth of others</p>	<p>ENTP</p> <p>Science Management Technology Arts or any other occupations where they have the opportunity to take on new challenges continually</p>
<p>ESTJ</p> <p>Management Administration Law enforcement or any other occupations where they can use logic and organization of the facts to get the task done</p>	<p>ESFJ</p> <p>Education Health care Religion or any other occupations where they can use their personal concern to provide service to others</p>	<p>ENFJ</p> <p>Religion Arts Teaching or any other occupations where they can help others with their emotional, intellectual, and spiritual grow</p>	<p>ENTJ</p> <p>Management Leadership or any other occupations where they can use tough-minded analysis, strategic planning, and organization to get the task done</p>

Source: Myers et al., 1998, p. 294

SHAO-WEI WU Curriculum Vitae

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Selected Presentations

- Weinstein, S. & **Wu, S.** (April, 2007). *Comparing the effectiveness of assessment methods in an upper level psychology course: Readiness assessment tests vs. frequent quizzing.* Poster presented at the Lilly-East Conference on College and University Teaching, University of Delaware, DE.
- Kapli, N., Morales, R., Hsieh, M., **Wu, S.**, Hsieh, W. and Grabowski, B. (October, 2005), *Identity of Instructional Design: Bringing Multiple Perspectives Together.* Presented at the AECT conference, Orlando, FL.
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- Grabowski, B., Osguthorpe, R., Cox, S., Hsieh, M., **Wu, S.**, Liu, Y., & Hsieh, W. (October, 2003). *Who ARE We? And How do Academics Define Our Field?* Presented at the AECT conference. Anaheim, CA.