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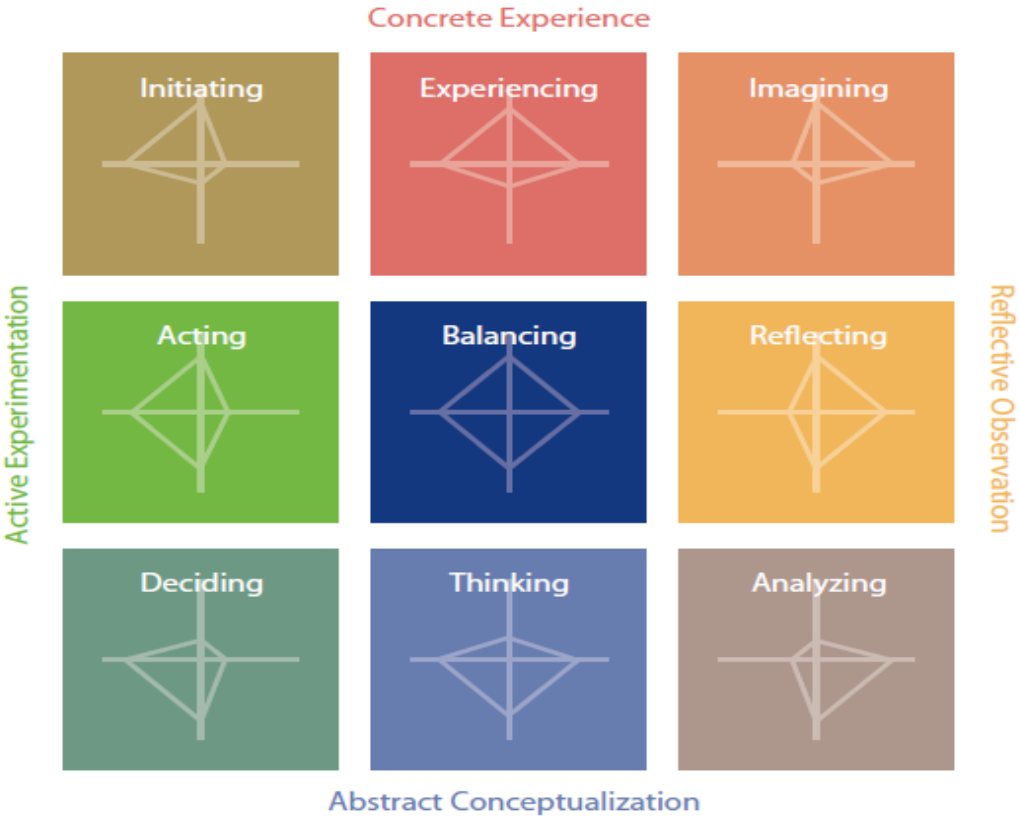
# THE KOLB LEARNING STYLE INVENTORY 4.0

## A Comprehensive Guide to the Theory, Psychometrics, Research on Validity and Educational Applications

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# THE KOLB LEARNING STYLE INVENTORY- Version 4.0

## A Comprehensive Guide to the Theory, Psychometrics, Research on Validity and Educational Applications

**Alice Y. Kolb & David A. Kolb**

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## Abstract

The Kolb Learning Style Inventory version 4.0 (KLSI 4.0) revised in 2011, is the latest revision of the original Learning Style Inventory developed by David A. Kolb. Like its predecessors, the KLSI 4.0 is based on experiential learning theory (Kolb 1984) and is designed to help individuals identify the way they learn from experience. The Kolb Learning Style Inventory 4.0 is the first major revision of the KLSI since 1999 and the third since the original LSI was published in 1971. Based on many years of research involving scholars around the world and data from many thousands of respondents, the KLSI 4.0 includes four major additions-- A new nine learning style typology, assessment of learning flexibility, an expanded personal report focused on improving learning effectiveness, and improved psychometrics. The technical specifications are designed to adhere to the standards for educational and psychological testing developed by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (1999).

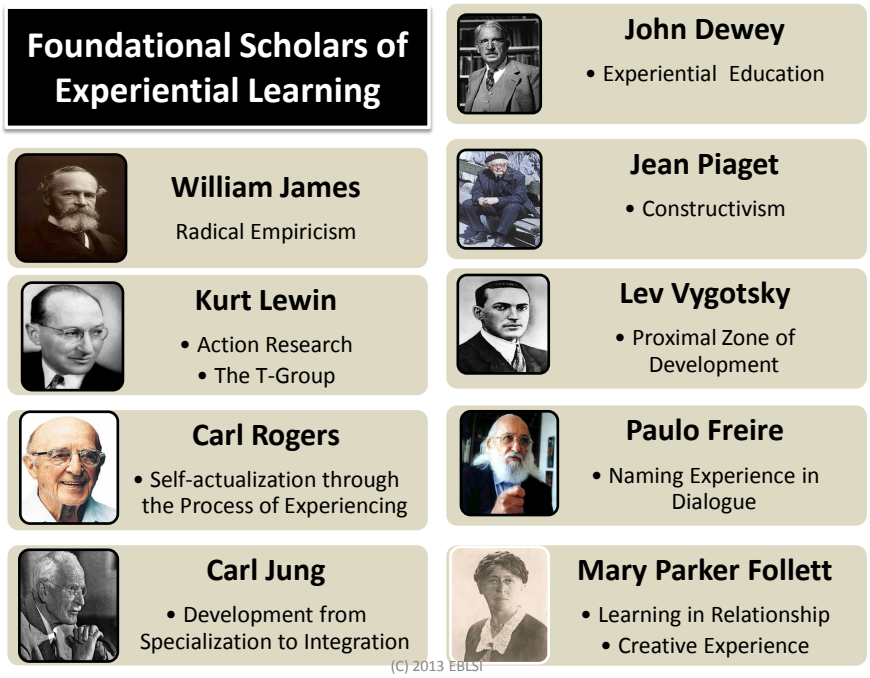
The first chapter describes the conceptual foundations of the LSI 3.1 in the theory of experiential learning (ELT). Chapter 2 provides a description of the inventory that includes its purpose, history, and format. Chapter 3 describes the characteristics of the KLSI 4.0 normative sample. Chapter 4 includes internal reliability and test-retest reliability studies of the inventory. Chapter 5 provides information about research on the internal and external validity for the instrument. Internal validity studies of the structure of the KLSI 4.0.1 using correlation and factor analysis are reported. External validity includes research on demographics, educational specialization, concurrent validity with other experiential learning assessment instruments, aptitude test performance, academic performance and experiential learning in teams. Chapter 6 describes the new Learning Flexibility Index including scoring formulas, normative data and validity evidence. In chapter 7 the current research on educational applications of ELT and the KLSI in many fields is reviewed.

## Table of Contents

## 1. EXPERIENTIAL LEARNING THEORY AND INDIVIDUAL LEARNING STYLES

The Kolb Learning Style Inventory differs from other tests of learning style and personality used in education by being based on a comprehensive theory of learning and development. Experiential Learning Theory (ELT) draws on the work of prominent 20th century scholars who gave experience a central role in their theories of human learning and development—notably John Dewey, Kurt Lewin, Jean Piaget, Lev Vygotsky, William James, Carl Jung, Paulo Freire, Carl Rogers and Mary Parker Follett—to develop a holistic model of the experiential learning process and a multi-dimensional model of adult development (Figure 1.)

**Figure 1.**




The theory, described in detail in *Experiential Learning: Experience as the Source of Learning and Development* (Kolb 1984), is built on six propositions that are shared by these scholars.

1. *Learning is best conceived as a process, not in terms of outcomes.* Although punctuated by knowledge milestones, learning does not end at an outcome, nor is it always evidenced in performance. Rather, learning occurs through the course of connected experiences in which knowledge is modified and re-formed. To improve learning in higher education, the primary focus should be on engaging students in a process that best enhances their learning – a process that includes feedback on the effectiveness of their learning efforts. "…education must be conceived as a continuing reconstruction of experience: … the process and goal of education are one and the same thing." (Dewey 1897: 79)

2. *All learning is re-learning.* Learning is best facilitated by a process that draws out the students' beliefs and ideas about a topic so that they can be examined, tested and integrated with new, more refined ideas. Piaget called this proposition constructivism—individuals construct their knowledge of the world based on their experience and learn from experiences that lead them to realize how new information conflicts with their prior experience and belief.

3. *Learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world.* Conflict, differences, and disagreement are what drive the learning process. These tensions are resolved in iterations of movement back and forth between opposing modes of reflection and action and feeling and thinking.

4. *Learning is a holistic process of adaptation to the world.* Learning is not just the result of cognition but involves the integrated functioning of the total person—thinking, feeling, perceiving and behaving. It encompasses other specialized models of adaptation from the scientific method to problem solving, decision making and creativity.

5. *Learning results from synergetic transactions between the person and the environment.* In Piaget's terms, learning occurs through equilibration of the dialectic processes of assimilating new experiences into existing concepts and accommodating existing concepts to new experience. Following Lewin's famous formula that behavior is a function of the person and the environment, ELT holds that learning is influenced by characteristics of the learner and the learning space.

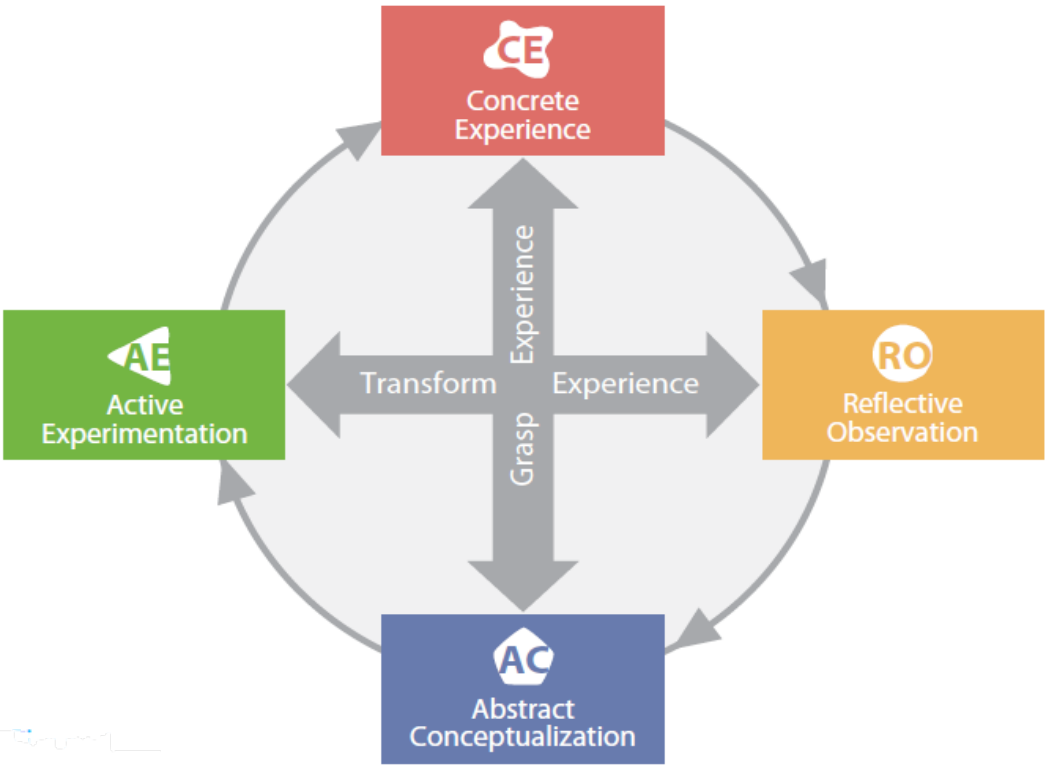
6. *Learning is the process of creating knowledge.* In ELT, knowledge is viewed as the transaction between two forms of knowledge: social knowledge, which is co-constructed in a socio-historical context, and personal knowledge, the subjective experience of the learner. This conceptualization of knowledge stands in contrast to that of the "transmission" model of education in which pre-existing, fixed ideas are transmitted to the learner. ELT proposes a constructivist theory of learning whereby social knowledge is created and recreated in the personal knowledge of the learner.

## THE CYCLE OF EXPERIENTIAL LEARNING

ELT is a dynamic view of learning based on a learning cycle driven by the resolution of the dual dialectics of action/reflection and experience/abstraction. Learning is defined as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience." (Kolb, 1984, p. 41). Grasping experience refers to the process of taking in information, and transforming experience is how individuals interpret and act on that information. The ELT model portrays two dialectically related modes of grasping experience—Concrete Experience (CE) and Abstract Conceptualization (AC)—and two dialectically related modes of transforming experience—Reflective Observation (RO) and Active Experimentation (AE).

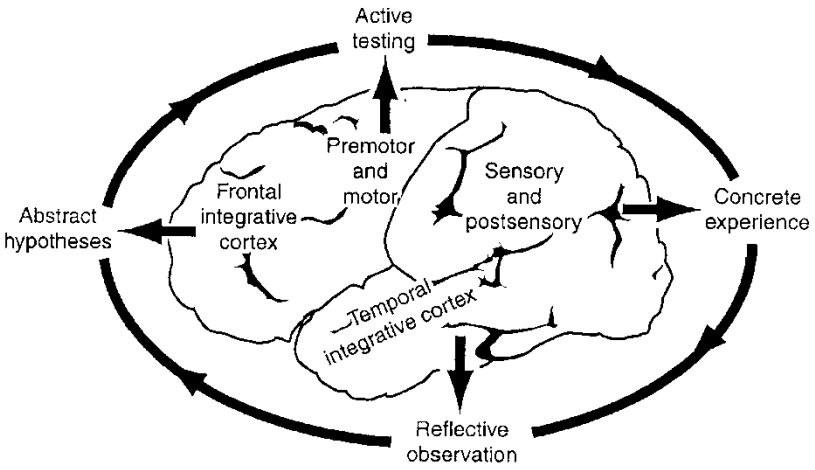
Learning arises from the resolution of creative tension among these four learning modes. This process is portrayed as an idealized learning cycle or spiral where the learner "touches all the bases"—experiencing (CE), reflecting (RO), thinking (AC), and acting (AE)—in a recursive process that is sensitive to the learning situation and what is being learned. Immediate or concrete experiences are the basis for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn. These implications can be actively tested and serve as guides in creating new experiences (Figure 2).

**Figure 2. The Experiential Learning Cycle**




In *The art of changing the brain: Enriching teaching by exploring the biology of learning*, James Zull a biologist and founding director of CWRU's University Center for Innovation in Teaching and Education (UCITE) sees a link between ELT and neuroscience research, suggesting that this process of experiential learning is related to the process of brain functioning as shown in Figure 2. "Put into words, the figure illustrates that concrete experiences come through the sensory cortex, reflective observation involves the integrative cortex at the back, creating new abstract concepts occurs in the frontal integrative cortex, and active testing involves the motor brain. In other words, the learning cycle arises from the structure of the brain." (Zull 2002: 18-19; 2011)

**Figure 3. The Experiential Learning Cycle and Regions of the Cerebral Cortex.**




Reprinted with permission of the author (Zull 2002)

## LEARNING STYLE

Learning style describes the unique ways individuals spiral through the learning cycle based on their preference for the four different learning modes—CE, RO, AC, & AE. Because of one's genetic makeup, particular life experiences, and the demands of the present environment, a preferred way of choosing among these four learning modes is developed. The conflict between being concrete or abstract and between being active or reflective is resolved in patterned, characteristic ways. Much of the research on ELT has focused on the concept of learning style using the Kolb Learning Style Inventory (KLSI) to assess individual learning styles (Kolb & Kolb 2005b). In the KLSI a person's learning style is defined by their unique combination of preferences for the four learning modes defining a "kite" shape profile of their relative preference for the four phases of the learning cycle. Because each person's learning style is unique, everyone's kite shape is a little different.

ELT posits that learning style is not a fixed psychological trait but a dynamic state resulting from synergistic transactions between the person and the environment. This dynamic state arises from an individual's preferential resolution of the dual dialectics of experiencing/conceptualizing and acting/reflecting. "The stability and endurance of these states in individuals comes not solely from fixed genetic qualities or characteristics of human beings: nor, for that matter, does it come from the stable fixed demands of environmental circumstances. Rather, stable and enduring patterns of human individuality arise from consistent patterns of transaction between the individual and his or her environment…The way we process the possibilities of each new emerging event determines the range of choices and decisions we see. The choices and decisions we make to some extent determine the events we live through, and these events influence our future choices. Thus, people create

themselves through the choice of the actual occasions that they live through" (Kolb, 1984, p. 63-64).

Previous research with KLSI versions 1-3.1 has identified four learning style groupings of similar kite shapes that are associated with different approaches to learning — Diverging, Assimilating, Converging, and Accommodating. This research has shown that learning styles are influenced by culture, personality type, educational specialization, career choice, and current job role and tasks (Kolb & Kolb, 2013; Kolb, 1984). These patterns of behavior associated with the four basic learning styles are shaped by transactions between persons and their environment at five different levels—personality, educational specialization, professional career, current job role, and adaptive competencies. While some have interpreted learning style as a personality variable (Garner 2000, Furnam, Jackson & Miller 1999), ELT defines learning style as a social psychological concept that is only partially determined by personality. Personality exerts a small but pervasive influence in nearly all situations; but at the other levels learning style is influenced by increasingly specific environmental demands of educational specialization, career, job, and tasks skills. Table 1 summarizes previous research that has identified how learning styles are determined at these various levels.

Table 1
Relationship Between Learning Styles and Five Levels of Behavior.

| Behavior level | Diverging | Assimilating | Converging | Accommodating |
|---|---|---|---|---|
| Personality types | Introverted Feeling | Introverted Intuition | Extraverted Thinking | Extraverted Sensation |
| Educational specialization | Arts, English History Psychology | Mathematics Physical Science | Engineering Medicine | Education Communication Nursing |
| Professional career | Social service Arts | Sciences Research Information | Engineering Medicine Technology | Sales Social service Education |
| Current jobs | Personal jobs | Information jobs | Technical jobs | Executive jobs |
| Adaptive competencies | Valuing skills | Thinking skills | Decision skills | Action skills |

**Personality Types.**

Although the learning styles of and learning modes proposed by ELT are derived from the works of Dewey, Lewin and Piaget many have noted the similarity of these concepts to Carl Jung's descriptions of individuals' preferred ways for adapting in the world. Several research studies relating the LSI with the Myers-Briggs Type Indicator (MBTI) indicate that Jung's Extraversion/Introversion dialectical dimension correlates with the Active/Reflective dialectic of ELT and the MBTI Feeling/Thinking dimension correlates with the LSI Concrete Experience/ Abstract Conceptualization dimension. The MBTI Sensing type is associated with the LSI Accommodating learning style and the MBTI Intuitive type with the LSI Assimilating style. MBTI Feeling types correspond to LSI Diverging learning styles and Thinking types to Converging styles. The above discussion implies that the Accommodating learning style is the Extraverted Sensing type, and the Converging style the Extraverted Thinking type. The Assimilating learning style corresponds to the Introverted Intuitive personality type and the Diverging style to the Introverted Feeling type. Myers (1962) descriptions of these MBTI types are very similar to the corresponding LSI learning styles as described by ELT (Kolb, 1984, pp: 83-85).

**Educational Specialization.**

Early educational experiences shape people's individual learning styles by instilling positive attitudes toward specific sets of learning skills and by teaching students how to learn. Although elementary education is generalized, there is an increasing process of specialization that begins in high school and becomes sharper during the college years. This specialization in the realms of social knowledge influences individuals' orientations toward learning, resulting in particular relations between learning styles and early training in an educational specialty or discipline. For example, people specializing in the arts, history, political science, English, and psychology tend to have Diverging learning styles, while those majoring in more abstract and applied areas like medicine and engineering have Converging learning styles. Individuals with Accommodating styles often have educational backgrounds in education, communication and nursing, and those with Assimilating styles in mathematics and physical sciences.

**Professional Career.**

A third set of factors that shape learning styles stems from professional careers. One's professional career choice not only exposes one to a specialized learning environment, but it also involves a commitment to a generic professional problem, such as social service, that requires a specialized adaptive orientation. In addition, one becomes a member of a reference group of peers who share a professional mentality, and a common set of values and beliefs about how one should behave professionally. This professional orientation shapes learning style through habits acquired in professional training and through the more immediate normative pressures involved in being a competent professional. Research over the years has shown that social service and arts careers attract people with a Diverging learning style. Professions in the sciences and

information or research have people with an Assimilating learning style. The Converging learning styles tends to be dominant among professionals in technology intensive fields like medicine and engineering. Finally, the Accommodating learning style characterizes people with careers in fields such as sales, social service and education.

**Current Job Role.**

The fourth level of factors influencing learning style is the person's current job role. The task demands and pressures of a job shape a person's adaptive orientation. Executive jobs, such as general management, that require a strong orientation to task accomplishment and decision making in uncertain emergent circumstances require an Accommodating learning style. Personal jobs, such as counseling and personnel administration, that require the establishment of personal relationships and effective communication with other people demand a Diverging learning style. Information jobs, such as planning and research, that require data gathering and analysis, as well as conceptual modeling, require an Assimilating learning style. Technical jobs, such as bench engineering and production that require technical and problem-solving skills require a convergent learning orientation.

**Adaptive competencies.**

The fifth and most immediate level of forces that shapes learning style is the specific task or problem the person is currently working on. Each task we face requires a corresponding set of skills for effective performance. The effective matching of task demands and personal skills results in an adaptive competence. The Accommodative learning style encompasses a set of competencies that can best be termed Acting skills: Leadership, Initiative, and Action. The Diverging learning style is associated with Valuing skills: Relationship, Helping others, and Sense-making. The Assimilating learning style is related to Thinking skills: Information-gathering, Information-analysis, and Theory building. Finally, the Converging learning style is associated with Decision skills like Quantitative Analysis, Use of Technology, and Goal-setting (Kolb, 1984).

The following summary of the four basic learning styles is based on both research and clinical observation of these patterns of KLSI scores (Kolb, 1984, Kolb & Kolb 2013).

An individual with diverging style has CE and RO as dominant learning abilities. People with this learning style are best at viewing concrete situations from many different points of view. It is labeled "Diverging" because a person with it performs better in situations that call for generation of ideas, such as a "brainstorming" session. People with a Diverging learning style have broad cultural interests and like to gather information. They are interested in people, tend to be imaginative and emotional, have broad cultural interests, and tend to specialize in the arts. In formal learning situations, people with the Diverging style prefer to work in groups, listening with an open mind and receiving personalized feedback.

An individual with an assimilating style has AC and RO as dominant learning abilities. People with this learning style are best at understanding a wide range of information and putting into concise, logical form. Individuals with an Assimilating style are less focused on people and more interested in ideas and abstract concepts. Generally, people with this style find it more important that a theory have logical soundness than practical value. The Assimilating learning style is important for effectiveness in information and science careers. In formal learning situations, people with this style prefer readings, lectures, exploring analytical models, and having time to think things through.

An individual with a converging style has AC and AE as dominant learning abilities. People with this learning style are best at finding practical uses for ideas and theories. They have the ability to solve problems and make decisions based on finding solutions to questions or problems. Individuals with a Converging learning style prefer to deal with technical tasks and problems rather than with social issues and interpersonal issues. These learning skills are important for effectiveness in specialist and technology careers. In formal learning situations, people with this style prefer to experiment with new ideas, simulations, laboratory assignments, and practical applications.

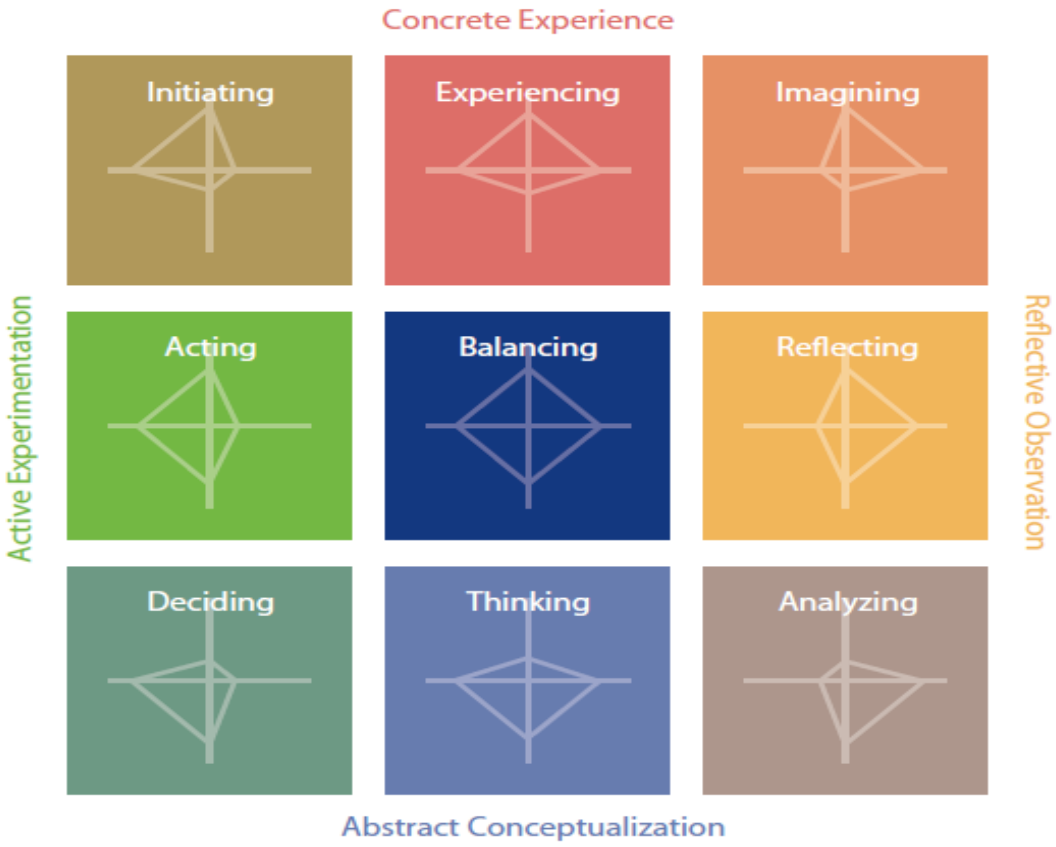
An individual with an accommodating style has CE and AE as dominant learning abilities. People with this learning style have the ability to learn from primarily "hands-on" experience. They enjoy carrying out plans and involving themselves in new and challenging experiences. Their tendency may be to act on "gut" feelings rather than on logical analysis. In solving problems, individuals with an Accommodating learning style rely more heavily on people for information than on their own technical analysis. This learning style is important for effectiveness in action-oriented careers such as marketing or sales. In formal learning situations, people with the Accommodating learning style prefer to work with others to get assignments done, to set goals, to do field work, and to test out different approaches to completing a project.

## The nine learning styles of the KLSI 4.0

Data from empirical and clinical studies over the years has shown that these original four learning style types—Accommodating, Assimilating , Converging and Diverging— can be refined further into a nine style typology that better defines the unique patterns of individual learning styles and reduces the confusions introduced by borderline cases in the old 4 style typology (Eickmann, Kolb, & Kolb, 2004; Kolb & Kolb, 2005a&b; Boyatzis & Mainemelis, 2000). With feedback from users we first began noticing a fifth "balancing" style describing users who scored at the center of the Learning Style grid. Later we discovered that individuals who scored near the grid boundary lines also had distinctive styles. For example an "Experiencing" style was identified between the Accommodating and Diverging styles Four of these style types emphasize one of the four learning modes—Experiencing (CE), Reflecting (RO), Thinking (AC) and Acting (AE) (Abbey, Hunt & Weiser, 1985; Hunt, 1987). Four others represent style types that emphasize two learning modes, one from the grasping dimension and one from the transforming dimension of the ELT model—Imagining (CE & RO), Analyzing (AC & RO), Deciding (AC &AE) and Initiating (CE &AE). The final style type balances all four modes of the learning cycle—Balancing (CE, RO, AC &AE; Mainemelis, Boyatzis, & Kolb, 2002).

The new KLSI 4.0 introduces these nine style types by moving from a 4 pixel to 9 pixel resolution of learning style types as described below. The learning style types can be systematically arranged on a two-dimensional learning space defined by Abstract Conceptualization-Concrete Experience and Active Experimentation-Reflective Observation. This space, including a description of the distinguishing kite shape of each style, is depicted in Figure 4. See Appendix 9 for detailed descriptions and case studies of the nine types.

**Figure 4. The Nine Learning Styles in the KLSI 4.0**

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The **Initiating** style - initiating action to deal with experiences and situations. The Initiating style is characterized by the ability to initiate action in order to deal with experiences and situations. It involves active experimentation (AE) and concrete experience (CE).

The **Experiencing** style - finding meaning from deep involvement in experience. The Experiencing style is characterized by the ability to find meaning from deep involvement in experience. It draws on concrete experience (CE) while balancing active experimentation (AE) and reflective observation (RO).

The **Imagining** style - imagining possibilities by observing and reflecting on experiences. The Imagining style is characterized by the ability to imagine possibilities by observing and reflecting on experiences. It combines the learning steps of concrete experience (CE) and reflective observation (RO).

The **Reflecting** style - connecting experience and ideas through sustained reflection. The Reflecting style is characterized by the ability to connect experience and ideas through sustained reflection. It draws on reflective observation (RO) while balancing concrete experience (CE) and abstract conceptualization (AC).

The **Analyzing** style - integrating ideas into concise models and systems through reflection. The Analyzing style is characterized by the ability to integrate and systematize ideas through reflection. It combines reflective observation (RO) and abstract conceptualization (AC).

The **Thinking** style - disciplined involvement in abstract reasoning and logical reasoning. The Thinking style is characterized by the capacity for disciplined involvement in abstract and logical reasoning. It draws on abstract conceptualization (AC) while balancing active experimentation (AE) and reflective observation (RO).

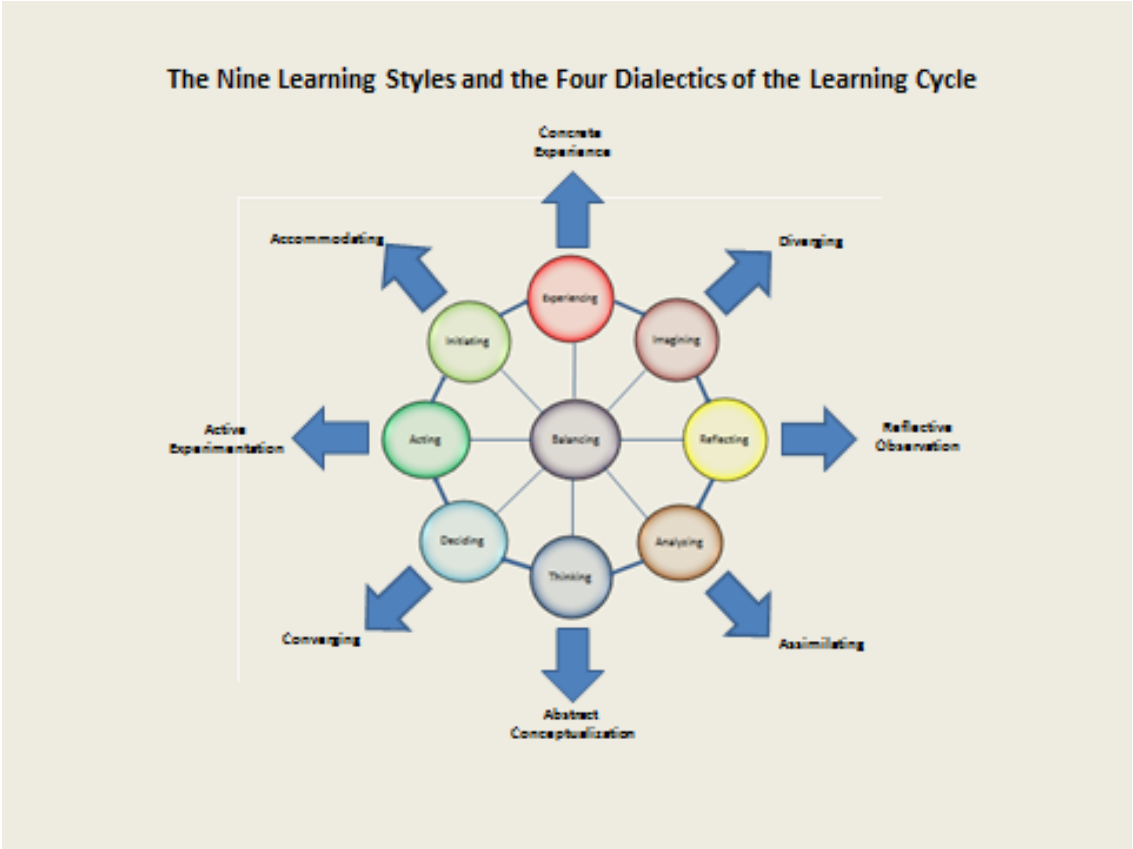
The **Deciding** style - using theories and models to decide on problem solutions and courses of action. The Deciding style is characterized by the ability to use theories and models to decide on problem solutions and courses of action. it combines abstract conceptualization (AC) and active experimentation (AE).

The **Acting** style - a strong motivation for goal directed action that integrates people and tasks. The Acting style is characterized by a strong motivation for goal directed action that integrates people and tasks. It draws on active experimentation (AE) while balancing concrete experience (CE) and abstract conceptualization (AC).

The **Balancing** style - adapting by weighing the pros and cons of acting versus reflecting and experiencing versus thinking. The Balancing style is characterized by the ability to adapt; weighing the pros and cons of acting versus reflecting and experiencing versus thinking. It balances concrete experience, abstract conceptualization, active experimentation and reflective observation.

These nine KLSI 4.0 learning styles further define the experiential learning cycle by emphasizing four dialectic tensions in the learning process. In addition to the primary dialectics of Abstract Conceptualization/Concrete Experience and Active Experimentation/Reflective Observation, The combination dialectics of Assimilation/Accommodation and Converging/Diverging are also represented in an eight stage learning cycle with Balancing in the center. Thus The Initiating style has a strong preference for active learning in context (Accommodation) while the Analyzing style has a strong preference for reflective conceptual learning (Assimilation). The Imagining style has a strong preference for opening alternatives and perspectives on experience (Diverging) while the Deciding style has a strong preference for closing on the single best option for action (Converging). The formulas for calculating the continuous scores on these combination dialectics are reported on page 41. Figure 5 depicts this expanded learning cycle and illustrates how an individual's particular style represents their preferred space in the cycle.

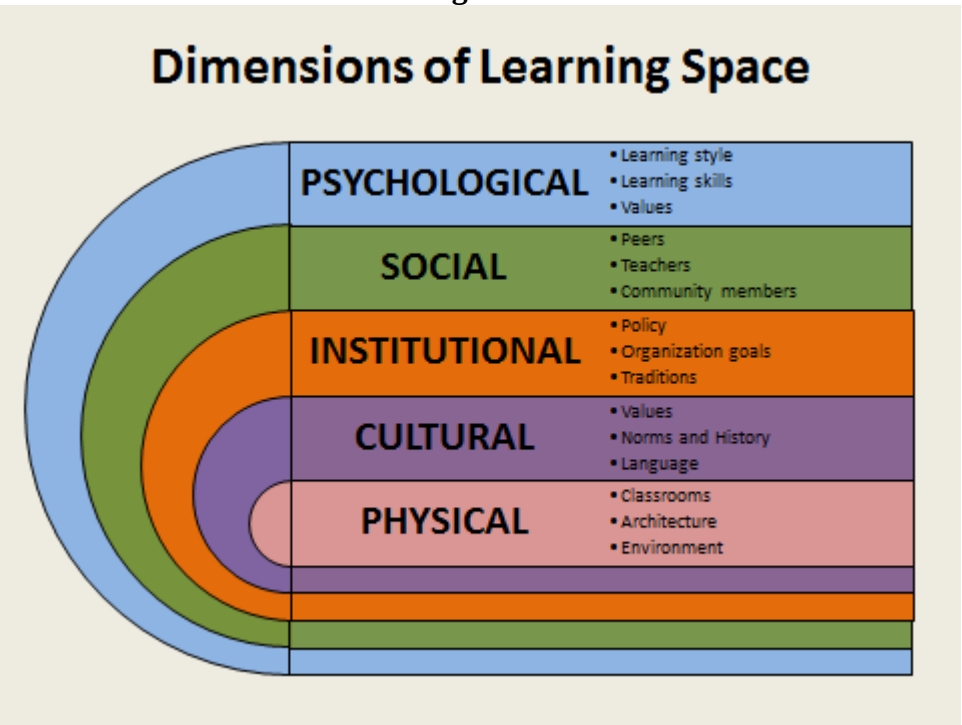
**Figure 5**


The Nine Learning Styles and the Four Dialectics of the Learning Cycle
Concrete Experience
Accommodating
Diverging
Experiencing
Initiating
Imagining
Active Experimentation
Acting
Balancing
Reflecting
Reflective Observation
Deciding
Analyzing
Thinking
Converging
Assimilating
Abstract Conceptualization

## LEARNING SPACE

If learning is to occur, it requires a space for it to take place. While, for most, the concept of learning space first conjures up the image of the physical classroom environment, it is much broader and multi-dimensional. Dimensions of learning space include physical, cultural, institutional, social and psychological aspects (See Figure 6).

**Figure 6**




In ELT these dimensions all come together in the experience of the learner. This concept of learning space builds on Kurt Lewin's field theory and his concept of life space (1951). For Lewin, person and environment are interdependent variables where behavior is a function of person and environment and the life space is the total psychological environment, which the person experiences subjectively. To take time as an example, in many organizations today employees are so busy doing their work that they feel that there is no time to learn how to do things better. This feeling is shaped by the objective conditions of a hectic work schedule along with the expectation that time spent reflecting will not be rewarded.

Three other theoretical frameworks inform the ELT concept of learning space. Urie Bronfrenbrenner's (1977, 1979) work on the ecology of human development has made significant sociological contributions to Lewin's life space concept. He defines the ecology of learning/development spaces as a topologically nested arrangement of structures each contained within the next. The learner's immediate setting such as a course or classroom is called the *microsystem,* while other concurrent settings in the person's life such as other courses, the dorm or family are referred to as the *mesosystem.* The *exosystem* encompasses the formal and informal social structures that influence the person's immediate environment,

such as institutional policies and procedures and campus culture. Finally, the *macrosystem* refers to the overarching institutional patterns and values of the wider culture, such as cultural values favoring abstract knowledge over practical knowledge, that influence actors in the person's immediate microsystem and mesosystem. This theory provides a framework for analysis of the social system factors that influence learners' experience of their learning spaces.

Another important contribution to the learning space concept is situated learning theory (Lave and Wenger 1991). Like ELT situated learning theory draws on Vygotsky's (1978) activity theory of social cognition for a conception of social knowledge that conceives of learning as a transaction between the person and the social environment. Situations in situated learning theory like life space and learning space are not necessarily physical places but constructs of the person's experience in the social environment. These situations are embedded in communities of practice that have a history, norms, tools, and traditions of practice. Knowledge resides, not in the individual's head, but in communities of practice. Learning is thus a process of becoming a member of a community of practice through legitimate peripheral participation (e.g. apprenticeship). Situated learning theory enriches the learning space concept by reminding us that learning spaces extend beyond the teacher and the classroom. They include socialization into a wider community of practice that involves membership, identity formation, transitioning from novice to expert through mentorship and experience in the activities of the practice, as well as the reproduction and development of the community of practice itself as newcomers replace old-timers.

Finally, in their theory of knowledge creation, Nonaka and Konno ( 1998) introduce the Japanese concept of "ba", a "context that harbors meaning", which is a shared space that is the foundation for knowledge creation. "Knowledge is embedded in *ba,* where it is then acquired through one's own experience or reflections on the experiences of others." (Nonaka and Konno 1998:40) Knowledge embedded in *ba* is tacit and can only be made explicit through sharing of feelings, thoughts and experiences of persons in the space. For this to happen, the *ba* space requires that individuals remove barriers between one another in a climate that emphasizes "care, love, trust, and commitment". Learning spaces similarly require norms of psychological safety, serious purpose, and respect to promote learning.

Since a learning space is in the end what the learner experiences it to be, it is the psychological and social dimensions of learning spaces that have the most influence on learning. From this perspective learning spaces can be viewed as aggregates of human characteristics. "Environments are transmitted through people and the dominant features of a particular environment are partially a function of the individuals who inhabit it" (Strange & Banning, 2001). Using the "human aggregate" approach, the experiential learning space is defined by the attracting and repelling forces (positive and negative valences) of the poles of the dual dialectics of action/reflection and experiencing/conceptualizing, creating a two dimensional map of the regions of the learning space like that shown in Figure 4. An individual's learning style positions him/her in one of these regions depending on the equilibrium of forces among action, reflection, experiencing and conceptualizing. As with the concept of life space, this position is determined by a combination of individual disposition and characteristics of the learning environment.

The KLSI measures an individual's preference for a particular region of the learning space, their home region so to speak. The regions of the ELT learning space offer a typology of the different types of learning based on the extent to which they require action vs. reflection and experiencing vs. thinking, thereby emphasizing some stages of the learning cycle over others. A number of studies of learning spaces in higher education have been conducted using the human aggregate approach by showing the percentage of students whose learning style places them in the different learning space regions (Kolb & Kolb, 2005a; Eickmann, Kolb & Kolb, 2004). Figure 7, for example, shows the ELT learning space of the MBA program in a major management school. In this particular case, students are predominately concentrated in the abstract and active regions of the learning space, as are the faculty. This creates a learning space that tends to emphasize the quantitative and technical aspects of management over the human and relationship factors.

Figure 7. The Learning Space of an MBA Program Defined by the Learning Styles of MBA Students (n = 1286; Kolb & Kolb 2005a)

Concrete Experience

| | | | |
|---|---|---|---|
| | Initiating 10.1% | Experiencing 6% | Imagining 5.1% |
| Active Experimentation | Acting 13.5% | Balancing 10.2% | Reflecting 9.3% |
| | Deciding 12.7% | Thinking 17% | Analyzing 16% |

Reflective Observation

Abstract Conceptualization

The ELT learning space concept emphasizes that learning is not one universal process but a map of learning territories, a frame of reference within which many different ways of learning can flourish and interrelate. It is a holistic framework that orients the many different ways of learning to one another. The process of experiential learning can be viewed as a process of locomotion through the learning regions that is influenced by a person's position in the learning space. One's position in the learning space defines their experience and thus defines their "reality." Teachers objectively create learning spaces by the information and activities they offer in their course; but this space is interpreted in the students' subjective experience through the lens of their learning style.

## Creating learning spaces for experiential learning

In our recent research we have focused on the characteristics of learning spaces that maximize learning and development and have developed principles for creating them (Kolb & Kolb, 2005a). For a learner to engage fully in the learning cycle, a space must be provided to engage in the four modes of the cycle—feeling, reflection, thinking, and action. It needs to be a hospitable, welcoming space that is characterized by respect for all. It needs to be safe and supportive, but also challenging. It must allow learners to be in charge of their own learning and allow time for the repetitive practice that develops expertise.

The enhancement of experiential learning can be achieved through the creation of learning spaces that promote growth producing experiences for learners. A central concept in Dewey's educational philosophy is the continuum of experience that arrays experiences that promote or inhibit learning. "The belief that all genuine education comes about through experience does not mean that all experiences are genuinely educative…For some experiences are mis-educative. Any experience is mis-educative that has the effect of arresting or distorting the growth of further experience…Hence the central problem of an education based on experience is to select the kind of present experiences that live fruitfully and creatively in subsequent experiences" (Dewey 1938, p. 25-28). There are a number of educational principles that flow from this philosophy.

**Respect for Learners and their Experience.** A growth producing experience in the philosophy of experiential learning refers not just to a direct experience related to a subject matter under study but to the total experiential life space of the learner. This includes the physical and social environment and the quality of relationships. We refer to this as the Cheers/Jeers experiential continuum. At one end learners feel that they are members of a learning community who are known and respected by faculty and colleagues and whose experience is taken seriously, a space "where everybody knows your name". At the other extreme are "mis-educative" learning environments where learners feel alienated, alone, unrecognized and devalued. Learning and growth in the Jeers environment "where nobody knows your name" can be difficult if not impossible. This principle an be problematic for even the finest educational institutions. President Lawrence Summers of Harvard dedicated his 2003 commencement address to the introduction of a comprehensive examination of the undergraduate program, motivated in part by a letter he received from a top science student which contained the statement, "I am in the eighth semester of college and there is not a single science professor here who could identify me by name." Summers concludes "The only true measure of a successful educational model is our students' experience of it." (Summers 2003:64)

**Begin Learning with the Learner's Experience of the Subject Matter.** To learn experientially one must first of all own and value their experience. Students will often say, "But I don't have any experience." meaning that they don't believe that their experience is of any value to the teacher or for learning the subject matter at hand. The new science of learning (Bransford, Brown and Cocking 2000) is based on the cognitive constructivist theories of Piaget and Vygotsky that emphasize that people construct new knowledge and understanding from what they already know and believe based on their previous experience.

Zull (2002) suggests that this prior knowledge exists in the brain as neuronal networks which cannot be erased by a teacher's cogent explanation. Instead the effective teacher activates prior knowledge, building on exploration of what students already know and believe, on the sense they have made of their previous concrete experiences. Beginning with these or related concrete experiences allows the learner to re-examine and modify their previous sense-making in the light of new ideas.

**Creating and Holding a Hospitable Space for Learning.** To learn requires facing and embracing differences; be they differences between skilled expert performance and one's novice status, differences between deeply held ideas and beliefs and new ideas or differences in the life experience and values of others that can lead to understanding them. These differences can be challenging and threatening, requiring a learning space that encourages the expression of differences and the psychological safety to support the learner in facing these challenges (Sanford 1966). As Robert Kegan says, "…people grow best where they continuously experience an ingenious blend of challenge and support" (1994: 42). As Kegan implies by his use of the term "ingenious blend", creating and holding this learning space is not easy. He notes that while educational institutions have been quite successful in challenging students, they have been much less successful in providing support. One reason for this may be that challenges tend to be specific and immediate while support must go beyond an immediate "You can do it." statement. It requires a climate or culture of support that the learner can trust to "hold" them over time. In *Conversational Learning* (Baker, Jensen and Kolb 2002) we draw on the work of Henri Nouwen (1975) and Parker Palmer (1983, 1990, 1998) to describe this challenging and supportive learning space as one that welcomes the stranger in a spirit of hospitality where "students and teachers can enter into a fearless communication with each other and allow their respective life experiences to be their primary and most valuable source of growth and maturation" (Nouwen: 60).

**Making Space for Conversational Learning.** Human beings naturally make meaning from their experiences through conversation. Yet genuine conversation in the traditional lecture classroom can be extremely restricted or nonexistent. At the break or end of the class the sometimes painfully silent classroom will suddenly come alive with spontaneous conversation among students. Significant learning can occur in these conversations, although it may not always be the learning the teacher intended. Making space for good conversation as part of the educational process provides the opportunity for reflection on and meaning making about experiences that improves the effectiveness of experiential learning (Keeton, Sheckley, and Griggs 2002, Bunker 1999). For example the creation of learning teams as part of a course promote effective learning when psychologically safe conditions are present (Wyss-Flamm 2002). *Conversational Learning* describes the dimensions of spaces that allow for good conversation. Good conversation is more likely to occur in spaces that integrate thinking and feeling, talking and listening, leadership and solidarity, recognition of individuality and relatedness and discursive and recursive processes. When the conversational space is dominated by one extreme of these dimensions, e.g. talking without listening, conversational learning is diminished.

**Making Space for Development of Expertise.** With vast knowledge bases that are ever changing and growing in every field, many higher education curricula consist of course

after course "covering" a series of topics in a relatively superficial factual way. Yet as the National Research Council in it's report on the new science of learning recommends on the basis of research on expert learners; effective learning requires not only factual knowledge, but the organization of these facts and ideas in a conceptual framework and the ability to retrieve knowledge for application and transfer to different contexts (Bransford, Brown, and Cocking 2002). Such deep learning is facilitated by deliberate, recursive practice on areas that are related to the learner's goals (Keeton, Sheckley, and Griggs 2002). The process of learning depicted in the experiential learning cycle describes this recursive spiral of knowledge development. Space needs to be created in curricula for students to pursue such deep experiential learning in order to develop expertise related to their life purpose.

**Making Spaces for Acting and Reflecting** . Learning is like breathing; it involves a taking in and processing of experience and a putting out or expression of what is learned. As Dewey noted, "…nothing takes root in mind when there is no balance between doing and receiving. Some decisive action is needed in order to establish contact with the realities of the world and in order that impressions may be so related to facts that their value is tested and organized." (1934: 45) Yet many programs in higher education are much more focused on impressing information on the mind of the learner than on opportunities for the learners to express and test in action what they have learned. Many courses will spend 15 weeks requiring students to take in volumes of information and only a couple of hours expressing and testing their learning, often on a multiple choice exam. This is in contrast to arts education built on the demonstration-practice-critique process where active expression and testing are continuously involved in the learning process. Zull (2002) suggests that action may be the most important part of the learning cycle because it closes the learning cycle by bringing the inside world of reflection and thought into contact with the outside world of experiences created by action. (cf. Dewey 1897) Keeton, Sheckley and Gross (2002) propose another level of action/reflection integration, emphasizing the importance of active reflection in deepening learning from experience.

**Making Spaces for Feeling and Thinking**. We have seen a polarization between feeling and thinking in the contrast between the feeling oriented learning space of CIA arts education and the thinking oriented learning spaces of the Case undergraduate and MBA programs (Kolb & Kolb 2005a). It seems that educational institutions tend to develop a learning culture that emphasizes the learning mode most related to their educational objectives and devalues the opposite learning mode. Yet, Damasio (1994, 2003), LeDoux (1997), Zull (2002) and others offer convincing research evidence that reason and emotion are inextricably related in their influence on learning and memory. Indeed it appears that feelings and emotions have primacy in determining whether and what we learn. Negative emotions such as fear and anxiety can block learning, while positive feelings of attraction and interest may be essential for learning. To learn something that one is not interested in is extremely difficult.

**Making Space for Inside-out Learning.** David Hunt (1987, 1991) describes inside-out learning as a process of beginning with oneself in learning by focusing on one's experienced knowledge; the implicit theories, metaphors, interests, desires and goals that guide experience. Making space for inside-out learning by linking educational experiences to

the learner's interests kindles intrinsic motivation and increases learning effectiveness. Under the proper educational conditions, a spark of intrinsic interest can be nurtured into a flame of committed life purpose. (Dewey 1897) Yet learning spaces that emphasize extrinsic reward can drive out intrinsically motivated learning (Kohn 1993, Deci and Ryan 1985, Ryan and Deci 2000). Long ago Dewey described the trend toward emphasis on extrinsic reward in education and the consequences for the teacher who wields the carrot and stick: "Thus in education we have that systematic depreciation of interest which has been noted…Thus we have the spectacle of professional educators decrying appeal to interest while they uphold with great dignity the need of reliance upon examinations, marks, promotions and emotions, prizes and the time honored paraphernalia of rewards and punishments. The effect of this situation in crippling the teacher's sense of humor has not received the attention which it deserves. (1916: 336)

**Making Space for Learners to Take Charge of their own Learning .** Many students enter higher education conditioned by their previous educational experiences to be passive recipients of what they are taught. Making space for students to take control of and responsibility for their learning can greatly enhance their ability to learn from experience. Some use the term self-authorship to describe this process of constructing one's own knowledge vs. passively receiving knowledge from others, considering self-authorship to be a major aim of education (Kegan 1994, King 2003, Baxter-Magolda 1999). Others describe this goal as increasing students' capacity for self direction (Boyatzis 1994, Robertson 1988). The Management Development and Assessment course in the Case MBA program aims to develop student self direction through assessment and feedback on learning skills and competencies and the development of a learning plan to achieve their career/life goals (Boyatzis 1994). Bransford, Brown, and Cocking (2002) argue for the development of meta-cognitive skills to promote active learning. By developing their effectiveness as learners (Keeton, Sheckley and Griggs 2002), students can be empowered to take responsibility for their own learning by understanding how they learn best and the skills necessary to learn in regions that are uncomfortable for them. Workshops on experiential learning and learning styles can help students to develop meta-cognitive learning skills. At CIA and the Case undergraduate programs student workshops help students interpret their LSI scores and understand how to use this information to improve their learning effectiveness. John Reese at the University of Denver Law School conducts "Connecting with the Professor" workshops in which students select one of four teaching styles based on the four predominant learning styles that they have difficulty connecting with. The workshop gives multiple examples of remedial actions that the learner may take to correct the misconnection created by differences in teaching/learning styles. Peer group discussions among law students give an opportunity to create new ideas about how to get the most from professors with different learning/teaching styles (Reese 1998).

## THE SPIRAL OF LEARNING AND ADULT DEVELOPMENT

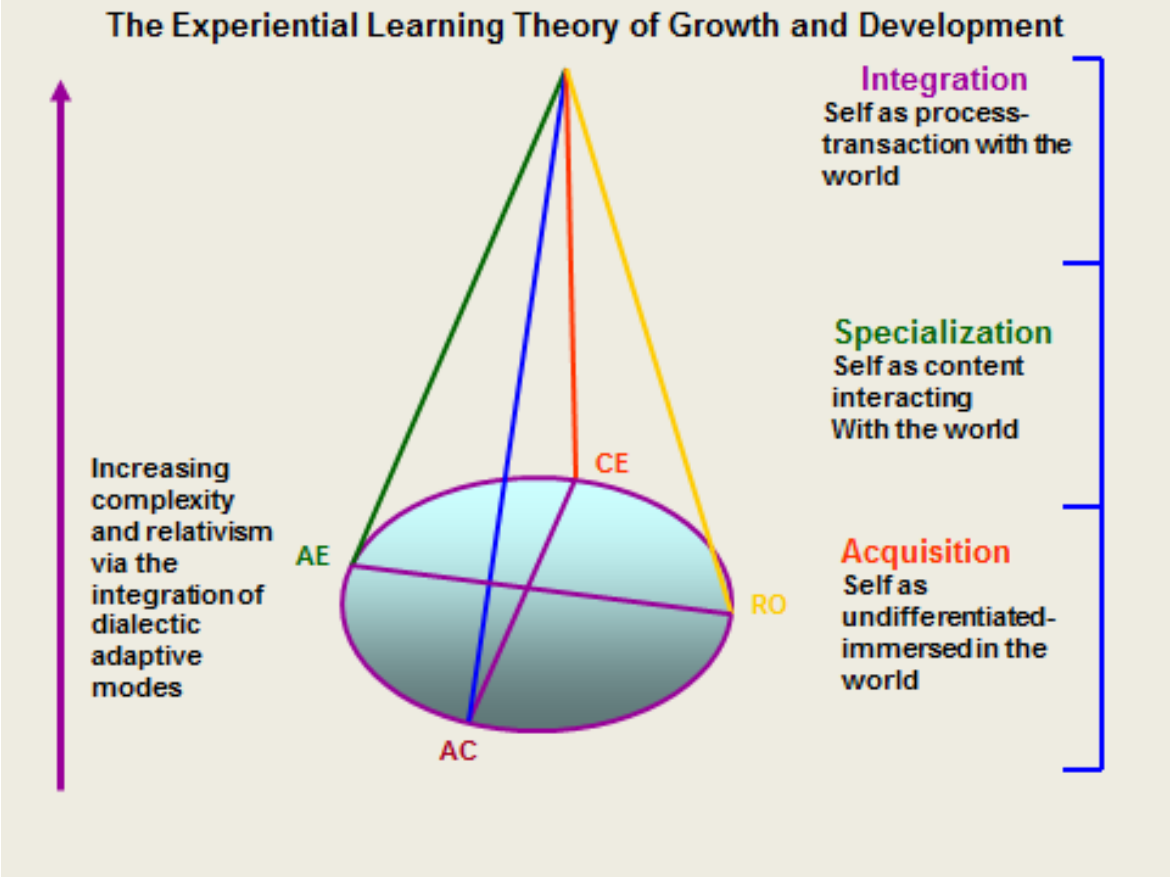
In ELT, adult development occurs through learning from experience. This is based on the idea that the experiential learning cycle is actually a learning *spiral*. When a concrete experience is enriched by reflection, given meaning by thinking and transformed by action, the new experience created becomes richer, broader and deeper. Further iterations of the cycle continue the exploration and transfer to experiences in other contexts. In this process learning is integrated with other knowledge and generalized to other contexts leading to higher levels of adult development.

Zull (2002) explained a link between ELT and neuroscience research, suggesting that the spiraling process of experiential learning is related to the process of brain functioning. Humberto Maturana (1970) also arrived at the concept of a spiral when he searched for the pattern of organization that characterizes all living systems. He concluded that all living systems are organized in a closed circular process that allows for evolutionary change in a way that circularity is maintained. He called this process *autopoeisis*, which means "self-making," emphasizing the self-referential and self-organizing nature of life. Applying autopoeisis to cognition, he argued that the process of knowing was identical to autopoeisis, the spiraling process of life (Maturana & Varela, 1980). As these researchers suggest, the organization of the mind can be viewed as networks of *autopoeitic* learning spirals which are embodied in the neuronal networks that cover the surface layer of the neo-cortex. These neuronal networks are strengthened and enlarged by spirals of learning recursively cycling through these major regions of the neo-cortex.

Progress toward development is seen as increases in the complexity and sophistication of the dimensions associated with the four modes of the learning cycle—affective, perceptual, symbolic and behavioral complexity—and the integration of these modes in a flexible full cycle of learning.

The ELT developmental model (Kolb, 1984) follows Jung's theory that adult development moves from a specialized way of adapting toward a holistic integrated stage that he calls individuation. The model defines three stages: (1) *acquisition,* from birth to adolescence where basic abilities and cognitive structures develop; (2) *specialization,* from formal schooling through the early work and personal experiences of adulthood where social, educational, and organizational socialization forces shape the development of a particular, specialized learning style; and (3) *integration* in mid-career and later life where non-dominant modes of learning are expressed in work and personal life. Development through these stages is characterized by increased integration of the dialectic conflicts between the four primary learning modes (AC-CE and AE-RO) and by increasing complexity and relativism in adapting to the world. Each of the learning modes is associated with a form of complexity that is used in conscious experience to transform sensory data into knowledge such that development of CE increases affective complexity, of RO increases perceptual complexity, of AC increases symbolic complexity, and of AE increases behavioral complexity (Figure 8). These learning modes and complexities create a multi-dimensional developmental process that is guided by an individual's particular learning style and life path.

**Figure 8**




The concept of *deep learning* describes the developmental process of learning that fully integrates the four modes of the experiential learning cycle—experiencing, reflecting, thinking and acting (Jensen & Kolb, 1994; Border, 2007). Deep learning refers to the kind of learning that leads to development in the ELT model. Development toward deep learning is divided into three levels. In the first level learning is registrative and performance-oriented, emphasizing the two learning modes of the specialized learning styles. The second level is interpretative and learning-oriented involving three learning modes, and the third level is integrative and development-oriented involving all four learning modes in a holistic learning process. In his foundational work, *Learning from Experience toward Consciousness,* William Torbert (1972) described these levels of learning as a three-tiered system of feedback loops; work that has been extended by Chris Argyris, Donald Schön, Peter Senge and others in the concepts of single and double loop learning. The traditional lecture course, for example, emphasizes first level, registrative learning emphasizing the learning modes of reflection and abstraction involving little action (often multiple choice tests that assess registration of concepts in memory) and little relation to personal experience. Adding more extensive learning assessments that involve practical application of concepts covered can create second level learning involving the three learning modes where reflection supplemented by action serve to further deepen conceptual understanding. Further addition of learning experiences that involve personal experience such as internships or field projects create the potential for third level integrative learning (cf. Kolb `1984, Chapter 6). As a counter example, an

internship emphasizes registrative learning via the modes of action and experience. Deeper interpretative learning can be enhanced by the addition of activities to stimulate reflection such as team conversation about the internship experience and/or student journals. Linking these to the conceptual material related to the experience adds the fourth learning mode, abstraction and integration though completion of the learning spiral.

A study by Clarke (1977) of the accounting and marketing professions illustrates the ELT developmental model. The study compared the learning styles of cross-sectional samples of accounting and marketing students and professionals in school and at lower, middle and senior level career stages. The learning styles of marketing and accounting students were similar, being fairly balanced among the four learning modes. Lower level accountants had convergent, abstract and active learning styles, and this convergent emphasis was even more pronounced in middle-level accountants, reflecting a highly technical specialization. The senior level accountants, however, became more accommodative in learning style integrating their non-dominant concrete learning orientation. Clark found a similar pattern of development in the marketing profession. Gypen (1981) found the same move from specialization to integration in his study of the learning styles of a cross-sectional sample of social work and engineering university alumni from early to late career. “As engineers move up from the bench to management positions, they complement their initial strengths in abstraction and action with the previously non-dominant orientations of experience and reflection. As social workers move from direct service into administrative positions they move in the opposite direction of the engineers.” (1981: ii)

Notice that in both studies the transitions to non-dominant learning modes in later life stages are associated with changes in the work environment. Development appears not to be solely a function of individual factors alone, but of the transaction between the person and his or her environment. For example, engineers who move from the “bench” into management may become more integrated because of the demands of the interpersonal and unstructured management role. However, choosing to move into the management position required individual development in interest and talent to do so. It is also important to note that these cross-sectional studies do not offer proof of the sequential development through stages predicted in Jung’s model. This would require longitudinal studies of individuals showing that they must first be in a specialized developmental stage before proceeding to the integrative stage. In fact, in spite of their theoretical similarity, elegance and plausibility, we are aware of no empirical evidence for stage-related development in any of the theories of adult development. This evidence is lacking in both the psychoanalytic models of Erikson and Loevinger and the Piaget inspired theories of King and Kitchner, Kegan, or Perry.

For both of these reasons, in our recent work we have considered development in a way that is more context specific, less age related and non-hierarchical. ELT describes registrative, interpretative and integrative levels of consciousness and three modes of adaptation -performance, learning and development (Boyatzis & Kolb, 2000) - which individuals will enter into at different times and situations depending on their life circumstances (Table 1). While these modes may be typical of the acquisition, specialization and development ELT developmental stages, there may be many exceptions in individual cases. Thus, a young person who has been primarily in a performance mode may transition

into a period in the development mode “to figure out what to do with his life” or an older person in the development mode may return to the performance mode to work on a project of importance.

## LEARNING FLEXIBILITY

Another important aspect of learning style is learning flexibility, the extent to which an individual adapts his or her learning style to the demands of the learning situation. As we have seen above, learning style is not a fixed personality trait but more like a habit of learning shaped by experience and choices—it can be an automatic, unconscious mode of adapting or it can be consciously modified and changed. The stability of learning style arises from consistent patterns of transaction between individuals and learning situations in their life. This process is called accentuation—the way we learn about a new situation determines the range of choices and decisions we see, the choices and decisions we make influence the next situation we live through and this situation further influences future choices. Learning styles are thus specialized modes of adaptation that are reinforced by the continuing choice of situations where a style is successful (Kolb 1984).

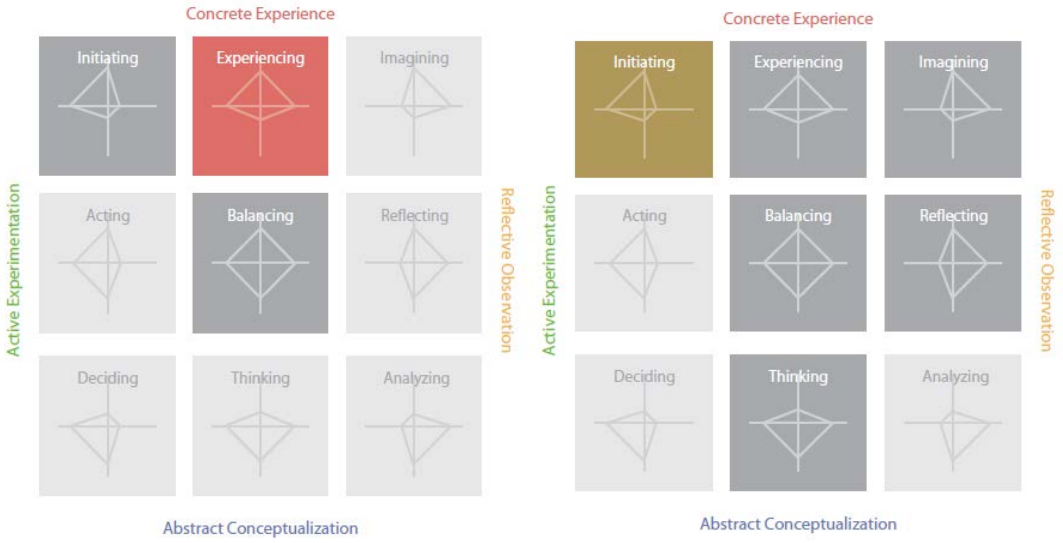
Since a specialized learning style represents an individual preference for only one or two of the four modes of the learning cycle, its effectiveness is limited to those learning situations that require these strengths. Learning flexibility indicates the development of a more holistic and sophisticated learning process The learning style types described above portray how one prefers to learn in general. Many individuals feel that their learning style type accurately describes how they learn most of the time. They are consistent in their approach to learning. Others, however, report that they tend to change their learning approach depending on what they are learning or the situation they are in. They may say, for example, that they use one style in the classroom and another at home with their friends and family. These are flexible learners.

Learning flexibility indicates the development of a more holistic and sophisticated learning process. Following Jung's theory that adult development moves from a specialized way of adapting toward a holistic integrated way, development in learning flexibility is seen as a move from specialization to integration. Integrated learning is a process involving a creative tension among the four learning modes that is responsive to contextual demands. Learning flexibility is the ability to use each of the four learning modes to move freely around the learning cycle and to modify one’s approach to learning based on the learning situation. Experiencing, reflecting, thinking and acting each provide valuable perspectives on the learning task in a way that deepens and enriches knowledge.

This can be seen as traveling through each of the regions of the learning space in the process of learning. The flexibility to move from one learning mode to another in the learning cycle is important for effective learning. Learning flexibility can help us move in and out of the learning space regions, capitalizing on the strengths of each learning style. Learning flexibility broadens the learning comfort zone and allows us to operate comfortably and effectively in more regions of the learning space, promoting deep learning and

development. In addition to providing a measure of how flexible one is in their approach to learning, the KLSI 4.0 also provides an indication of which learning space they move to in different learning contexts—their back-up learning styles. Figure 9 shows the backup styles of Initiating and Balancing for an Experiencing type with a low flexibility score and the backup styles of Experiencing, Imagining, Balancing, Reflecting and Thinking for an Initiating learning style with a high flexibility score. High flexibility individuals tend to show more backup styles and hence a greater ability to move around the learning cycle (See Chapter 6).

**Figure 9**
**Backup Styles for High and Low Learning Flexibility Learners**




## DELIBERATE EXPERIENTIAL LARNING

A primary purpose of the KLSI 4.0 is empower learners to understand and intentionally improve their learning capability. This ability to deliberately learn from experience is perhaps the most powerful source of adult learning. In leadership development for example, Ashford and DeRue point out, "…consider the fact that leadership development programs customarily teach leadership concepts and skills, but rarely do development programs teach individuals how to learn leadership — which is ironic considering that over 70% of leadership development occurs as people go through the ups and downs of challenging, developmental experiences on the job. We contend that the return on investment in leadership development would be much greater if organizations invested in developing individuals' skills related to the learning of leadership from lived experiences, as opposed to simply teaching leadership concepts, frameworks, and skills.(2012 p147). Deliberate experiential learning draws on theories in three areas; meta-cognition (Kolb & Kolb 2009), mindfulness (Yeganeh 2006; Yeganeh & Kolb 2009),) and studies of expert learning called deliberate practice (Ericsson, Krampe & Tesch-Römer 1993).

**Meta-cognition--Understanding yourself as a learner**

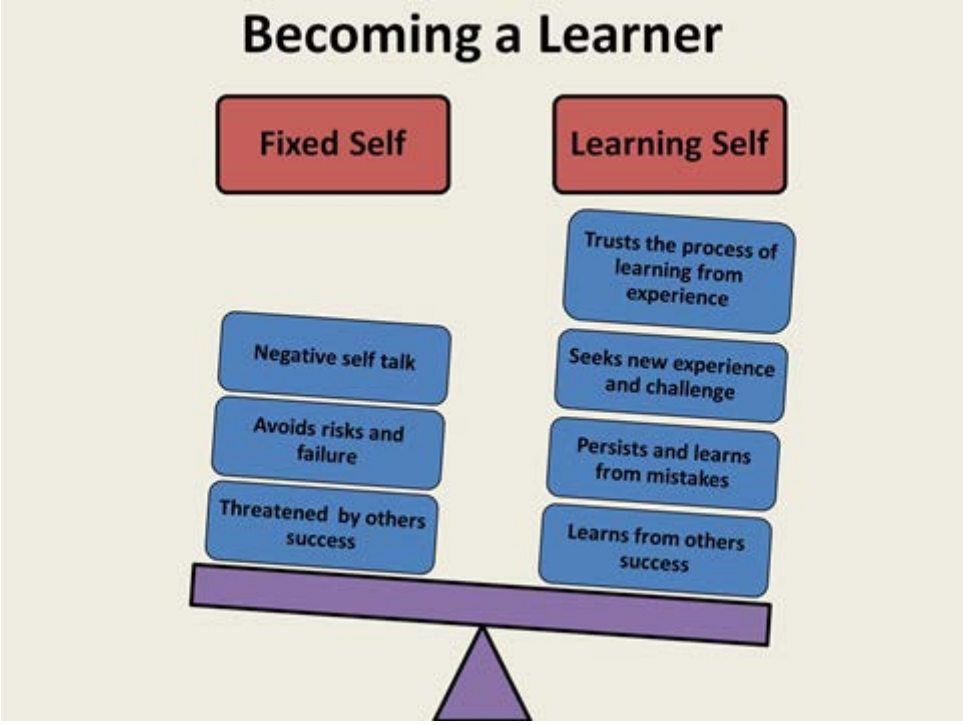
Deliberate experiential learning refers to individuals' conscious meta-cognitive control of their learning process that enables them to monitor and select learning approaches that work best for them in different learning situations. In the late 1970's Flavell (1979) introduced the concept of meta-cognition. He divided meta-cognitive knowledge into three sub-categories: 1) Knowledge of person variables refers to general knowledge about how human beings learn and process information, as well as individual knowledge of one's own learning processes. 2) Task variables include knowledge about the nature of the task and what it will require of the individual. 3) knowledge about strategy variables include knowledge about ways to improve learning as well as conditional knowledge about when and where it is appropriate to use such strategies.

By using the experiential learning model, learners can better understand the learning process, themselves as learners and the appropriate use of learning strategies based on the learning task and environment. When individuals engaged in the process of learning by reflective monitoring of the learning process they are going through, they can begin to understand important aspects of learning: how they move through each stage of the learning cycle, the way their unique learning style fits with how they are being taught, and the learning demands of what is being taught. This comparison results in strategies for action that can be applied in their ongoing learning process.

**Develop a learning identity.** A key aspect of meta-cognitive learning is a person's beliefs about themselves, particularly their views about their ability to learn. At the extreme, if a person does not believe that they can learn they won't. Learning requires conscious attention, effort and "time on task". These activities are a waste of time to someone who does not believe that they have the ability to learn. On the other hand there are many successful individuals who attribute their achievements to a learning attitude. Oprah Winfrey for example has said, "I am a woman in process. I'm just trying like everybody else. I try to take every conflict, every experience, and learn from it. Life is never dull."

One's self-identity is deeply held. One is likely to defend against experiences that contradict this identity. For the vast majority of us our self-identity is a mix of fixed and learning beliefs. We may feel that we are good at learning some things like sports and not good at others like mathematics. Every success or failure can trigger a reassessment of one's learning ability. Figure 10 depicts one's self-identity as balancing characteristics that reinforce a fixed self and a learning self. Fixed self characteristics shift the balance to the fixed self. Factors associated with the learning self tip the balance toward becoming a learner.

**Figure 10**




From the above figure we suggest several practical steps for developing a positive meta-cognitive learning identity.

*Trust your experience.* Place experience at the center of your learning process, making it the focal point of your choices and decisions. This does not mean that you shouldn't learn from experts or the experience of others since this advice is also part of your experience. The key is to own your choices and validate them in your experience. When you do this you take charge of your learning and your life.

*Trust the learning process.* Avoid an excessive focus on the outcomes of immediate performance and focus instead on the longer term recursive process of learning by tracking your performance progress over time. Rarely is a single performance test a matter of life and death, and to treat it as such only reinforces a fixed identity. Every performance is an occasion for learning and improvement in future performances.

*Redefine your relationship to failure.* No one likes to fail but failure is an inevitable part of doing something new. Thomas Edison provided a role model for the learning response to failure when he said "Failure is the most important ingredient for success." James Dyson, the inventor of the Dyson vacuum cleaner and founder of Dyson, Inc, sees Edison as a role model saying he, "achieved great success through repeated failure. His 10000 failures pale in comparison to his 1093 US patents. Each one of Edison's inventions, from the Dictaphone to the light bulb came from his inability to give up" (Yang 2008:28).

Failures can also help focus your priorities and life path on your talents and strengths. In her commencement address to the 2008 graduates of Harvard University, J. K. Rowling

described the low period in her life after graduation, which was marked by failure on every front, and talked about its benefits; "…failure meant a stripping away of the inessential. I stopped pretending to myself that I was anything other than what I was, and began to direct my energy into finishing the only work that mattered to me. Had I succeeded at anything else, I might never have found the determination to succeed in the one arena where I believed I truly belonged. I was set free because my greatest fear had been realized and I was still alive, and I still had a daughter whom I adored, and I had an old typewriter and a big idea." (Rowling 2008:56)

*Let go of strong emotional responses in order to learn from failure.* Failures, losses and mistakes provoke inevitable emotional responses. Yet it is important to learn to regulate emotional reactions that block learning and feed into a fixed identity. Golfers who slam their club and curse themselves and the game after a bad shot lose the opportunity to coolly analyze their mistake and plan for corrections on the next hole. An effective way to deal with the emotions that follow judging oneself a failure is to breath calmly and intentionally while accepting the current moment as it is. This enables a clearer mind with which to move forward. *Risk losing.* Joel Waitzkin in *The art of learning* provides a handbook of his meta-cognitive learning based on his process of becoming first a chess master and then a martial arts champion. He emphasizes the importance of losing in order to learn how to win. "If a big strong guy comes into a martial arts studio and someone pushes him, he wants to resist and push the guy back to prove that he is a big strong guy. The problem is that he isn't learning anything by doing this. In order to grow, he needs to give up his current mindset. (Waitzkin 2007: 107).

*Reassess your beliefs about how you learn and what you are good at.* It is important to consciously reflect on and choose how you define yourself as a learner. Often people are unaware of the way in which they characterize themselves and their abilities.

*Monitor the messages you send yourself.* Pay attention to your self-talk. Saying to yourself, "I am stupid." or, "I am no good at …" matters and reinforces a negative fixed identity; just as saying, "I can do this" reinforces a positive learning identity. Beware of internalized oppression. Some of these messages are introjections from others that you have swallowed without careful examination.

*Balance your success/failure accounts.* Most of us remember our failures more vividly than our successes. For example, in our experience as teachers we both tend to focus on the one or two negative remarks in our course ratings and ignore the praise and positive reactions. The danger of this type of focus is adjusting one's teaching style to suit one or two negative comments and risking losing the majority of positive experiences in the room. A deeper danger is that such a focus will negatively shape longer term thoughts and behaviors about oneself (Blackwell, Trzesniewski, & Dweck 2007:259-260). Sometimes it is useful to make an inventory of learning strengths and successes to balance your accounts.

**Learning style.** In addition to believing in ourselves as learners, it is also important to understand how it is that we learn best, our learning style. An understanding of one's unique learning preferences and capabilities, and the match between these and the demands

of learning tasks, can increase learning effectiveness. It can suggest why performance is not optimal and suggest strategies for improvement, as well as help explain why some topics and courses are interesting and others are painful. It can also help explain why some develop a non-learning self-identity. Our most gratifying experiences in teaching individuals about their learning style have been when they come up and say, "My whole life I thought I was stupid because I didn't do well in school. Now I realize that it is just because I learn in a different way than schools teach."

Those who use the KLSI to assess their learning style often decide that they wish to develop their capacity to engage in one or more of the four learning modes, experiencing (CE), reflecting (RO), thinking (AC), and acting (AE). In some cases this is based on a desire to develop a weak mode in their learning style. In others it may be to increase capability in a mode that is particularly important for their learning tasks. Because of the dialectic relationships among the learning modes, containing the inhibiting effects of opposing learning modes can be as effective in getting into a mode as actively trying to express it. Overall learning effectiveness is improved when individuals are highly skilled in engaging all four modes of the learning cycle. One way to develop in the learning modes is to develop the skills associated with them. The Learning Skills Profile (Boyatzis & Kolb, 1991, 1992, 1995) was created to help learners assess the learning skills associated with the four modes of the learning cycle—interpersonal skills for CE, information skills for RO, analytic skills for AC, and action skills for AE.

*Developing the capacity for experiencing*. Experiencing requires fully opening oneself to direct experience. Direct experience exists only in the here and now, a present moment of endless depth and extension that can never be fully comprehended. In fact, the thinking mode, being too much "in your head," can inhibit the ability to directly sense and feel the immediate moment. Engagement in concrete experience can be enhanced by being present in the moment and attending to direct sensations and feelings. This presence and attention are particularly important for interpersonal relationships. Interpersonal skills of leadership, relationship, and giving and receiving help in the development and expression of the experiencing mode of learning.

*Developing the capacity for reflecting*. Reflection requires space and time for it to take place. It can be inhibited by impulsive desires and/or pressures to take action. It can be enhanced by the practices of deliberately viewing things from different perspective and empathy. Stillness and quieting the mind foster deep reflection. Information skills of sense making, information gathering, and information analysis can aid in the development and expression of the reflecting mode of learning.

*Developing the capacity for thinking*. Thinking requires the ability to represent and manipulate ideas in your head. It can be distracted by intense direct emotion and sensations as well as pressure to act quickly. Engagement in thinking can be enhanced by practicing theoretical model building and the creation of scenarios for action. Analytical skills of theory building, quantitative data analysis, and technology

management can aid in the development and expression of the thinking mode of learning.

*Developing the capacity for action.* Acting requires commitment and involvement in the practical world of real consequences. In a sense it is the "bottom line" of the learning cycle, the place where internal experiencing, reflecting, and thinking are tested in reality. Acting can be inhibited by too much internal processing in any of these three modes. Acting can be enhanced by courageous initiative taking and the creation of cycles of goal setting and feedback to monitor performance. Action skills of initiative, goal setting, and action taking can aid in the development and expression of the acting mode of learning.

**Mindful Experiential Learning**

Mindfulness is one special form of meta-cognition that is especially effective for enhancing learning from experience. Mindfulness is an age old set of practices used to overcome the tendency to "sleep walk" automatically through our lives. In recent times these practices have been accepted into mainstream psychology, social psychology, and medicine. Empirical studies are now finding statistical support for what many have known for two millennia: that practicing mindfulness enhances mental and physical health, creativity, and contextual learning.

William James (1890), the originator of the theory of experience on which ELT is based, stated, "no state once gone can recur and be identical with what it was before" (p.155). The mind often neglects the rich context available for observation. Instead it automatically labels stimuli based on limited exposure and moves on to the next stimulus to under-observe. Labeling experiences as fun, boring, sad, happy, urgent, relaxed, and so on are also often based in automatically categorizing experience, rather than being fully present in the unique context of every moment. For James, everything begins and ends in the continuous flux and flow of experience. This emphasis on immediate direct sensual experience is exactly the focus on here and now experience that characterizes mindfulness. James emphasized the importance of attention, as he noted—"My experience is what I agree to attend to." (1890, p. 403). This also is a central element of mindfulness.

The practices of mindfulness are aimed at helping the individual: 1) focus on present and direct experience, 2) be intentionally aware and attentive and accept life as an emergent process of change. Our research on mindfulness and experiential learning (Yeganeh 2006, Yeganeh & Kolb 2009) suggests that the practice of mindfulness can help individuals learn from experience by enhancing presence and intentional attention.

To be present and engaged in direct experience, one must anchor in present-centered awareness by attending to the 5 senses. One of the strongest ways to attend to the present moment is through calm and aware breathing (Good & Yeganeh 2006, Yeganeh, 2006, Yeganeh & Kolb, 2009). Attending to the present moment serves to quiet the mind; reducing automatic, habitual patterns of thinking and responding. Presence enhances Concrete Experience and allows the learning cycle to begin. In a sense, we cannot learn from

experience if we do not first *have* an experience, and often, automatic routines make it difficult for direct experiencing in the moment to occur.

Intentional attention—the process of being aware and choiceful about what we are attending to—is, as James says, the process that creates our experience. Mindfulness becomes important when we consider *how* we choose to process and learn from the events in our lives. By intentionally guiding the learning process and paying attention to how we are going through the phases of the learning cycle, we make ourselves through learning. How and what we learn determines the way we process the possibilities of each new emerging experience, which in turn determines the range of choices and decisions we see. The choices and decisions we make to some extent determine the events we live through, and these events influence our future choices. Thus, we create ourselves through the choices of the actual occasions they live through. For many, this learning style choice is relatively unconscious, an auto-pilot program for learning. Mindfulness can put the control of our learning and our life back in our hands.

**Deliberate Practice—Becoming an Expert Learner**

We all know that learning involves repeated practice. However time spent practicing does not necessarily lead to learning and improved performance. Going to the golf practice range and hitting bucket after bucket of balls doesn't necessarily improve your game and in fact may make it worse by ingraining bad habits. Expert performance research initiated in the early 1990's by K. Anders Ericsson (Ericsson, Krampe & Tesch-Römer 1993; Ericsson & Charness 1994; Ericsson 2006; Baron & Henry 2010) teaches a great deal about learning from practice. The good news from this work is that greatness, for the most part, is not a function of innate talent; it is learned from experience. The not-so-good news is that it involves long term commitment (ten years or 10,000 hours for many top experts) and a particular kind of practice that is hard work, called deliberate practice.

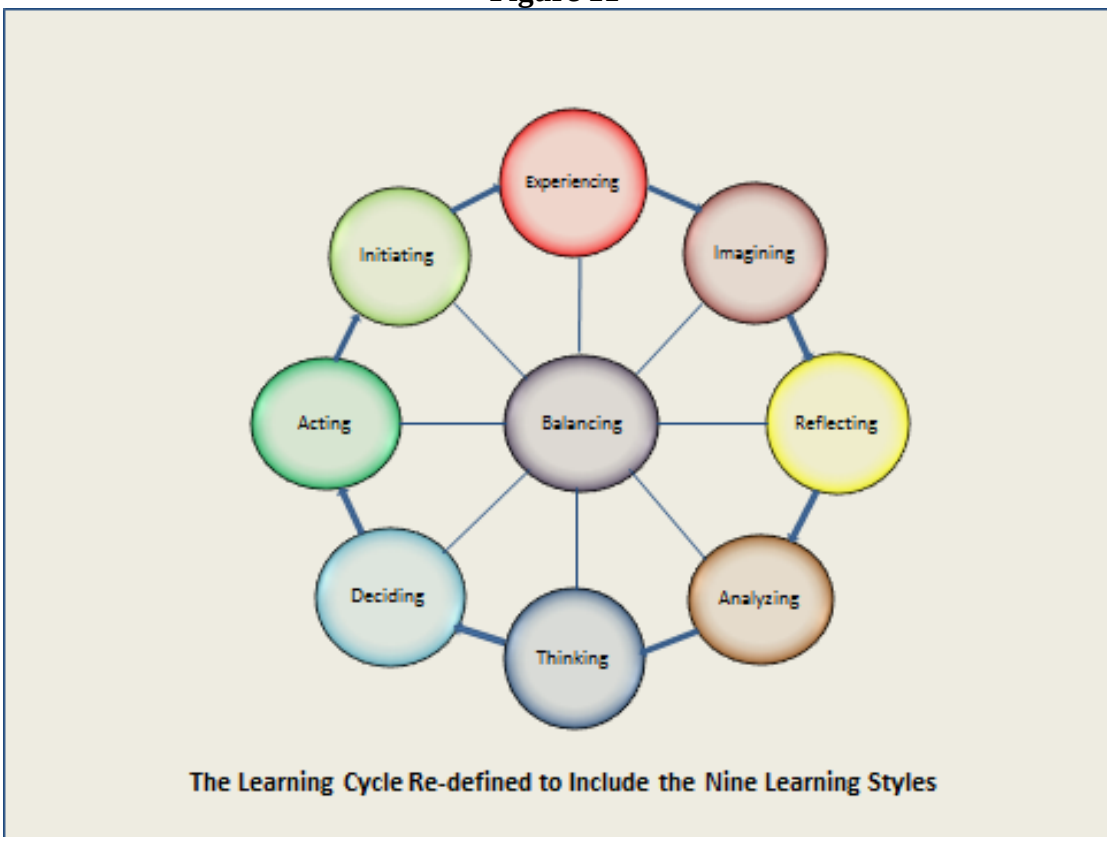
The basic techniques of deliberate practice are useful for improving our ability to learn from experience. Essentially deliberate practice involves intense concentrated, repeated performance that is compared against an ideal or "correct" model of the performance. It requires feedback that compares the actual performance against the ideal to identify "errors" that are corrected in subsequent performance attempts. In this sense deliberate practice can be seen as mindful experiential learning—focused reflection on a concrete performance experience that is analyzed against a meta-cognitive ideal model to improve future action in a recurring cycle of learning. Learning relationships can be of great help in deliberate practice by providing expert models, feedback and support for the focused effort required.

## EDUCATOR ROLES AND TEACHING AROUND THE LEARNING CYCLE

The major implication of ELT for education is to design educational programs in a way that teaches around the learning cycle so that learners can use and develop all learning styles in a way that completes the learning cycle for them and promotes deep learning. Chapter seven includes numerous examples of programs that have been created in this way in many fields of study. Appendix 10 gives sample experiential learning designs that teach to all learning styles and Appendix 11 describes the Personal Application Assignment which was created as a way to holistically assess learning in a way that equally evaluates all learning modes.

In our interviews and observations of experienced, successful educators we find that they tend to "teach around the learning cycle" in this manner. They organize their educational activities in such a manner that they address all four learning modes—experiencing, reflecting, thinking, and acting. As they do this, they lead learners around the cycle; shifting the role they play depending on which stage of the cycle they are addressing. In effect the role they adopt helps to create a learning space designed to facilitate the transition from one learning style to the other as shown in Figure 11. Often they do this in a recursive fashion, repeating the cycle many times in a learning program. In effect the cycle becomes a spiral with each passage through the cycle deepening and extending learners' understanding of the subject.

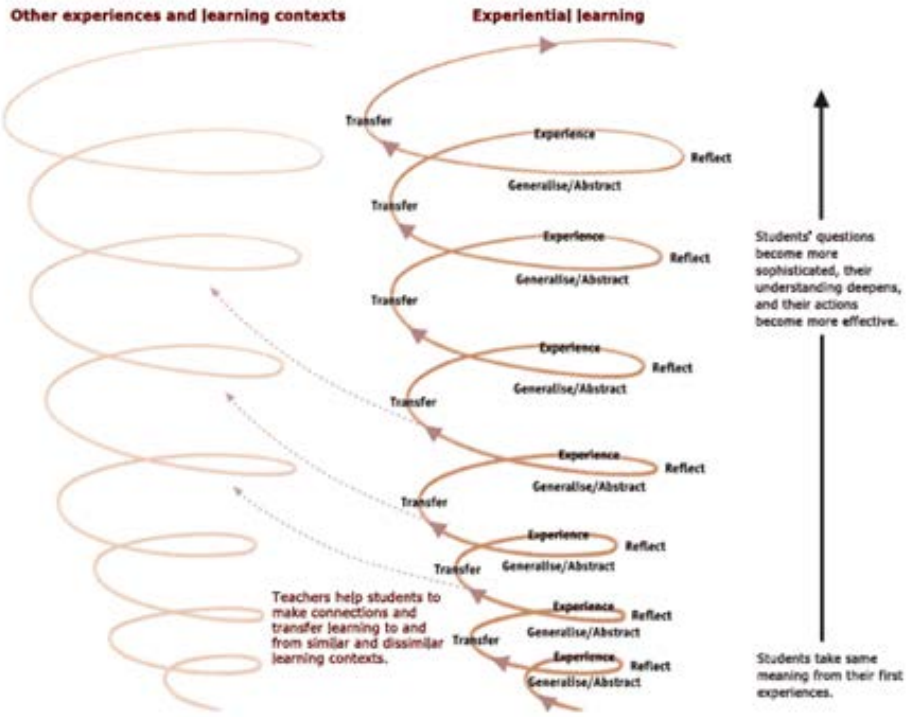
**Figure 11**




The Learning Cycle Re-defined to Include the Nine Learning Styles

When a concrete experience is enriched by reflection, given meaning by thinking and transformed by action the new experience created becomes richer, broader and deeper. Further iterations of the cycle continue the exploration and transfer to experiences in other contexts. The New Zealand Ministry of Education (2004) has used this spiraling learning process as the framework for the design of middle school curricula. Figure 12 describes how teachers use the learning spiral to promote higher level learning and to transfer knowledge to other contexts.

**Figure 12. Teaching and the Learning Spiral**



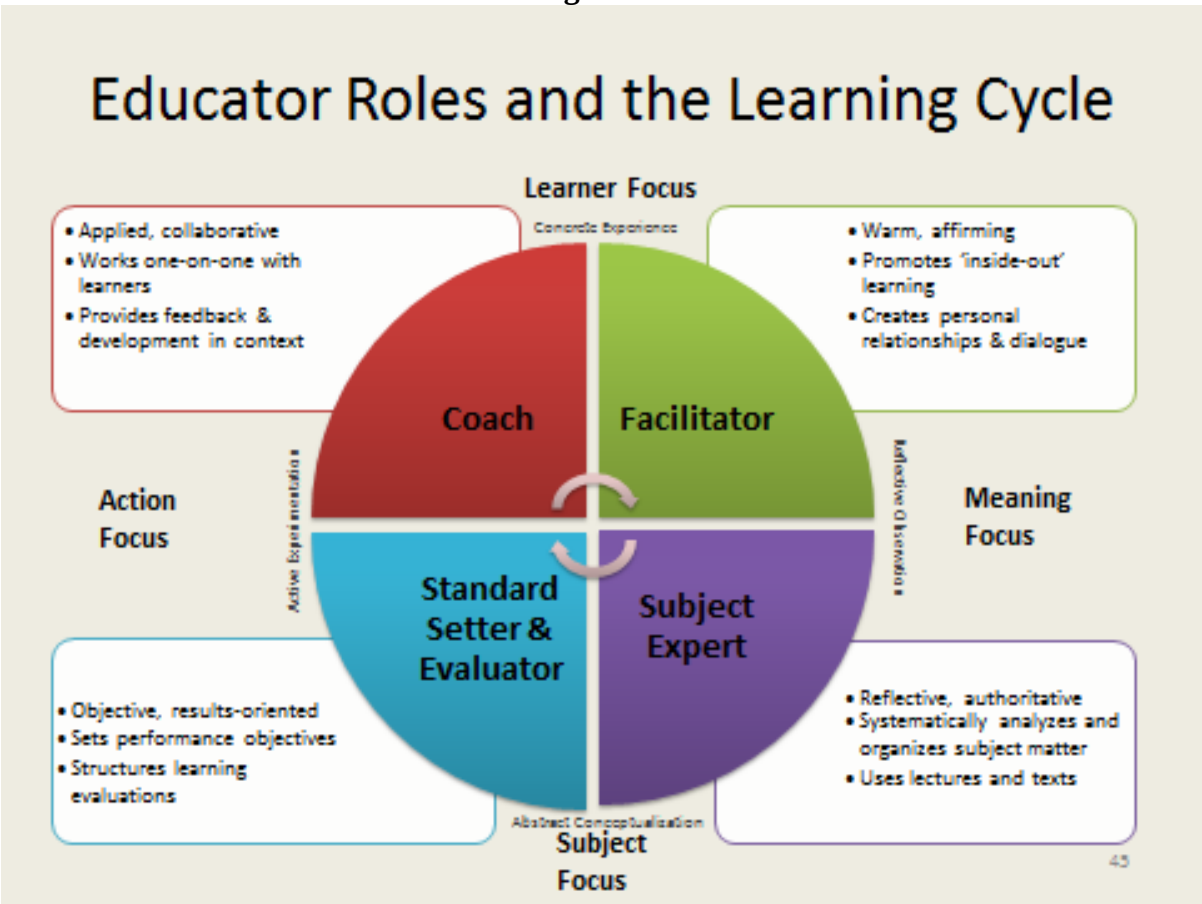

## Educator Roles

Teaching around the learning cycle and to different learning styles introduces the need for adjustments in the role one takes with learners. The Educator Role Profile (Kolb & Kolb, 2011) was created to help educators understand their preferred teaching role and plan for how they can adapt to teaching around the learning cycle. The self-report instrument is based on the assumption that preferences for teaching roles emerge from a combination of beliefs about teaching and learning, goals for the educational process, preferred teaching style, and instructional practices. Educator roles are not limited to individuals in formal classroom teaching situations. The framework can be extended to individuals in all walks of life who "teach" as leaders, coaches, parents, friends, etc.

A teaching role is a patterned set of behaviors that emerge in response to the learning environment, including students and the learning task demands. Each teaching role engages students to learn in a unique manner, using one mode of grasping experience and one mode of transforming experience. In the facilitator role, educators draw on the modes of concrete experience and reflective observation to help learners get in touch with their own experience

and reflect on it. Subject matter experts, using the modes of reflective observation and abstract conceptualization, help learners organize and connect their reflection to the knowledge base of the subject matter. They may provide models or theories for learners to use in subsequent analysis. The standard setting and evaluating role uses abstract conceptualization and active experimentation to help students apply knowledge toward performance goals. In this role, educators closely monitor the quality of student performance toward the standards they set, and provide consistent feedback. Finally, those in the coaching role draw on concrete experience and active experimentation to help learners take action on personally meaningful goals. These roles can also be organized by their relative focus on the student versus the subject and action versus knowledge as illustrated in Figure 13.

**Figure 13**




The Educator Role Profile (ERP) describes four role positions—Facilitator, Expert, Evaluator and Coach. Educators play these roles as they help learners maximize learning by moving through the four stages of the experiential learning cycle.

- **The Facilitator Role.** When facilitating, educators help learners get in touch with their personal experience and reflect on it. They adopt a warm affirming style to draw out learners' interests, intrinsic motivation and self-knowledge. They often do this by

facilitating conversation in small groups. They create personal relationships with learners.

- **The Expert Role.** In their role as subject expert, educators help learners organize and connect their reflections to the knowledge base of the subject matter. They adopt an authoritative, reflective style. They often teach by example, modeling and encouraging critical thinking as they systematically organize and analyze the subject matter knowledge. This knowledge is often communicated through lectures and texts.

- **The Evaluator Role.** As a standard setter and evaluator, educators help learners master the application of knowledge and skill in order to meet performance requirements. They adopt an objective results-oriented style as they set the knowledge requirements needed for quality performance. They create performance activities for learners to evaluate their learning.

- **The Coaching Role** In the coaching role, educators help learners apply knowledge to achieve their goals. They adopt a collaborative, encouraging style, often working one-on-one with individuals to help them learn from experiences in their life context. They assist in the creation of personal development plans and provide ways of getting feedback on performance.

Most of us adopt each of these roles to some extent in our educational and teaching activities. This is in part because these roles are determined by the way we resolve fundamental dilemmas of teaching. Do we focus on the learner's experience and interest or subject matter requirements? Do we focus on effective performance and action or on a deep understanding of the meaning of ideas? All are required for maximally effective learning. Individuals, however, tend to have a definite preference for one or two roles over the others; because of their educational philosophy, their personal teaching style, and the requirements of their particular educational setting including administrative mandates and learner needs. The ERP is designed to help you sharpen your awareness of these preferences and to make deliberate choices about what works best for you in your specific situation.

# 2. THE KOLB LEARNING STYLE INVENTORY

## PURPOSE

The Learning Style inventory (LSI) was created to fulfill two purposes:

**1. To serve as an educational tool to increase individuals' understanding of the process of learning from experience and their unique individual approach to learning.** By increasing awareness of how they learn, the aim is to increase learners' capacity for meta-cognitive control of their learning process; enabling them to monitor and select learning approaches that work best for them in different learning situations. By providing a language for talking about learning styles and the learning process the inventory can foster conversation among learners and educators about how to create the most effective learning environment for those involved. For this purpose the inventory is best presented, not as a test, but as an experience in understanding how you learn. Scores on the inventory should not be interpreted as definitive, but as a starting point for exploration of how one learns best. To facilitate this purpose a self-scoring and interpretation book that explains the experiential learning cycle and the characteristics of the different learning styles along with scoring and profiling instructions is included with the inventory.

**2. To provide a research tool for investigating experiential learning theory (ELT) and the characteristics of individual learning styles.** This research can contribute to the broad advancement of experiential learning and specifically to the validity of interpretations of individual learning style scores. A research version of the instrument including only the inventory to be scored by the researcher is available for this purpose.

**The LSI is not a criterion-referenced test and is not intended for use to predict behavior for purposes of selection, placement, job assignment, or selective treatment.** This includes not using the instrument to assign learners to different educational treatments, a process sometimes referred to as "tracking". Such categorizations based on a single test score amounts to stereotyping that runs counter to the philosophy of experiential learning that emphasizes individual uniqueness. "When it is used in the simple, straightforward, and open way intended, the LSI usually provides a valuable self-examination and discussion that recognizes the uniqueness, complexity and variability in individual approaches to learning. The danger lies in the reification of learning styles into fixed traits, such that learning styles become stereotypes used to pigeonhole individuals and their behavior." (Kolb, 1981: 290-291)

The LSI is constructed as a self-assessment exercise and tool for construct validation of ELT. Tests designed for predictive validity typically begin with a criterion like academic achievement and work backward to identify items or tests with high criterion correlations. Even so, even the most sophisticated of these tests rarely rises

above a .5 correlation with the criterion. For example, while Graduate Record Examination Subject Test scores are better predictors of first-year graduate school grades than either the General Test score or undergraduate GPA, the combination of these three measures only produces multiple correlations with grades ranging from .4 to .6 in various fields (Anastasi & Urbina, 1997).

Construct validation is not focused on an outcome criterion, but on the theory or construct the test measures. Here the emphasis is on the pattern of convergent and discriminant theoretical predictions made by the theory. Failure to confirm predictions calls into question the test and the theory. "However, even if each of the correlations proved to be quite low, their cumulative effect would be to support the validity of the test and the underlying theory." (Selltiz, Jahoda, Deutsch, & Cook, 1960, p. 160) Judged by the standards of construct validity ELT has been widely accepted as a useful framework for learning centered educational innovation, including instructional design, curriculum development, and life-long learning. Field and job classification studies viewed as a whole also show a pattern of results consistent with the ELT structure of knowledge theory.

## HISTORY

There have been six versions of the Learning Style Inventory published over the last 40 years. Through this time attempts have been made to openly share information about the inventory, its scoring, and technical characteristics with other interested researchers. The results of their research have been instrumental in the continuous improvement of the inventory.

### Learning Style Inventory—Version 1 (Kolb 1971, Kolb 1976).

The original Learning Style Inventory (LSI 1) was created in 1969 as part of a MIT curriculum development project that resulted in the first management textbook based on experiential learning (Kolb, Rubin and McIntyre 1971). It was originally developed as an experiential educational exercise designed to help learners understand the process of experiential learning and their unique individual style of learning from experience. The term “learning style” was coined to describe these individual differences in how people learn.

Items for the inventory were selected from a longer list of words and phrases developed for each learning mode by a panel of four behavioral scientists familiar with experiential learning theory. This list was given to a group of 20 graduate students asking them to rate each word or phrase for social desirability. Attempting to select words that were of equal social desirability, a final set of 12 items including a word or phrase for each learning mode was selected for pre-testing. Analysis showed that 3 of these sets produced nearly random responses and were thus eliminated resulting in a final version of the LSI with 9 items. These items were further refined through item-whole correlation analysis to include six scored items for each learning mode.

Research with the inventory was stimulated by classroom discussions with students who found the LSI to be helpful to them in understanding the process of experiential learning and how they learn. From 1971 until it was revised in 1985 there were over 350 published research studies using the LSI. Validity for the LSI 1 was established in a number of fields including education, management, psychology, computer science, medicine, and nursing (Hickcox 1990, Iliff 1994). The results of this research with LSI 1 provided provided empirical support for the most complete and systematic statement of ELT, *Experiential Learning: Experience as the Source of Learning and Development* (Kolb 1984). There were several studies of the LSI 1 that identified psychometric weaknesses of the instrument, particularly low internal consistency reliability and test-retest reliability.

**Learning Style Inventory—Version 2 (Kolb 1985)**

Low reliability coefficients and other concerns about the LSI 1 led to a revision of the inventory in 1985 (LSI 2). Six new items chosen to increase internal reliability (alpha) were added to each scale making 12 scored items on each scale. These changes increased scale alphas to an average of .81 ranging from .73 to .88. Wording of all items was simplified to a $7^{th}$ grade reading level and the format was changed to include sentence stems (e.g. "When I learn"). Correlations between the LSI 1 and LSI 2 scales averaged .91 and ranged from .87 to .93. A new more diverse normative reference group of 1446 men and women was created.

Research with the LSI 2 continued to establish validity for the instrument. From 1985 until the publication of the LSI 3 1999 over 630 studies were published most using the LSI 2. While internal reliability estimates for the LSI 2 remained high in independent studies, test-retest reliability remained low.

**Learning Style Inventory—Version 2a (Kolb 1993).**

In 1991 Veres, Sims and Locklear published a reliability study of a randomized version of the LSI 2 that showed a small decrease in internal reliability but a dramatic increase in test-retest reliability with the random scoring format. To study this format a research version of the random format inventory (LSI 2a) was published in 1993.

**Kolb Learning Style Inventory—Version 3 (Kolb 1999).**

In 1999 the randomized format was adopted in a revised self scoring and interpretation booklet (KLSI 3) that included a color-coded scoring sheet to simplify scoring. The new booklet was organized to follow the learning cycle emphasizing the LSI as an "experience in learning how you learn". New application information on teamwork, managing conflict, personal and professional communication and career choice and development were added. The KLSI 3 continued to use the LSI 2 normative reference group until norms for the randomized version could be created.

**Kolb Learning Style Inventory—Version 3.1 (Kolb 2005)**

The KLSI 3.1 modified the LSI 3 to include a new normative data sample of 6977 LSI users. The format, items, scoring and interpretative booklet remain identical with KLSI 3. The only change in the KLSI 3.1 is in the norm charts used to convert raw LSI scores.

**Kolb Learning Style Inventory—Version 3.2 (Kolb and Kolb 2013)**

The KLSI 3.2 was created in 2013 to incorporate the new nine learning style typology of the KLSI 4.0 in a paper version. The instrument and normative sample are identical to the KLSI 3.1. The self-scoring and Interpretation booklet was changed to explain the nine learning styles and their application to problem solving, relationships, etc..

**Kolb Learning Style Inventory—Version 4.0 (Kolb and Kolb 2011)**

The Kolb Learning Style Inventory 4.0 is the first major revision of the KLSI since 1999 and the third since the original LSI was published in 1971. Based on many years of research involving scholars around the world and data from many thousands of respondents, the KLSI 4.0 includes four major additions:

*A new 9 Learning Style Typology.* Data from empirical and clinical studies over the years has shown that the original 4 learning style types—Accommodating, Assimilating , Converging and Diverging— can be refined further into a 9 style typology that better defines the unique patterns of individual learning styles and reduces the confusions introduced by borderline cases in the old 4 style typology. The new nine styles are Initiating, Experiencing, Imagining, Reflecting, Analyzing, Thinking, Deciding, Acting and Balancing.

*Assessment of Learning Flexibility*. The experiential learning styles are not fixed traits but dynamic states that can "flex" to meet the demands of different learning situations. For the first time the KLSI 4.0 includes a personal assessment of the degree to which a person changes their style in different learning contexts. The flexibility score also shows which learning style types the individual uses in addition to their dominant learning style type. This information can help individuals improve their ability to move freely around the learning cycle and improve their learning effectiveness.

*An Expanded Personal Report Focused on Improving Learning Effectiveness*. The new personal interpretative report has been redesigned to focus on improving personal learning effectiveness based on a detailed profile of how the person prefers to learn and their learning strength and weaknesses. It helps learners take charge of their learningwith a planning guide for learning and tips for application in work and personal life.

*Improved Psychometrics.* This revision includes new norms that are based on a larger, more diverse and representative sample of 10423 LSI users. The KLSI 4.0 maintains the high scale reliability of the KLSI 3.1 while offering higher internal validity.

Score on the KLSI 4.0 are highly correlated with scores on the previous KLSI 3.1 thus maintaining the external validity that the instrument has shown over the years.

## FORMAT

The Learning Style Inventory is designed to measure the degree to which individuals display the different learning styles derived from experiential learning theory. The form of the inventory is determined by three design parameters. First, the test is brief and straightforward, making it useful both for research and for discussing the learning process with individuals and providing feedback. Second, the test is constructed in such a way that individuals respond to it as they would respond to a learning situation: it requires them to resolve the tensions between the abstract-concrete an active-reflective orientations. For this reason, the LSI format requires them to rank order their preferences for the abstract, concrete, active and reflective orientations. Third, and most obviously, it was hoped that the measures of learning styles would predict behavior in a way consistent with the theory of experiential learning.

All previous versions of the LSI have had the same format—a short questionnaire (9 items for LSI 1 and 12 items for subsequent versions) that asks respondents to rank four sentence endings that correspond to the four learning modes – Concrete Experience (e.g., experiencing), Reflective Observation (reflecting), Abstract Conceptualization (thinking), and Active Experimentation (doing). The KLSI 4.0 has 20 items in this format—12 that are similar to the items in the 3.1and 8 additional items that are about learning in different contexts. These 8 items are used to assess learning flexibility. The KLSI 4.0 is only available online due to the complex scoring formula for learning flexibility.

Items in the LSI are geared to a $7^{th}$ grade reading level. The inventory is intended for use by teens and adults. It is not intended for use by younger children. The LSI has been translated into many languages, including, Arabic, Chinese, French, Japanese, Italian, Portuguese, Spanish, Swedish and Thai; and there have been many cross cultural studies using it (Yamazaki 2002).

### The Forced-choice Format of the LSI

The format of the LSI is a forced choice format that ranks an individual's relative choice preferences among the four modes of the learning cycle. This is in contrast the more common normative or free choice format, such as the widely used Likert scale, that rates absolute preferences on independent dimensions. The forced choice format of the LSI was dictated by the theory of experiential learning and by the primary purpose of the instrument.

ELT is a holistic, dynamic and dialectic theory of learning. Because it is holistic the four modes that comprise the experiential learning cycle, CE, RO, AC, and AE are conceived as interdependent. Learning involves resolving the creative tension among these learning modes in response to the specific learning situation. Since the two learning dimensions, AC-CE and AE-RO are related dialectically, the choice of one pole involves not choosing the

opposite pole. Therefore, because ELT postulates that learning in life situations requires the resolution of conflicts among interdependent learning modes; to be ecologically valid the learning style assessment process should require a similar process of conflict resolution in the choice of ones preferred learning approach.

The primary purpose of the LSI is to provide learners with information about their preferred approach to learning. The most relevant information for the learner is about intra-individual differences, his or her relative preference for the four learning modes, not inter-individual comparisons. Ranking relative preferences among the four modes in a forced choice format is the most direct way to provide this information. While individuals who take the inventory sometimes report difficulty in making these ranking choices, they report that the feedback they get from the LSI gives them more insight than has been the case when we use a normative Likert rating scale version. This is because the social desirability response bias in the rating scales fails to define a clear learning style, i.e. they say they prefer all learning modes. This is supported by Harland's (2002) finding that feedback from a forced choice test format was perceived as more accurate, valuable and useful than feedback from a normative version.

The adoption of the forced choice method for the LSI has at times placed it in the center of an ongoing debate in the research literature about the merits of forced choice instruments between what might be called "rigorous statisticians" and "pragmatic empiricists". Statisticians have questioned the use of the forced choice format because of statistical limitations, called ipsativity, that are the result of the ranking procedure. Since ipsative scores represent the relative strength of a variable compared to others in the ranked set the resulting dependence among scores produces method induced negative correlations among variables and violates a fundamental assumption of classical test theory required for use of techniques such as analysis of variance and factor analysis—independence of error variance. Cornwell and Dunlap (1994) stated that ipsative scores cannot be factored and that correlation-based analysis of ipsative data produced uninterpretable and invalid results (c.f. Hicks 1970, Johnson et al. 1988). Other criticisms include the point that ipsative scores are technically ordinal, not the interval scales required for parametric statistical analysis; that they produce lower internal reliability estimates and lower validity coefficients (Barron 1996). While critics of forced choice instruments acknowledge that these criticisms do not take away from the validity of intra-individual comparisons (LSI purpose one), they argue that ipsative scores are not appropriate for inter-individual comparisons since inter-individual comparisons on a ranked variable are not independent absolute preferences but preferences that are relative to the other ranked variables in the set (Barron 1996, Karpatschof and Elkjaer 2000). However, since ELT argues that a given learning mode preference is relative to the other three modes, it is the comparison of relative not absolute preferences that the theory seeks to assess.

The "pragmatic empiricists" argue that in spite of theoretical statistical arguments, normative and forced choice variations of the same instrument can produce empirically comparable results. Karpatschof and Elkjaer (2000) advance this case in their metaphorically titled paper "Yet the Bumblebee Flies". With theory, simulation and empirical data they present evidence for the comparability of ipsative and normative data. Saville and Wilson (1991) found a high correspondence between ipsative and normative scores when forced choice involved a large number of alternative dimensions.

Normative tests also have serious limitations which the forced choice format was originally created to deal with (Sisson 1948). Normative scales are subject to numerous response biases—central tendency bias where respondents avoid extreme responses, acquiescence response, and social desirability responding—and are easy to fake. Forced choice instruments are designed to avoid these biases by forcing choice among alternatives in a way that reflects real live choice making (Hicks 1970, Barron 1996). Matthews and Oddy found large bias in the extremeness of positive and negative responses in normative tests and conclude that when sources of artifact are controlled "individual differences in ipsative scores can be used to rank individuals meaningfully" (1997: 179). Pickworth and Shoeman (2000) found significant response bias in two normative LSI formats developed by Marshall and Merritt (1986) and Geiger et al. (1993). Conversely, Beutell and Kressel (1984) found that social desirability contributed less that 4% of the variance in LSI scores in spite of the fact that individual LSI items all had very high social desirability.

In addition, ipsative tests can provide external validity evidence comparable to normative data (Barron 1996) or in some cases even better (Hicks 1970). For example, attempts to use normative rating versions of the LSI report reliability and internal validity data but little or no external validity (Pickworth and Shoeman 2000, Geiger et al. 1993, Romero et al. 1992, Marshall and Merrit 1986, Merrit and Marshall 1984). Jamieson2010 also found no external validity in her study comparing the LSI 3.1 with semantic differential and Likert scale versions of the instrument. Her results suggest caution in comparing research results from the LSI and these other formats since she found only a 47% match between style classifications with the three instruments and learning mode correlations "only explained 13% to 16% of the variance and the bi-polar dimensions explained 24% to 41% of the variance" between instruments (p 73).

**Characteristics of the LSI Scales.**

The LSI assesses six variables, four primary scores that measure an individual's relative emphasis on the four learning orientations –**Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE) and two combination scores measure an individual's preference for abstractness over concreteness (AC-CE) and action over reflection (AE-RO).** The four primary scales of the LSI are ipsative because of the forced choice format of the instrument. This results in negative correlations among the four scales the mean magnitude of which can be estimated (assuming no underlying correlations among them) by the formula $-1/(m-1)$ where $m$ is the number of variables (Johnson et al. 1988). This results in a predicted average method induced correlation of -.33 among the four primary LSI scales.

The combination scores AC-CE and AE-RO, however, are not ipsative. Forced choice instruments can produce scales which are not ipsative (Hicks 1970, Pathi, Manning and Kolb 1989). To demonstrate the independence of the combination scores and interdependence of the primary scores, Pathi, Manning and Kolb (1989) had SPSS-X randomly fill out and analyze 1000 LSI's according to the ranking instructions. While the

mean inter-correlation among the primary scales was -.33 as predicted; the correlation between AC-CE and AE-RO was +.038.

In addition, if AC-CE and AE-RO were ipsative scales the correlation between the two scales would be -1.0 according to the above formula. Observed empirical relationships are always much smaller, e.g. +.13 for a sample of 1591 graduate students (Freedman and Stumpf 1978), -.09 for the LSI 2 normative sample of 1446 respondents (Kolb 1999b), -.19 for a sample of 1296 MBA students (Boyatzis and Mainemelis 2000) and -.21 for the normative sample of 6977 LSI for the KLSI 3.1 described below.

The independence of the two combination scores can be seen by examining some example scoring results. For example, when AC-CE or AE-RO on a given item takes a value of +2 (from, say, AC = 4 and CE = 2 or AC = 3 and CE = 1) the other score can take a value of +2 or -2. Similarly when either score takes a value of +1 (from 4 -3, 3-2 or 2-1) the other can take the values of +3, +1, -1, or -3. In other words, when AC-CE takes a particular value, AE-RO can take two to four different values, and the score on one dimension does not determine the score on the other.

In the new KLSI 4.0 we introduce two new non-ipsative continuous combination scores in addition to the primary learning cycle dialectics of AC-CE and AE-RO. These scores assess the combination dialectics of Assimilation – Accommodation and Converging – Diverging assessed by the four learning style types in previous LSI versions:

**Assimilation - Accommodation = (AC+RO) - (AE+CE)**

A high score on this dimension indicates a learning preference for assimilation or generalized, conceptual learning, while a low score indicates a learning preference for accommodation or active contextual learning. The concepts of assimilation and accommodation are central to Piaget's (1952) definition of intelligence as the balance of adapting concepts to fit the external world (accommodation) and the process of fitting observations of the external world into existing concepts (assimilation). This measure was used in the validation of the Learning Flexibility Index (Sharma & Kolb 2010—see chapter 6) and has been used by other researchers in previous studies (Wiersta, and de Jong 2002, Allison and Hayes 1996).

**Converging – Diverging = (AC+AE) – (CE+RO)**

A high score on this dimension indicates a learning preference for converging or evaluative decision making that closes down on the best solution to a problem versus diverging to open up new imaginative possibilities and alternatives. The concepts of converging and diverging originated in Guilford's (1988) structure of intellect model as the central dialectic of the creative process. This dialectic concept has been used in research on ELT by Gemmell (2012) and Kolb (1983).

## Continuous Balance Scores

Some studies have used continuous balance scores for ACCE and AERO to assess balanced learning style scores (Mainemelis, Boyatzis and Kolb 2002, Sharma and Kolb 2010). These variables compute the absolute values of the ACCE and AERO scores adjusted to center on the $50^{th}$ percentile of the normative comparison group, in this case the KLSI 4.0.

**BALANCE ACCE = ABS [AC – (CE + 9)]**

**BALANCE AERO = ABS [AE – (RO + 6)]**

## 3. NORMS FOR THE KLSI VERSION 4.0

New norms for the KLSI 4.0 were created from responses by several groups of users who completed the instrument online. These norms are used to convert LSI raw scale scores to percentile scores (See Appendix 1). The purpose of percentile conversions is to achieve scale comparability among an individual's LSI scores (Barron 1996) and to define cut-points for defining the learning style types. Table 1 shows the means and standard deviations for KLSI scale scores for the normative groups.

**Table 2. KLSI 4.0 Scores for Normative Sample and Sub-samples**

| | N | CE | RO | AC | AE | AC-CE | AE-RO |
|---|---|---|---|---|---|---|---|
| **TOTAL NORM GROUP** | 10423 | 19.84<br>*6.47* | 26.22<br>*7.02* | 28.99<br>*6.66* | 31.84<br>*5.93* | 9.16<br>*10.86* | 5.62<br>*10.92* |
| **Medical students** | 670 | 18.70<br>*5.82* | 26.29<br>*6.88* | 30.31<br>*6.76* | 32.49<br>*5.73* | 11.62<br>*10.10* | 6.19<br>*10.45* |
| **Nursing students** | 38 | 20.89<br>*6.60* | 28.08<br>*8.15* | 26.34<br>*7.48* | 31.76<br>*6.86* | 5.45<br>*12.00* | 3.68<br>*13.18* |
| **Law students** | 166 | 19.14<br>*5.63* | 27.17<br>*6.35* | 29.32<br>*6.75* | 31.89<br>*5.60* | 10.19<br>*10.43* | 4.72<br>*9.90* |
| **University Undergrad** | 500 | 22.70<br>*6.86* | 26.73<br>*7.14* | 25.63<br>*6.37* | 32.74<br>*5.66* | 2.92<br>*11.01* | 6.01<br>*10.78* |
| **University Graduate** | 1478 | 20.11<br>*6.35* | 26.76<br>*7.04* | 28.89<br>*6.49* | 31.29<br>*5.97* | 8.78<br>*10.68* | 4.54<br>*11.12* |
| **Adult HE E-learning** | 663 | 19.72<br>*6.12* | 25.03<br>*6.60* | 30.19<br>*6..02* | 31.08<br>*5.52* | 10.48<br>*10.21* | 6.05<br>*10.29* |
| **Managers** | 1724 | 19.51<br>*6.40* | 25.71<br>*7.16* | 29.40<br>*6.57* | 31.75<br>*5.99* | 9.90<br>*10.68* | 6.04<br>*11.22* |

### TOTAL NORMATIVE GROUP

Normative percentile scores for the LSI 4.0 are based on a total sample of 10423 valid LSI scores from users who took the instrument online. The norm group is composed of 53% women and 47% men. Their ages range as follows--<19 = 1.3%, 19-24 = 19.9%, 25-34 = 29.6%, 35-44 = 26.5%, 45-54 = 17.9%, 55-64 = 5.3 %, >64 = .5%. Their educational level is as follows—primary school graduate = 2.3%, secondary school degree= 16.8%, university

degree= 49.9%, master's degree = 20.5% and doctoral degree = 10.5%. The sample includes college students and working adults in a wide variety of fields. It is made up primarily of US residents (65%) with the remaining users residing in 121different countries.

Seven more homogenous sub-groups that were selected from the norm group are described below:

**Medical students.** This sample includes 670 medical students and residents from several US medical schools. 51.5% of the sample are men and 48.5% are women.

**Nursing students.** This sample is composed of 38 entering freshmen at a top research university. 7.9% are men and 92.1% are women. All are between the ages of 25 and 55.

**Law students.** This group consists of 166 law students from an eastern US law school. Half are men and half are women. Ages range from 25-60.

**University undergraduates.** This sample is composed of 500 undergraduate students from several US colleges and universities. 73.6% are women and 26.4% are men. 84% are below age 25.

**University graduate students.** This group includes 1478 graduate students in business, education, psychology, nursing, engineering and other fields. They are 59% female and 41% male. 80% are between the ages of 25 & 54.

**Adult higher education e-learning students.** This sample is composed of 663 adult learners enrolled in e-learning programs at a large eastern US university. 37% were women and 63% men. 92% are between the ages of 25 & 54.

**Managers.** This is a diverse group of 1724 managers from many organizations in the US and around the world. 45.6% are female and 54.4% are male. 85% are between the ages of 25 and 54.

## CUT-POINTS FOR LEARNING STYLE TYPES

Recent theoretical and empirical work is showing that the original four learning styles can be refined to show nine distinct styles (Eickmann, Kolb & Kolb 2004, Kolb & Kolb 2005a, Boyatzis & Mainemelis 2000). David Hunt and his associates (Abby, Hunt and Weiser 1985, Hunt 1987) identified four additional learning styles which they identified as Northerner, Easterner, Southerner, and Westerner. In addition a Balancing learning style has been identified by Mainemelis, Boyatzis and Kolb (2002) that integrates AC and CE and AE and RO. These nine learning styles can be defined by placing them on the Learning Style Type Grid (See Figure 4, p 13). Instead of dividing the grid at the 50$^{th}$ percentiles of the 3.1 LSI normative distributions for AC-CE and AE-RO, the nine styles are defined by dividing the two normative distributions into thirds. On the AE-RO dimension the active regions are defined by percentiles greater than

66.67% (raw scores > 11) while the reflective regions are defined by percentiles less than 33.33% (< +1). On the AC-CE dimension the concrete regions are defined by < 6 and the abstract regions by > 14. For example the Initiating region would be defined by AC-CE raw scores < 6 and AE-RO scores > 11. The resulting 9 styles are thus defined as follows:

**Initiating—ACCE <6, AERO >11**
**Experiencing—ACCE <6, AERO > 0 & < 12**
**Imagining—ACCE <6, AERO <1**
**Reflecting—ACCE > 5 & < 15, AERO <1**
**Analyzing—ACCE >14, AERO <1**
**Thinking—ACCE >14, AERO > 0 & < 12**
**Deciding—ACCE >14, AERO >11**
**Acting—ACCE > 5 & < 15, AERO >11**
**Balancing—ACCE > 5 & < 15, AERO > 0 & < 12**

## 4. RELIABILITY OF THE KLSI 4.0

This section reports internal consistency reliability studies using Cronbach's alpha and test-retest reliability studies for the randomized KLSI 3.1.

### INTERNAL CONSISTENCY RELIABILITY

The KLSI 4.0 maintains the high scale reliability of the KLSI 3.1 with an average scale reliability (Cronbach Alpha) = .81 (4.0) vs .80 (3.1). Table 3 shows the alpha coefficients for the normative grop and sub-groups.

**Table 3. Internal Consistency Alphas for the Scale Scores of the KLSI 4.0**

| | N | CE | RO | AC | AE |
|---|---|---|---|---|---|
| **TOTAL NORM GROUP** | 10423 | .83 | .83 | *.83* | .76 |
| **Medical students** | 670 | .82 | .83 | .85 | .77 |
| **Nursing students** | 38 | .84 | .88 | .88 | .86 |
| **Law students** | 166 | .79 | .78 | .84 | .73 |
| **University Undergrad** | 500 | .82 | .83 | .80 | .73 |
| **University Graduate** | 1478 | .83 | .83 | .81 | .76 |
| **Adult HE E-learning** | 663 | .84 | .80 | .78 | .72 |
| **Managers** | 1724 | .84 | .84 | .82 | .78 |

### TEST-RETEST RELIABILITY

There have been no studies to date of test-retest reliability of the KLSI 4.0. Two test-retest reliability studies of the randomized format KLSI 3.1 have been published. Veres et al. (1991) administered the LSI three times at 8 week intervals to initial (N = 711) and

replication (N =1042) groups of business employees and students and found test-retest correlations well above .9 in all cases. Kappa coefficients indicated that very few students changed their learning style type from administration to administration (See Table 4). Ruble and Stout (1991) administered the LSI twice to 253 undergraduate and graduate business students and found test-retest reliabilities that averaged .54 for the six LSI scales. A Kappa coefficient of .36 indicated that 47% of students changed their learning style classification on re-test. In these studies test-retest correlation coefficients range from moderate to excellent.

**Table 4. Test-Retest Reliability for the KLSI 3.1 (Veres *et.al* 1991)**

| | LSI Scales | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Concrete | | | Reflective | | | Abstract | | | Active | | |
| Time | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| | | | | | Initial Samples (N=711) | | | | | | | |
| 1 | - | .95 | .92 | - | .96 | .93 | - | .97 | .94 | - | .95 | .91 |
| 2 | | - | .96 | | - | .97 | | - | .97 | | - | .96 |
| 3- | | | | | | | | | | | | |
| | | | | | Replication Sample (N=1042) | | | | | | | |
| 1 | - | .98 | .97 | - | .98 | .97 | - | .99 | .97 | - | .98 | .96 |
| 2 | | - | .99 | | - | .98 | | - | .99 | | - | .99 |
| 3 | | | | | | | | | | | | |

Data source: Veres et al. (1991). Reproduced with permission. Time between tests was 8 weeks
Note: Kappa coefficients for the initial sample were .81 for Time 1-Time2, .71 for time 1-Time 3 and .86 for Time 2-Time 3. These results indicate that very few subjects changed their learning style classification from one administration to another.

**Table 5. Test-retest Reliability for KLSI 3.1 (Ruble and Stout 1991)**

| Sample | N | CE | RO | AC | AE | AC-CE | AE-RO |
|---|---|---|---|---|---|---|---|
| UG&Grad business majors | 253 | .37 | .59 | .61 | .58 | .48 | .60 |

LSI was randomized but in different order than KLSI 3.1. Time between tests was 5 weeks. Kappa coefficient was .36 placing 53% of respondents in the same category on retest.

The discrepancy between the studies is difficult to explain and there has been a long-standing debate about the meaningfulness of test-retest reliability for the LSI since ELT hypothesizes that learning style is situational, varying in response to environmental demands. Changes in style may be the result of discontinuous intervening experiences between test and retest (Kolb 1981) or individuals' ability to adapt their style to changing environmental demands (Mainemelis, Boyatzis and Kolb 2002, Jones, Reichard, and Mokhtari 2003).

# 5. VALIDITY OF THE KLSI 4.0

This chapter reports studies on the validity of the KLSI 4.0. It begins with analysis of the relationship between scores on the KLSI 4.0 and the previous KLSI 3.1 followed by other internal validity evidence for the KLSI 4.0 normative group including correlation and factor analysis studies of the LSI scales. The final part is focused on external validity evidence for the KLSI 4.0 and other LSI versions. It begins with demographic relationships of learning style with age, gender and educational level in the KLSI 4.0. This is followed by evidence for the relationship between learning style and educational specialization. Concurrent validity studies of relationships between learning style and other experiential learning assessment inventories are then presented followed by studies relating learning style to performance on aptitude tests and academic performance. Finally research on ELT and learning style in teams is presented.

## INTERNAL VALIDITY EVIDENCE

### Correlation of KLSI 4.0 with KLSI 3.1

Table 6 shows that scores on the KLSI 4.0 are highly correlated with scores on the previous KLSI 3.1 thusmaking validity research with previous LSI versions applicable to the KLSI 4.0 maintaining the external validity that the instrument has shown over the years. The average correlation between 3.1 and 4.0 scales equals .92.

**Table 6.**

**CORRELATIONS BETWEEN KLSI 4.0 AND KLSI 3.1 SCALES**

| | | CE4 | RO4 | AC4 | AE4 | ACCE4 | AERO4 |
|---|---|---|---|---|---|---|---|
| KLSI 3.1 Concrete Experience | Pearson Correlation | .786** | -.454** | -.464** | .067** | -.753** | .329** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| KLSI 3.1 Reflective Observation | Pearson Correlation | -.230** | .965** | -.166** | -.476** | .034** | -.879** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| KLSI 3.1 Abstract Conceptualization | Pearson Correlation | -.372** | -.179** | .990** | -.431** | .829** | -.118** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| KLSI 3.1 Active Experimentation | Pearson Correlation | -.126** | -.432** | -.428** | .938** | -.187** | .787** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| KLSI 3.1 AC-CE | Pearson Correlation | -.663** | .144** | .857** | -.297** | .920** | -.254** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| KLSI 3.1 AE-RO | Pearson Correlation | .072** | -.825** | -.131** | .801** | -.123** | .965** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |

**Correlation Studies of the LSI Scales.**

Several predictions can be made from ELT about the relationship among the scales of the Learning Style Inventory. These relationships have been empirically examined in two ways—through a first order correlation matrix of the six LSI scales and through factor analysis of the four primary LSI scales and/or inventory items.

ELT proposes that the four primary modes of the learning cycle—CE, RO, AC & AE--are composed of two independent dialectic (bi-polar) dimensions--a "grasping" dimension measured by the combination score AC-CE and a "transformation" dimension measured by the AE-RO combination score. Thus, the prediction is that AC-CE and AE-RO should be uncorrelated. Also, the CE and AC scales should not correlate with AE-RO and the AE and RO scales should not correlate with AC-CE. In addition the dialectic poles of both combination dimensions should be negatively correlated, though not perfectly since the dialectic relationship predicts the possibility of developmental integration of the opposite poles. Finally, the cross dimensional scales—CE/RO, AC/AE, CE/AE & AC/RO--should not be correlated as highly as the within dimension scales.

Table 7 shows these critical scale inter-correlations for the total normative sample of 10423. The correlations between AC-CE and AE-RO are significant but low. The 4.0 increases internal validity by increasing the statistical independence of the grasping (AC-CE) and transforming (AE-RO) dimensions of the learning cycle. Independence of AC-CE & AE-RO dimensions has increased reducing the negative correlation from -.27 in the 3.1 to -.09 in the 4.0 RO is unrelated with AC-CE as ELT predicts, but correlations of AE with AC-CE is correlated negatively with AC-CE (-.169). Correlations of AC and CE with AE-RO are both very low as they should be. As predicted both AC & CE (-.369) and AE & RO (-.418) are highly negatively correlated. The cross dimensional scales, CE/AE, CE/RO and AC/RO have low correlations as predicted, but AC/AE has a higher negative correlation (-.407) than predicted. Overall, with the exception of the negative correlation between AC and AE, the scale inter-correlations demonstrate internal validity by showing excellent correspondence with ELT predictions.

**Table 7**

**INTER-CORRELATION OF KLSI 4 SCALES**

| | | CE4 | RO4 | AC4 | AE4 | ACCE4 | AERO4 |
|---|---|---|---|---|---|---|---|
| CE4 | Pearson Correlation | 1 | | | | | |
| | Sig. (2-tailed) | | | | | | |
| | N | 10423 | | | | | |
| RO4 | Pearson Correlation | -.225** | 1 | | | | |
| | Sig. (2-tailed) | .000 | | | | | |
| | N | 10423 | 10423 | | | | |
| AC4 | Pearson Correlation | -.369** | -.210** | 1 | | | |
| | Sig. (2-tailed) | .000 | .000 | | | | |
| | N | 10423 | 10423 | 10423 | | | |
| AE4 | Pearson Correlation | -.137** | -.418** | -.407** | 1 | | |
| | (2-tailed) | .000 | .000 | .000 | | | |
| | N | 10423 | 10423 | 10423 | 10423 | | |
| ACCE4 | Pearson Correlation | -.822** | .006 | .833** | -.169** | 1 | |
| | Sig. (2-tailed) | .000 | .566 | .000 | .000 | | |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | |
| AERO4 | Pearson Correlation | .071** | -.870** | -.086** | .812** | -.095** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |

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

## Factor Analysis Studies.

We have identified 17 published studies that used factor analysis to study the internal structure of the LSI. Most of these studies have focused on the LSI 2, have studied different kinds of samples and have used a number of different factor extraction and rotation methods and criteria for the interpretation of results. Seven of these studies supported the predicted internal structure of the LSI (Merritt & Marshall 1984, Marshall & Merritt 1985, Marshall & Merritt1986, Katz 1986, Brew 1996, Yaha 1998, and Kayes 2005), four studies found mixed support (Loo 1996 & 1999, Willcoxson & Prosser 1996 and Brew 2002), and six studies found no support (Manfredo 1989, Newstead 1992, Cornwell, Manfredo & Dunlop 1991, Geiger, Boyle & Pinto 1992, Ruble & Stout 1990 and Wierstra & de Jong 2002).

Factor analysis of the KLSI 4.0 total normative sample and sub-groups follows recommendations by Yaha (1998). Principal components analysis with varimax rotation was used to extract 2 factors using the 4 primary LSI scales. Analysis at the item level was not done since it is not the item scores, but the scale scores that are proposed as operational

measures of the ELT learning mode constructs. Also, the -.33 correlation among the four items in a set (resulting from the ipsative forced choice format) makes the interpretation of item factor loadings difficult. Loo argues that the analysis by scale scores alleviates this problem. "It should be noted that factoring scale scores (i.e. Yaha 1998) rather than item scores bypasses the issue of ipsative measures when testing for the two bi-polar dimensions (1999: 216).

ELT would predict that this factor analysis procedure would produce two bipolar factors, one with AC & CE as poles and the other with AE and RO as poles, representing the grasping and transforming dimensions of the learning cycle (See Figure 2). This is the result for the total norm group, adult e-learning, managers, university undergraduates and graduates. However, the medical, nursing and law student groups show a more mixed result with the AC scale as one pole and a combination of CE and AE as the other in factor one. Medicine and nursing show a clear AE-RO factor 2, while factor 2 in the law group has RO as the dominant pole with AE only slightly higher than CE and AC. The percent of variance explained by the two factors was about the same in all eight analyses with the total being between 70 & 75%, factor one 36-41% and factor two 29-35%.

**Table 8. Norm Group Factor Analysis of KLSI 4.0 Scales**

| Sample | Factor | CE | RO | AC | AE |
|---|---|---|---|---|---|
| TOTAL | 1 | -.011 | .855 | .062 | -.826 |
| NORM | 2 | .674 | .151 | -.928 | .254 |
| Medical | 1 | .343 | .310 | -.982 | .446 |
| students | 2 | -.009 | .868 | -.033 | -.780 |
| Nursing | 1 | .669 | .062 | -.961 | .429 |
| students | 2 | .225 | -.966 | .042 | .723 |
| Law | 1 | .572 | -.079 | -.942 | .684 |
| students | 2 | -.199 | .982 | -.250 | -.389 |
| University | 1 | .668 | .158 | -.937 | .278 |
| undergrad | 2 | -.057 | .879 | .012 | -.794 |
| University | 1 | .015 | .844 | .090 | -.859 |
| graduate | 2 | .737 | .105 | -.901 | .191 |
| Adult | 1 | .710 | .125 | -.923 | .267 |
| e-learning | 2 | -.061 | .883 | .034 | -.804 |
| Managers | 1 | -.004 | .863 | .083 | -.836 |
| | 2 | .668 | .145 | -.925 | .269 |

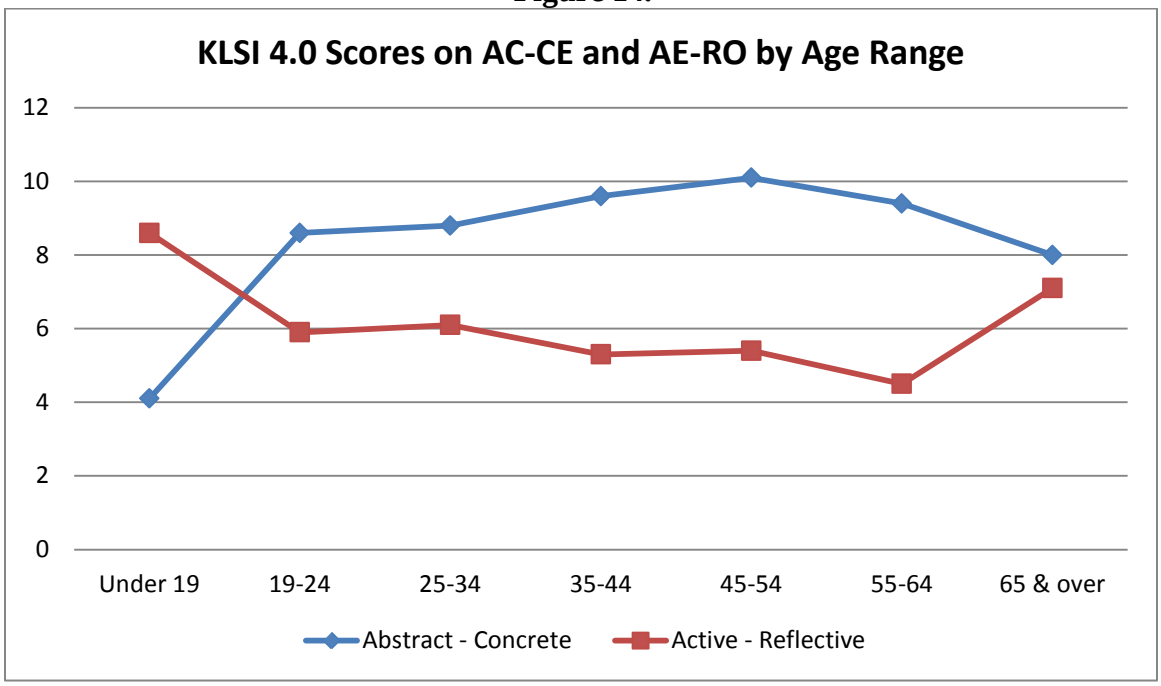
Overall the results of correlation and factor analysis studies show similar results. As Loo notes, "…with only four scale scores, factoring may be unnecessary because the factor pattern structure can be accurately estimated from an inspection of the correlation pattern among the four scales" (1999: 216). These data are better than previous versions of the LSI (Kolb 1976b, 1985b) and give support for the ELT basis for the inventories.

## EXTERNAL VALIDITY EVIDENCE

### Age

Previous research with the LSI showed a linear increase in preference for learning by abstraction with age as measured by the AC-CE scale and a curvilinear relationship with learning by action as measured by AE-RO with middle age being the most active period of life (Kolb 1976b, Kolb & Kolb 2005b). Results from the KLSI 4.0 normative sample with much larger age cohort sample sizes than the LSI 1 norm group show a similar linear relationship between AC-CE and seven age ranges--<19, 19-24, 25-34, 35-44, 45-54, 55-64 & >65. The AE-RO dimension shows a different pattern than previously with a decrease in active orientation from the under 19 group to the 19-24 group (Similar to the increase in reflection seen in college students over their four years (Mentkowski , M. and Associates 2000). AE-RO scores hold relatively constant through the adult years with a movement toward action in the >65 group. See Figure 14 and Appendix 2 for complete descriptive statistics.

**Figure 14.**



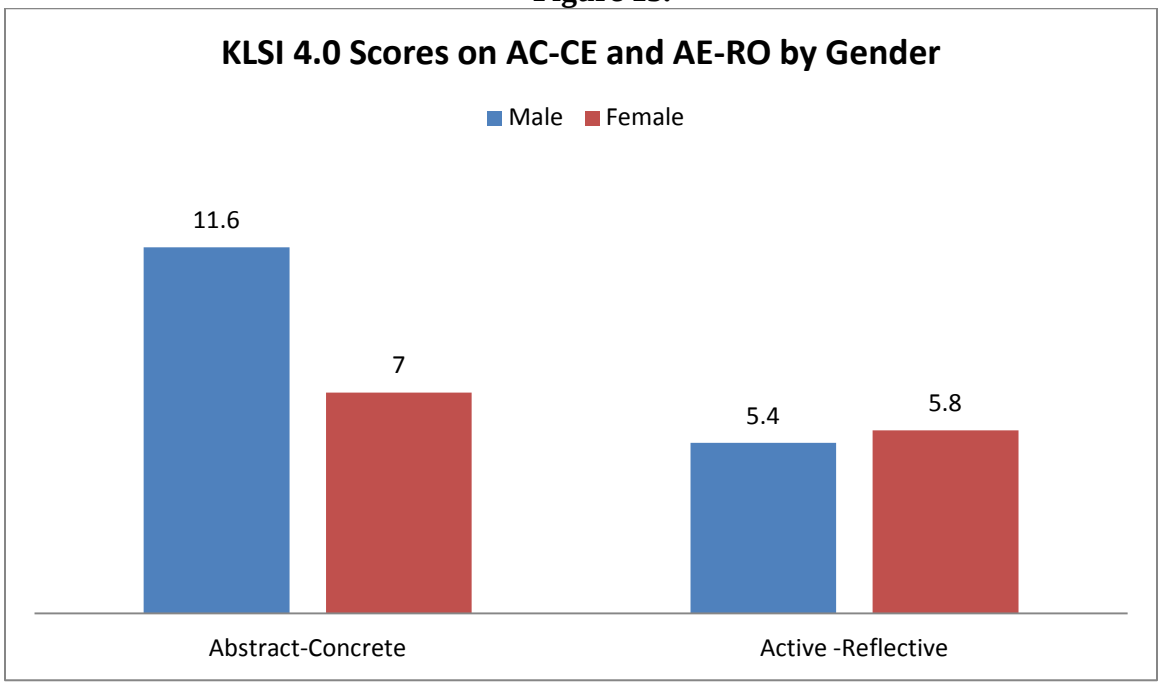

### Gender

Research with the previous LSI versions showed that males were more abstract that females on the AC-CE scale and no significant gender differences on the AE-RO dimension (Kolb 1976b, 1985b, Kolb & Kolb 2005b). Results from the KLSI 4.0 normative sample show similar results. See Figure 4 and Appendix 3 for complete descriptive statistics. These results need to be interpreted carefully since educational specialization and career choices often interact with gender differences making it difficult to sort out how much variance in LSI scores can be attributed to gender alone and how much is a function of one's educational background and career (Willcoxson and Prosser

1996). Also, statements like "Women are concrete and men are abstract" are unwarranted stereotypical generalizations since mean differences are statistically significant but there is considerable overlap between male and female distributions on AC-CE and AE-RO.

These consistent differences by gender on the LSI AC-CE scale provide a theoretical link between ELT and the classic work by Belenky et al., *Womens Ways of Knowing* (1986). They used gender as a marker to identify two different epistemological orientations, connected knowing and separate knowing which their research suggested characterized women and men respectively. Connected knowing is empathetic and interpersonal and theoretically related to CE and separate knowing emphasizes distance from others and relies on challenge and doubt, related to AC. Knight et al. (1997) tested this hypothesized relationship by developing a Knowing Styles Inventory and correlating separate and connected learning with the AC and CE scales of the LSI. They found no relationship between AC and their measure of separate knowing for men or women and no relationship between CE and connected knowing for women. However, they did find a significant correlation between CE and connected knowing for men.

**Figure 15.**

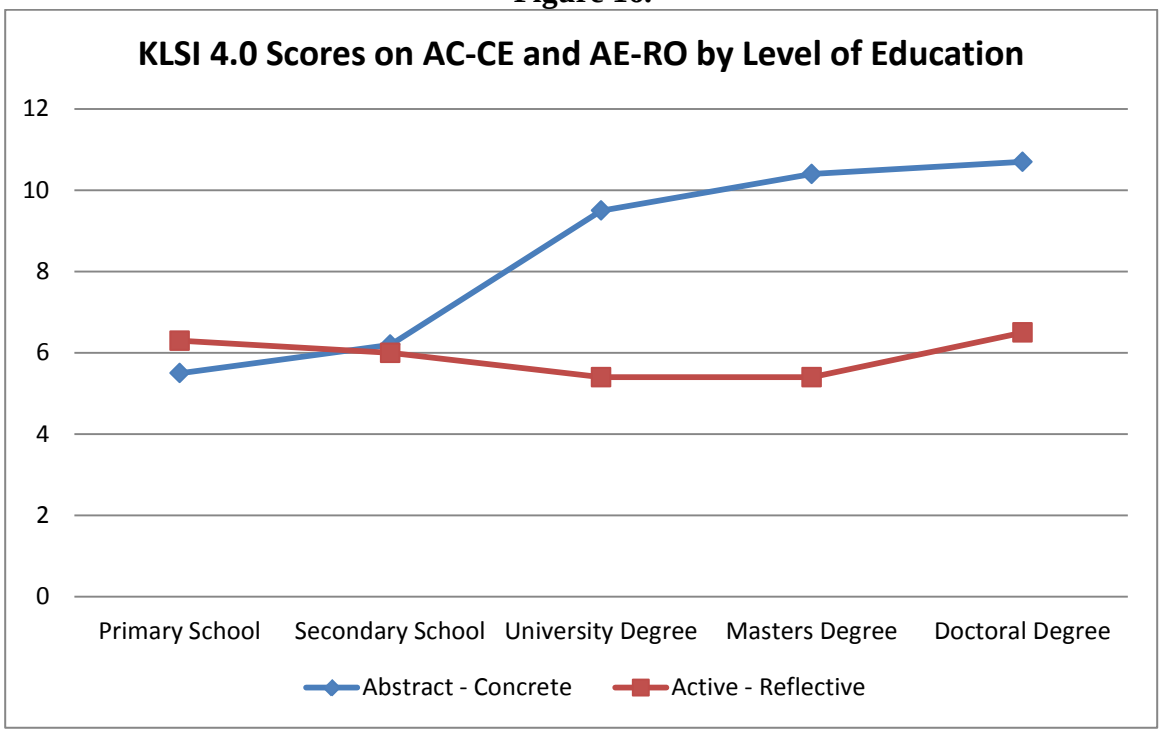



## Educational Level

ELT defines two forms of knowledge. *Social knowledge* is based on abstract knowledge that is culturally codified in language, symbols and artifacts. An individual's personal knowledge is based on direct uncodified concrete experience plus the level of acquired social knowledge that he or she has acquired. Hence, the theory predicts that

abstractness in learning style is related to an individual's level of participation in formal education. Research relating educational level to learning style in the LSI 1 normative sample (Kolb 1976b) showed the predicted linear relationship between amount of education and abstractness. Data from the KLSI 4.0 normative sample show the same linear relationship between abstractness and highest degree obtained—from Elementary to High School to University to Graduate degrees. Differences among degree groups on the AE-RO dimension are smaller indicating relatively little influence of educational level on orientation toward action or reflection. See Figure 16 and Appendix 4 for complete descriptive statistics.

**Figure 16.**




## Educational Specialization

A corollary of the ELT definition of learning as the creation of knowledge through the transformation of experience is that different learning styles are related to different forms of knowledge. Academic disciplines differ in their knowledge structure, technologies and products, criteria for academic excellence and productivity, teaching methods, research methods, and methods for recording and portraying knowledge. Disciplines even show socio-cultural variation- differences in faculty and student demographics, personality and aptitudes, as well as differences in values and group norms. For students, education in an academic field is a continuing process of selection and socialization to the pivotal norms of the field governing criteria for truth and how it is to be achieved, communicated, and used. The resulting educational system emphasizes specialized learning and development through the accentuation of the student's skills and interests. The student's developmental process is a product of the interaction between his or her choices and socialization experiences in

academic disciplines. That is, the student's dispositions lead to the choice of educational experiences that match those dispositions. And the resulting experiences further reinforce the same choice dispositions for later experiences. Over time the socialization and specialization pressures combine to produce increasingly impermeable and homogeneous disciplinary culture and correspondingly specialized student orientations to learning.

ELT (Kolb 1981b, 1984) provides a typology of specialized fields of study, learning styles, and forms of knowledge and based on Pepper's (1942) "world hypotheses" framework. Social professions such as education and social work are typified by the accommodating learning style, a way of knowing that is based on contextualism. The science based professions such as medicine and engineering are characterized by the converging learning style which is based on formism. The humanities and social sciences are typified by the diverging learning style and are based on the world hypothesis of organicism. Mathematics and the natural sciences are characterized by the assimilating learning style and the world hypothesis of mechanism.

Overall, previous research with the LSI shows that student learning style distributions differ significantly by academic fields as predicted by ELT. For example Willcoxson and Prosser in their review of research on learning style and educational specialization using the LSI 1 conclude that there is "some measure of agreement amongst researchers regarding the learning style preferences typically found in specified disciplines and more agreement if disciplines are subsumed under descriptions such as social sciences or humanities. It also appears as specified by experiential learning theory that learning styles may be influenced by environmental demands and thus results obtained for professionals and students in a specified discipline may be dissimilar…in all studies the reporting of a numerical majority as the predominant learning style obscures the range of styles found." (1996: 249)

Their last point is important since ELT does not predict that a match between an individual's learning style and the general knowledge structure of their chosen field is necessary for effectiveness; since learning is essential in all fields and therefore, all learning perspectives are valuable. For example, a person in marketing with an assimilating style of learning doesn't match the typical accommodating style of marketing but, because of his or her assimilating style may be more effective in communicating with research and development scientists (Kolb 1976).

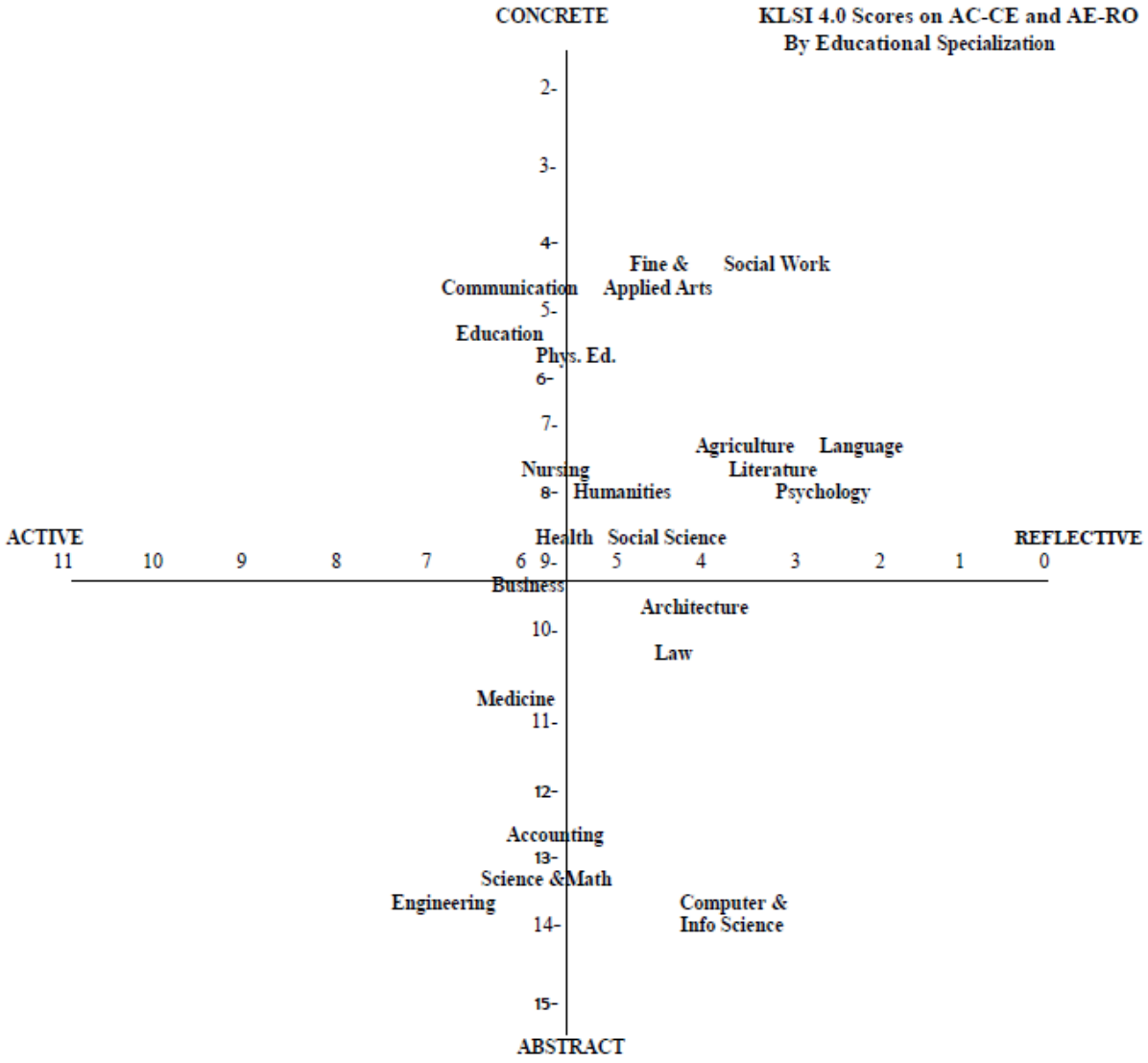
There is considerable variation in inquiry norms and knowledge structures within some fields. Professions such as management (Loo 2002a, 2002b, Brown & Burke 1987) and medicine (Sadler et al. 1978, Plovnick 1975) are multi-disciplinary including specialties that emphasize different learning styles. Social sciences can vary greatly in their basic inquiry paradigms. In addition fields can show variation within a given academic department, from undergraduate to graduate levels and so on. For example, Nulty and Trigwell (1996) caution that the learning style grouping should not be taken as absolute representation of a particular student population, because different teaching strategies and discourse mode may be adopted which are non-traditional to that discipline. Their study also suggests that learning styles are related to the stage the students are in their studies. While students in the first third of their studies adopted learning styles that were similar to each other irrespective of the disciplines,

learning styles of students in the final third of their studies tended to be related to the learning requirement of their academic major.

The distinct value systems and educational goals of each educational institution also exert significant influence on differences in students' learning styles. To investigate the relationship between the way a major is structured and student outcomes, Ishiyama and Hartlaub ( 2003) conducted a comparative study of student learning styles in two different political science curricular models at two Universities. The results indicate that while there was no statistically significant relationship between student learning styles in underclass students, there was a significant difference in mean AC-CE scores among upper class students between the two universities. Students taking the highly structured, concept-centered political science curriculum at Truman State University demonstrated higher abstract reasoning skills than did students enrolled in the flexible, more content-oriented major at Frostburg State University. The authors suggest that Truman State program better facilitates the academic requirements recommended by Association of American College and University (AACU) to promote abstract reasoning skills and critical thinking skills necessary for the rigors of professional and graduate education than the flexible curriculum structure at Frostburg State. Other researchers and educators also contend that understanding of the distribution of learning styles in one's field of discipline and sub-specialty is crucial for the improvement of the quality of instructional strategies that respond to the individual need of the learner as well as the optimal level of competency and performance requirement of each profession (Baker, Simon, and Bazeli 1986, Bostrom, Olfman, & Sein 1990, Drew and Ottewill 1998; Fox and Ronkowski,1997; Kreber, 2001; Laschinger, 1986; McMurray,1998; Rosenthal, 1999; Sandmire, Vroman, & Sanders 2000; Sims, 1983).

Results from the KLSI 4.0 normative group show similar results to earlier research on the relationship between learning style and educational specialization. Figure 17 plots the mean scores on AC-CE and AE-RO for respondents who reported different educational specializations on the KLSI 4.0 and Appendix 5 shows the distribution of learning style types for each educational specialty.

**Figure 17**

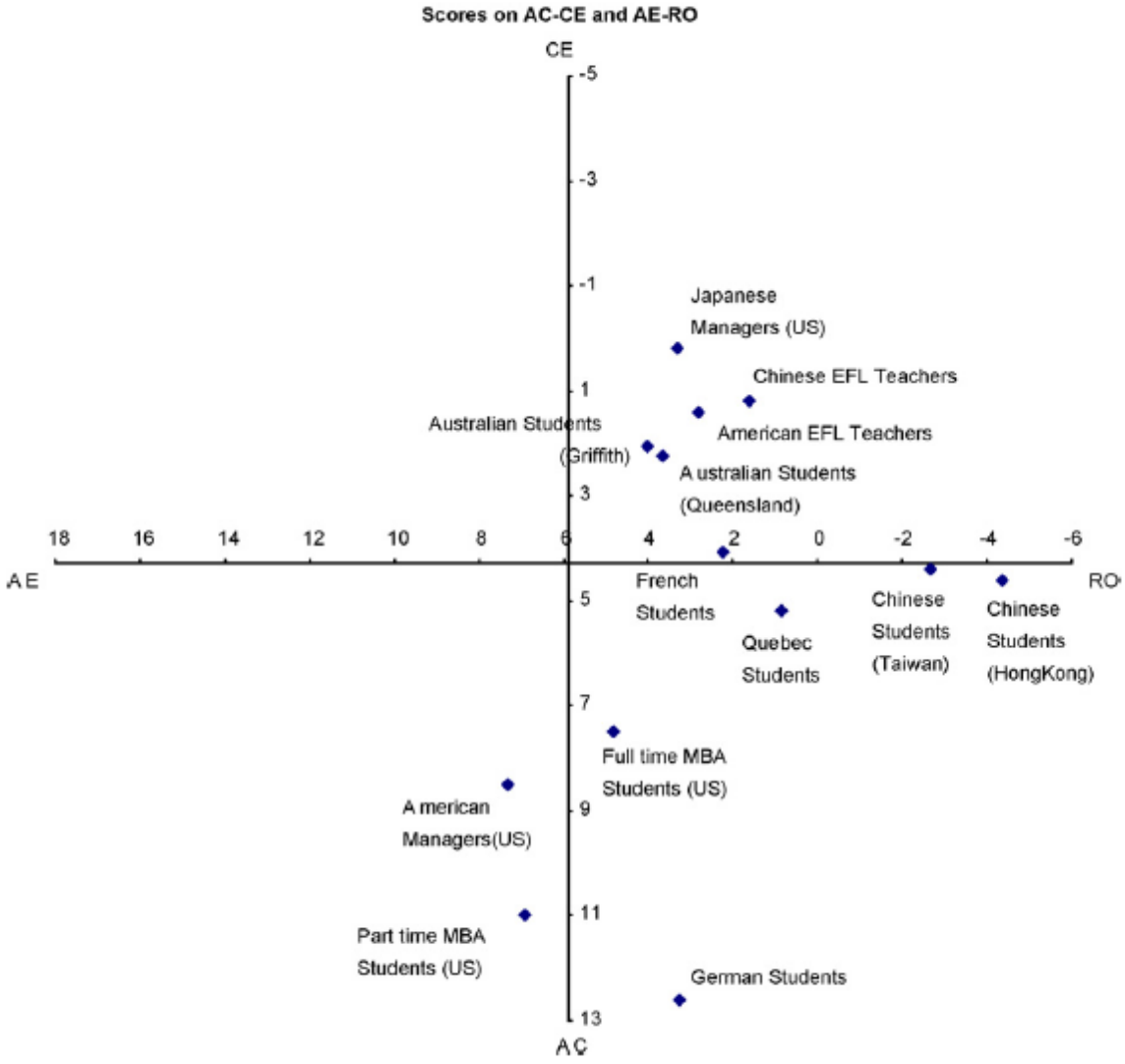



## Culture

A number of comparative studies using KLSI found significant differences in the learning style preferences among the samples from different countries. Yamazaki's (2005) meta-analysis provides a summary of some of these studies. He compiled Yamazaki's and Kayes' (2005) study on Japanese and American mangers, Fridland's (2002) study of Chinese and American teachers, Barmeyer's (2004) study of students from France, Quebec and Germany, Auyeung's and Sand's (1996) study of accounting students from Australia and Hong Kong, and Hoppe's (1990) study of managers from 19 countries. Fig. 17 is a graphic representation of the mean scores on AC-CE and AE-RO of the samples from these studies. The cut-off

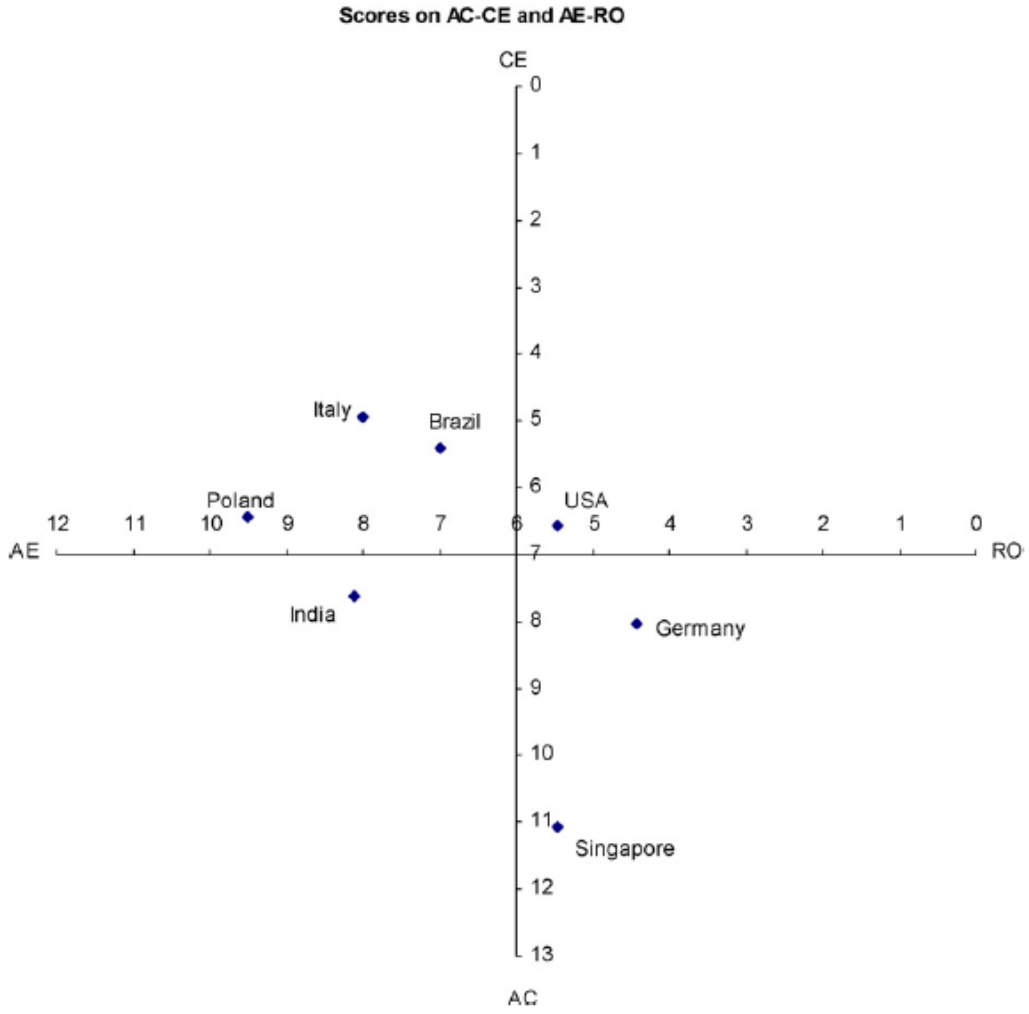
point for AC-CE was 4.3 and for AE-RO 5.9 following the KLSI 2.0 norms that were used in the reported studies.

**Figure 18. Yamazaki's Meta-analysis of Learning Style and Culture Studies**




Joy and Kolb (2009) examined the role that culture plays in the way individuals learn using the KLSI 3.1 to assess differences in how individuals learn and the framework for categorizing cultural differences from the Global Leadership and Organizational Effectiveness (GLOBE) study where national cultures are examined by cultural clusters and individual cultural dimensions. The first part of the study assesses the relative influence of culture in comparison to gender, age, level of education and area of specialization of 533 respondents born in and currently residing in 7 nations. Figure 19 shows the KLSI 3.1 scores for the seven nations.

**Figure 19. Learning Styles of Respondents in Poland, Italy, Brazil, USA, India, Germany and Singapore**




This study to examine the influence of culture on learning style while examining some of the other factors known to influence an individual's approach to learning. Results of the study indicate that culture as measured by the GLOBE country clusters and by representative countries from each cluster does indeed significantly influence learning style, particularly the extent to which individuals rely on concrete experiences versus abstract concepts in the way they learn. On the AC-CE dimension of the KLSI, culture in the cluster sample accounted for 22% of the explained variance as compared with 17% for gender and 39% for educational specialization while in the country sample the percentages of explained variance were 28%

for culture, 8.6 % for gender, 18% for level of education and 32 % for educational specialization. Thus, in both samples while educational specialization accounted for the most variance in AC-CE, culture ranked second ahead of gender, educational level, and age. Analysis of the GLOBE country ratings on individual cultural dimensions suggests that individuals tend to have abstract learning styles in countries that are high in uncertainty avoidance, future orientation, performance orientation and institutional collectivism. Individuals from Italy and Brazil had the most concrete learning styles and those from Singapore and Germany had the most abstract learning styles.

On the AE-RO dimension of the KLSI, in the cluster sample only age had a significant influence on individuals' emphasis on action versus reflection in learning, accounting for 45% of the explained variance. In the country sample age accounted for 36% of the explained variance and educational specialization accounted for 23%. The influence of culture was marginally significant ($p<.07$) and accounted for 34% of explained variance. Analysis of the GLOBE country ratings on individual cultural dimensions suggests that individuals tend to have reflective learning styles in countries that are high in uncertainty avoidance and active learning styles in countries that are high in in-group collectivism, Individuals from Germany had the most reflective learning styles and those from Poland had the most active learning styles.

**Other Experiential Learning Assessment Instruments.**

***The Learning Skills Profile***

The Learning Skills Profile (LSP, Boyatzis and Kolb 1991a, 1991b, 1995) was developed to assess systematically the adaptive competencies associated with learning style (Kolb 1984). The LSP uses a modified Q-sort method to assess level of skill development in four skill areas that are related to the four learning modes--Interpersonal Skills (CE), Perceptual/Information Skills (RO), Analytical Skills (AC) and Behavioral Skills (AE). Several studies have used the LSP in program evaluation (Ballou, Bowers, Boyatzis, & Kolb, 1999; Boyatzis, Cowen, & Kolb, 1995) and learning needs assessment (Rainey, Hekelman, Glazka, & Kolb, 1993; Smith 1990). Yamazaki et al. (2003) studied the relationship between LSP and LSI 3.1 scores in a sample of 288 research university freshmen. AC-CE was negatively related to the interpersonal skills of leadership, relationship and help and positively related to the analytic skills of theory building, quantitative analysis and technology as predicted. The AE-RO dimension did not relate to the perceptual/information skills of sense making, information gathering and information analysis but did relate to the behavioral skills of goal setting and initiative as predicted (See Table 10). In another study of 198 MBA students, Mainemelis et al. (2002) found similar relationships between LSI 2 scores and the LSI clusters of Interpersonal, Information, Analytic and Behavioral learning skills (See Table 11).

**Table 9. Relationship between Learning Skills Profile scores and KLSI 3.1 AC-CE and AE-RO Scales (Yamazaki et al. 2003)**

| | Interpersonal learning skills (CE) | | | | | | Perceptual learning skills (RO) | | | | | | Analytical learning skills (AC) | | | | | | Behavioral learning skills (AE) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variables** | **Leadership** | | **Relationship** | | **Help & understanding** | | **Sense making** | | **Information gathering** | | **Information analysis** | | **Theory building** | | **Quantitative analysis** | | **Technology & computer** | | **Goal setting** | | **Action** | | **Initiative** | |
| | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** | **β** | **$R^2$** |
| **AC-CE** | -.14* | .06 | -.22*** | .06 | -.24*** | .06 | .06 | .01 | -.01 | .00 | .20*** | .04 | .30*** | .10 | .33*** | .11 | .21*** | .04 | .16** | .04 | .03 | .01 | -.15** | .07 |
| **AE -RO** | .19*** | | .08 | | .07 | | .10 | | .04 | | .07 | | .10 | | -.01 | | .02 | | .13* | | .09 | | .22*** | |
| F | 8.27*** | | 8.26*** | | 9.54*** | | 1.92 | | .26 | | 6.58** | | 15.12*** | | 17.18*** | | 6.36** | | 6.39** | | .89 | | 11.08*** | |
| df | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | | 2, 285 | |

N = 288
* p < .05
** p < .01
*** p < .001

**Table 10. Correlations between LSI 2 and The Learning Skills Profile (Mainemelis et al. 2002)**

| N | Interpersonal /CE | Information /RO | Analytic /AC | Behavior /AE | Anal.-Interp. /AC-CE | Behav.-Info. /AE-RO |
|---|---|---|---|---|---|---|
| 198 | .31 | -.14 | .54 | .12 | .57 | .23 |

*r's> .14 p< .05, r's>.24 p<.001* two-tailed

### *The Adaptive Style Inventory*

The Adaptive Style Inventory (ASI) was developed to assess situational variability in learning style in response to different kinds of learning task demands (Kolb 1984). It uses a paired comparison method to rank learning preferences for the four learning modes in eight personalized learning contexts. It measures adaptive flexibility in learning, the degree to which one systematically changes learning style to respond to different learning situations in their life. Earlier studies found that adaptive flexibility is positively related to higher levels of ego development on Loevinger's instrument (Kolb & Wolfe, 1981). Individuals with high adaptive flexibility are more self-directed, have richer life structures, and experience less conflict in their lives (Kolb, 1984).

Mainemelis, Boyatzis and Kolb (2002) employed the LSI 2, the Adaptive Style Inventory (Boyatzis and Kolb 1993), and the Learning Skills Profile (LSP, Boyatzis and Kolb 1991, 1995, 1997) to test a fundamental ELT hypothesis: The more balanced people are in their learning orientation on the LSI, the greater will be their adaptive flexibility on the ASI. To assess a balanced LSI profile two different indicators of a balanced learning profile using absolute LSI scores on the Abstract/Concrete and Active/Reflective dimensions were

developed. The results supported the hypotheses showing that people with balanced learning profiles in both dimensions of the LSI are more adaptively flexible learners as measured by the ASI. The relationship was stronger for the profile balanced on the Abstract/Concrete dimension than the active/reflective dimension. Other results showed that individuals with specialized LSI learning styles have a greater level of skill development in the commensurate skill quadrant of the LSP. The study also produced some unexpected results. For example, while it was predicted that specialized learning styles would show less adaptive flexibility on the ASI, the results showed that this is true for the abstract learning styles but not for the concrete styles.

The ASI also produces total scores for the sum of the eight different learning contexts on the four basic learning modes. Table shows the correlations between these total ASI scores and the scales of the LSI 2 indicating high concurrent validity between the two instruments.

**Table 11. Correlations between LSI 2 and Adaptive Style Inventory Scale Scores**

| Source | N | CE | RO | AC | AE | AC-CE | AE-RO |
|---|---|---|---|---|---|---|---|
| Mainemelis *et.al.* (2002) | 198 | .43 | .37 | .49 | .42 | .53 | .44 |

*r's>.28 p< .001* two-tailed

***The Honey-Mumford Learning Styles Questionnaire***

Honey and Mumford (1982, 1992) developed the Learning Styles Questionnaire (LSQ) based on ELT with the aim to create an instrument that was phrased in the language of UK managers and of pragmatic value to them, not "something that was academically respectable" (1986: 5). While they base their learning styles on the learning cycle they define the four learning modes somewhat differently. Three of the learning modes on the face of it appear similar to ELT; Reflector and RO, Theorist and AC and Pragmatist and AE; but the fourth mode Activist and CE is not, confusing concrete experience and active experimentation. This appearance is supported by a cluster analysis and factor analysis of the LSQ by Swailes and Senior (1999) who found a three stage learning cycle of action, reflection and planning instead of the ELT four stage cycle. Honey and Mumford's (1982) correlation of the LSI 1 and the LSQ is also consistent although the sample is quite small. In a larger study of undergraduate students by Sims Veres and Shake (1989) there was very little relationship between any of the LSI 2 and LSQ scales. Another study by Goldstein et al. (1992) of 44 students and faculty found similar small correlations between the LSQ and LSI 1 and LSI 2 scales (See Table 12). They argued with some justification that the proper correspondence between the LSQ and LSI is between the LSQ scales and the LSI learning style types (eg. Activist = Accommodating) but found little evidence to support it. Only 41% were correctly classified with the LSI 1 and 29% with LSI 2. In addition a factor analysis of the LSQ by De Ciantis and Kirton (1996) failed to support the two bipolar dimensions, AC-CE and AE-RO predicted by ELT; as did a study by Duff and Duffy (2002). Finally,

Mumford in Swailes and Senior (2001:215) stated, “the LSQ is not based upon Kolb’s bi-polar structure as the academic community seems to think”.

Given these results, caution should be used in equating scores from the LSI and LSQ and in interpreting LSQ research as either confirming or disconfirming ELT.

**Table 12. Correlations of the Honey-Mumford Learning Styles Questionnaire with the LSI 1 and LSI 2**

| Source | N | LSI version | Activist-CE | Reflector-RO | Theorist-AC | Pragmatist-AE |
|---|---|---|---|---|---|---|
| Honey & Mumford 1982 | 29 | LSI 1 | .23 | .73 | .54 | .68 |
| Sims,et.*al.* 1989 | 279 | LSI 2 | .22*** | .28*** | .11* | .01 |
| Goldstein et al. 1992 | 44 | LSI 1<br>LSI 2 | .23<br>.43** | .09<br>.14 | .36*<br>.23 | .38*<br>.38* |

*** p < .001, ** p<.01,* p < .05 No sig. levels reported by Honey & Mumford

**Multiple Intelligences**

Narli, S., Ozgen, K., & Alkan, H. (2011) examined the relationship between individuals' multiple intelligence areas and their learning styles using the mathematical concept of rough sets. Multiple intelligence areas and learning styles of 243 mathematics prospective teachers studying at a state university were identified using the "Multiple Intelligence Inventory for Educators" developed by Armstrong (2000) and the KLSI 3.1. The authors conclude, “Given that the data analysis of this study revealed that intelligence areas together could explain learning styles at 0.794 level, we tend to take the position that it is unacceptable to believe that learning styles and intelligence areas are totally different from and irrelevant of each other…On the contrary, the findings of this study could be argued to present results in line with the researchers…who believe that multiple intelligence and learning styles should be explored together. These results also largely overlap with Gardner's approach that ‘learning styles and multiple intelligence types are different and a learning style could be related to more than one intelligence area’.”

**Epistemological Beliefs Questionnaire**

Tumkaya, S. (2012) investigated the epistemological beliefs of university students according to their genders, classes, fields of Study, academic success and learning styles. This study was carried out with 246 females and 242 males university students using the Epistemological Beliefs Questionnaire.(Shommer 1990, EBQ)and the Kolb Learning Style Inventory 2.0 translated into Turkish. The EBQ had a structure of three factors and consisted of 34 items. There were 17 items in the first factor named “the belief concerning that earning depends on effort”, 9 items in the second factor named “the belief concerning that learning depends on ability” (Range 9-45) and 8 items in the third factor named “the belief

concerning that there is one unchanging truth" Results indicated that students who have *diverging* learning styles believe more strongly that learning depends on ability and that there is one unchanging truth more strongly than students who have *assimilating, accommodating* and *converging* learning styles.

**Aptitude Test Performance**

Studies of the relationship between learning style and aptitude test performance have consistently found that individuals with abstract, and sometimes active, learning styles perform best on tests of this type. Boyatzis and Mainemelis (2000) found significant correlations ($p<.001$) between the total GMAT scores of MBA students and their LSI 2 scores on AC-CE (.16 for 576 full time students and .19 for part time students) and on AC (.23 FT and . 21 PT). Data from the research university freshmen normative sample shows significant correlations ($p<.001$) between their total SAT scores and the KLSI 3.1 AC-CE (.32) and AC (.37) scales. Kolb (1976b) reported significant correlations between the LSI 1 and the LSAT for a sample of 43 law students for RO (-.29 $p< .05$) and for AC (.30 $p<.05$)

Two studies have examined the relationship between the Wonderlic test of general mental ability and the LSI. Kolb (1976b) reported data from 311 industrial managers indicating significant positive relationships between the LSI 1 AC-CE (.18 $p<.01$) and AE-RO (.24 $p<.001$) scales and Wonderlic scores. Cornwall and Manfredo (1994) studied the relationship between learning style and the Wonderlic in a group of 74 students and young working professionals. They scored the LSI 2 using a nominal scoring method and found that those whose primary learning mode was AC score significantly higher than those with the other primary learning modes.

While some have concluded that these relationships between AC and aptitude test performance indicate that abstract persons have greater mental ability (eg. Cornwall and Manfredo 1994) it is also possible that the one best answer format of tests of this type is biased toward the converging learning style (See below).

**Assessment of Academic Performance.**

A number of studies have examined the relationship between learning style, assessment method and academic performance. While some studies show relationships between grades and the converging learning style (Rutz 2003, Mainemelis et al. 2000), other studies indicate that these learning style differences in student performance may be a function of the assessment technique used.

Tucker (2009) found that design students in architecture change towards the learning styles of design teachers as they progress through their studies, producing a statistically significant relationship between learning styles and academic performance in design assignments. They found that successful architecture students' learning styles were located in a southerly direction or south of the AE-RO bi-polar dimension or in the converging and assimilating quadrants as the skill sets and ways of thinking about implementing architecture reflect these two learning styles. Weaker students had learning styles north of the AE-RO bi-polar dimension or in the accommodating and diverging quadrants.

Lynch, Woelfl, Steele, & Hanssen explored the relationship between learning style and three different academic performance measures in a third-year surgery clerkship in a medical school. Two cohorts of third-year medical students took the United States Medical Licensing Examination step1 (USMLE 1), the National Board of Medical Examiners (NBME), and NBME computer-based case simulations (CBX). The USMLE 1 and NBME subject examination rely on a single best answer, multiple-choice question format to assess performance, whereas CBX is a complex computer simulation intended to measure clinical management skills: The CBX consists of eight patient management simulations, each involving a patient with an unknown surgical problem. The simulation allows the student to obtain results of the history and physical examination, to order laboratory studies, to request radiology procedures, and to perform invasive/interventional procedures of surgeries. Beyond the presenting complaint, management is unprompted, and the student must balance the clinical evaluation with the acuity and progression of the clinical problem. Time advances during the simulation in proportion to the time necessary to perform each examination, laboratory study, or intervention. (1998: 63). Of the 227 participants in the study, 102(45%) were converging learners, 59(26%) assimilating, 48(21%) accommodating, and 18(8%) were diverging learners. The result indicated that converging and assimilating learners scored significantly higher on the two multiple choice performance measures, while no learning style difference was found on the CBX computer simulation. The authors concluded that the results support the Kolb (1984) and Newland (1992) assertions that converging and assimilating learners may have a performance advantage on objective, single-best answer multiple choice examination. They also concluded that the absence of relationships between learning style and CBX simulation suggests that multiple choice examination and clinical case simulations measure different capabilities and achievements. Clinical management may require not only an abstract orientation supporting the acquisition, organization, and synthesis of preclinical basic science data, but also a concrete orientation involving pattern recognition and instinct. The data demonstrate the importance of evaluating learning outcomes by applying more than one type of examination format. Multiple-choice examinations favor abstract learners, however, clinical performance requires additional cognitive skills and abilities, and behaviors that are not adequately reflected in objective measures of performance.

Oughton & Reed (2000) measured the relationship between graduate students' learning styles and performance outcome in a hypermedia environment in which students are required to structurally map out their acquired knowledge and grasp the interrelationships among various ideas and concepts. The dependent measures included the number of concepts, number of nodes, number of links, number of bidirectional links, number of multiple concept nodes, number of nodes with multiple links, levels of depth, preserved concepts, omitted concepts, and added concepts on each student's map. The results show that assimilating and diverging learners were the most productive on their concept maps. The authors concluded that this result can be attributed to the common traits shared by the two learning styles: the ability to see many perspectives and the ability to generate many ideas.

Holley & Jenkins (1993) examined the impact of learning style on four different accounting exam question formats: multiple-choice theory (MCT), multiple-choice quantitative (MCQ),

open-ended theory (OET), and open-ended quantitative (OEQ). Their results indicated that there was a significant performance difference by learning style for all but the multiple – choice quantitative format. On the active-reflective learning style continuum, there was a significant difference in students' performance on the multiple choice theory format ($p < .01$) and the open-ended quantitative format ($p < .05$) with active students performing better. On the abstract-concrete learning style continuum, abstract students performed better on the open-ended theory format ($p < .062$). The authors concluded that students with different learning styles perform differently depending on the examination format, and that performance cannot be generalized for similar subjects if the testing format varies.

This research suggests that educators need to exercise caution in evaluating performance based on a single outcome measure. Diverse assessment strategies are required to adequately measure student overall competence and performance.

## Experiential Learning in Teams

Current research, involving different methodologies and different educational and workplace populations, has shown that ELT is useful for understanding team learning and performance (Adams, Kayes & Kolb 2005a). A number of studies support the proposition that a team is more effective if it learns from experience and emphasizes all four learning modes. Summarized below are studies of team member learning style, team roles, and team norms.

### *Team member learning style.*

In the first experimental study of the effect of learning styles on team performance, Wolfe (1977) examined how homogeneous three-person teams of accommodators, divergers, assimilators, or convergers performed on a complex computer business simulation compared with heterogeneous teams. The four groups of homogeneous teams had similar performance results. However, the teams that had members with diverse learning styles performed significantly better, earning nearly twice the amount of money of the homogeneous learning style teams. Similarly, Kayes (2001) found that teams made up of members whose learning styles were balanced among the four learning modes performed at a higher level on a critical thinking task than teams whose members had specialized learning styles.

Sandmire and Boyce (2004) investigated the performance of two-person collaborative problem-solving teams in an allied health education anatomy, physiology, and pathology course. They compared a group of high abstract/high concrete student pairs with a group of abstract pairs and a group of concrete pairs. The abstract/concrete pairs performed significantly better on a simulated clinical case than the abstract pairs and slightly better than the concrete pairs, indicating the value of integrating the abstract and concrete dialectics of the learning cycle. However, a similar study by Sandmire, Vroman, and Sanders (2000) investigating pairs formed on the action/reflection dialectic showed no significant performance differences.

Halstead and Martin (2002) found that engineering student teams that were formed randomly to include all learning styles performed better that self-selected teams. Furthermore, in her studies of engineering students, Sharp stated, “Classroom experience shows that students can improve teamwork skills with Kolb theory by recognizing and capitalizing on their strengths, respecting all styles, sending messages in various ways, and analyzing style differences to resolve conflict and communicate effectively with team members” (2001, F2C-2). In his study of a 6-week teambuilding program, Hall (1996) reported difficulty with self-selected teams that tended to group on the basis of friendship. He advocated random team assignment, concluding, “If we had taken this approach there would have been more disagreement to work through, personality clashes to cope with and conflict to resolve. The stress would have been greater, but the *learning* probably more profound” (1996, p. 30).

Using another approach, Jackson studied the learning styles of ongoing workgroup team members who participated in a paired team competition. The exercise was designed to require teamwork skills. Results showed that teams with a balanced learning styles performed better. In 17 of the 18 team pairs, the winning team average score was higher than that of the losing team. Jackson concluded, “Designing teams that reflect the dynamic nature of team activities has great appeal in that it gives all team members a more equal opportunity to contribute and a more equal opportunity to be valued. . . . The process model advocates that different team members lead in different team activities or learning situations (2002, p. 11).

Kyprianidou, Demetriadis, Tsiatsos& Pombortsis (2012) explored the impact of teacher-led heterogeneous group formation on students' teamwork, based on students' learning styles. Fifty senior university students participated in a project-based course with two key organizational features: first, a web system (PEGASUS) was developed to help students identify their learning styles and distribute them to heterogeneous groups. Second, group facilitation meetings were introduced as a technique to help students reflect on their weak/strong traits and employ appropriate roles in their group. Evaluation data revealed that students gradually overcame their initial reservations for the innovative group formation method and were highly benefited since styles heterogeneity within the group emphasized complementarities and pluralism in students' ways of thinking. They conclude “Overall, this work provides evidence that the adoption of learning styles theories in practice can be facilitated by systems for automated group formation and supportive group facilitation meetings that help avoiding the trivial and discouraging approach of using learning styles to simply label students.”

Lau, Beckman & Agogino (2012) examined how diversity in learning styles affect the dynamics and success of a design team. Data was gathered over two semesters of a multidisciplinary, project-based graduate level design course offered at the University of California at Berkeley. The results offer insights into how students with different learning styles appear to contribute to design team performance and provide recommendations that will help inform design educators on how to enhance overall team performance and innovation, with an understanding of learning style differences.

A study by Jules (2007) examined the influence of both learning style diversity and experiential learning team norms on team performance in a survey of 33 work teams from 6 different industries. Overall both team member learning style diversity and experiential learning work norms were positively related to a team's ability to make decisions, to achieve its goals and to overall team performance. However, learning style diversity was not related to team experiential learning norms suggesting that other factors than member composition such as team leadership, team task or organization culture influence team norms. This was supported by the fact that learning style diversity was positively related to performance in teams with routine tasks and unrelated to performance in teams with non-routine tasks and experiential team norms were more strongly related to performance in teams with non-routine tasks.

***Team roles.***

Park and Bang (2002) studied the performance of 52 Korean industrial work teams using the Belbin team role model, which is conceptually linked to ELT (Jackson, 2002). They found that the best-performing teams were those whose members adopted at a high level all nine of Belbin's roles covering all stages of the learning cycle. They also found that teams with roles that matched the particular stage of a team's work/learning process performed best.

McMurray (1998) organized his English as a foreign language classroom using ELT principles. He divided his Japanese students into four-person teams with maximally diverse learning styles. Students were assigned to one of four roles that matched their strongest learning mode: leader (concrete experience), artist (reflective observation), writer (abstract conceptualization), and speaker (active experimentation). The leader's role was to direct classmates in completing assignments; the artist's, to create ideas for presentations; and the writer's, to compose messages for speakers to read. Class lessons were organized to include all four stages of the learning cycle. Classroom observations supported the idea that students benefited from the team role assignment and from accounting for learning style in the course design.

Gardner and Korth used ELT, learning styles, and the learning cycle to develop a course for human resource development graduate students that focused on learning to work in teams. They found strong relationships between learning styles and preference for learning methods—assimilators preferred lectures, reading, writing, and individual work, while accommodators and often divergers and convergers preferred partner and group work. They advocated providing different student roles during team learning activities to develop appreciation for, and skill in, all learning styles. "Part of the class could actively participate in a role play (accommodating), while a second group observes and provides feedback to the participants (diverging), a third group develops a model/theory from what they have seen and shares it with the class (assimilating) and the fourth group develops a plan for applying what they have seen to a new situation and shares it with the class (converging)" (1999, p. 32).

***Team norms.***

Carlsson, Keane, and Martin used the ELT learning cycle framework to analyze the bi-weekly reports of research and development project teams in a large consumer products corporation. Successful project teams had work process norms that supported a recursive cycling through the experiential learning cycle. Projects that deviated from this work process by skipping stages or being stuck in a stage "indicated problems deserving of management attention" (1976, p. 38).

Gardner and Korth used ELT to design a course in group dynamics, group development, and group effectiveness. They taught student learning teams to use the experiential learning cycle to improve the transfer of learning. They concluded, "The use of learning groups in conjunction with the experiential learning model enhances the learning process, reinforces the link between theory and practice, and facilitates the transfer of learning to the workplace" (1997, p. 51).

Pauleen, Marshall, & Ergort used ELT to construct and implement web-based team learning assignments in a graduate-level course in knowledge management. Students worked on projects in virtual teams. Follow-up student evaluations indicated that 75% "agreed or strongly agreed that experiential learning was a valuable way of experiencing and learning about a variety of communication channels in a team environment" (2004, p. 95); 99% found experiential learning to be more valuable than simply reading about something.

Two studies have explicitly examined team conversational learning spaces with norms that support the experiential learning cycle. Wyss-Flamm (2002) selected from a management assessment and development course three multicultural student teams who rated themselves as high in psychological safety, defined as the ability of the team to bring up and talk about difficult or potentially psychologically uncomfortable issues. Three of the teams rated themselves as low in psychological safety. Through intensive individual and team interviews, she analyzed the teams' semester-long experience. In teams with high psychological safety, the conversations followed a recursive experiential learning cycle: differences were experienced among team members, examined through reflective juxtaposition that articulated learning, and culminated in either an integration of the differences or an affirmation of the contrast. Teams with low psychological safety tended to have early disturbing incidents that limited conversation and made the conversational flow more turbulent and conflict filled. Lingham (2004) developed a questionnaire to assess the norms of conversational space in a sample of 49 educational and work teams. He found that the more the teams supported the experiential learning cycle through norms that focused their conversation on interpersonal diverging (concrete experience and reflective observation) and task-oriented converging (abstract conceptualization and active experimentation), the better they performed, the more satisfied they were with their membership on the team, and the more they felt psychologically safe to take risks on the team.

Based on the above research a workbook of structured experiential learning exercises designed to promote team learning has been developed--*The Kolb Team Learning Experience* (Kayes, Kayes, Kolb & Kolb 2004). The workbook program uses the

experiential learning cycle and members' learning style information to help teams learn about their purpose, work process, team membership, roles, context and action plans. Initial research on the impact on this educational intervention suggests that the program is effective in promoting team learning in educational and organizational settings (Adams, Kayes & Kolb 2005b).

# 6. LEARNING FLEXIBILITY

For the first time the KLSI 4.0 includes a personal assessment of the degree to which a person changes their style in different learning contexts. It gives an overall measure of learning style flexibility called the Learning Flexibility Index and a specific analysis of which "backup" learning styles they use, showing which learning style types the individual uses in addition to their dominant learning style type. This information can help individuals improve their ability to move freely around the learning cycle and improve their learning effectiveness.

## The Learning Flexibility Index.

The LFI is comprised of 8 items that describe 8 different learning contexts chosen to represent learning situations that emphasize different modes around the learning cycle. The situations "starting something new" and "influencing someone" emphasize AE & CE. "getting to know someone" and "learning in a group" emphasize CE & RO. "planning something" and "analyzing something" emphasize RO & AC and "evaluating an opportunity" and "choosing between alternatives" emphasize AC &AE. The items are revisions of the original ASI in a ranking format similar to the KLSI. Respondents are asked to think of an example of each situation in their life and then to rank which of the four learning mode responses to the learning situation they tend to use. For example, for the item "When I start something new", the endings are "I rely on my feelings to guide me" (CE); "I imagine different possibilities" (RO); "I analyze the situation" (AC); and "I try to be practical and realistic" (AE).

## Learning Flexibility Index Formula.

The measure for calculating learning flexibility is based on the Kendall's Coefficient of Concordance or W (Legendre, 2005), a non-parametric statistic typically used to measure the degree of agreement among judges ranking objects.

In the LFI, W is calculated *for each individual* by assessing the degree of agreement in their ranking of the four learning modes (the objects) across the 8 different learning contexts (8 "judging" situations). A low W score for an individual indicates that the learner varies their ranking of learning modes across learning contexts thus showing high learning flexibility.

W finds the deviation between the mean response ranking (by learning mode) and the grand mean of the ranking. This deviation is divided by the maximum possible sum of squares deviation. The coefficient varies from 0 to 1 with 1 denoting complete agreement (Sigler, & Tallent-Runnels, 2006).

We thus define Learning Flexibility Index (LFI) as: LFI= 1-W. The modified formula for W is:

$$\mathrm{W} = (12S - 3p^2\mathrm{n}(\mathrm{n}+1)^2))/\mathrm{p}^2(n^3 - n)$$

Where, $s = \sum_{i=1}^{n} R_i^2$

p= number of learning contexts (=8)

n= number of learning modes (=4)

R= row sum of ranks for the 8 contexts

Table 13 shows the LFI scores for the KLSI 4.0 normative sample and sub-samples and Appendix 7 shows the Learning Flexibility Index percentile scores for the normative sample.

**Table 13. Learning Flexibility Index Scores for Normative Sample and Sub-samples**

| | N | LFI Mean | S. D. | Minimum | Maximum |
|---|---|---|---|---|---|
| TOTAL NORM GROUP | 10423 | .73 | .17 | .07 | 1.00 |
| Medical students | 670 | .72 | .17 | .18 | .99 |
| Nursing students | 38 | .75 | .14 | .43 | .98 |
| Law students | 166 | .76 | .16 | .29 | .99 |
| University Undergrad | 500 | .76 | .16 | .29 | .99 |
| University Graduate | 1478 | .73 | .16 | .12 | 1.00 |
| Adult HE E-learning | 663 | .73 | .16 | .18 | .99 |
| Managers | 1724 | .72 | .17 | .09 | 1.00 |

**Previous ELT Research on Learning Flexibility**

Previous research on learning flexibility (previously named adaptive flexibility) was conducted with the Adaptive Style Inventory (ASI—Boyatzis & Kolb, 1993). The ASI was originally developed to assess individuals' level of integrative complexity as they progressed from the specialized to integrated stage of the ELT developmental model (Kolb, 1984). The instrument assessed adaptive flexibility by measuring how individuals change their learning style in response to different situational demands. It was based on the theory that if people show systematic variability in their response to different contextual learning demands, one

could infer a higher level of integrative development because systematic variation would imply higher order decision rules or meta-cognitive processes (Kolb & Kolb, 2009) for guiding behavior.

A number of researchers have found evidence to support the link between learning flexibility and integrative development. Early studies found that adaptive flexibility is positively related to higher levels of ego development on Loevinger's sentence completion instrument (Kolb & Wolfe, 1981; Kolb, 1984). Individuals with higher levels of adaptive flexibility perceived themselves to be more self-directed in their current life situation and to have greater flexibility. They had higher levels of differentiation in their personal relationships, and used more constructs to describe their life structure. In addition, they experienced less conflict and stress in their life despite experiencing their life to be more complex. Subsequent research on learning flexibility has replicated some of these findings. Perlmutter (1990) studied 51 medical professionals and found significant relationships between Loevinger's ego development instrument and adaptive flexibility. Thompson (1999) in a sample of 50 professionals from various fields found that self-directed learners had higher levels of adaptive flexibility than learners who were not self-directed.

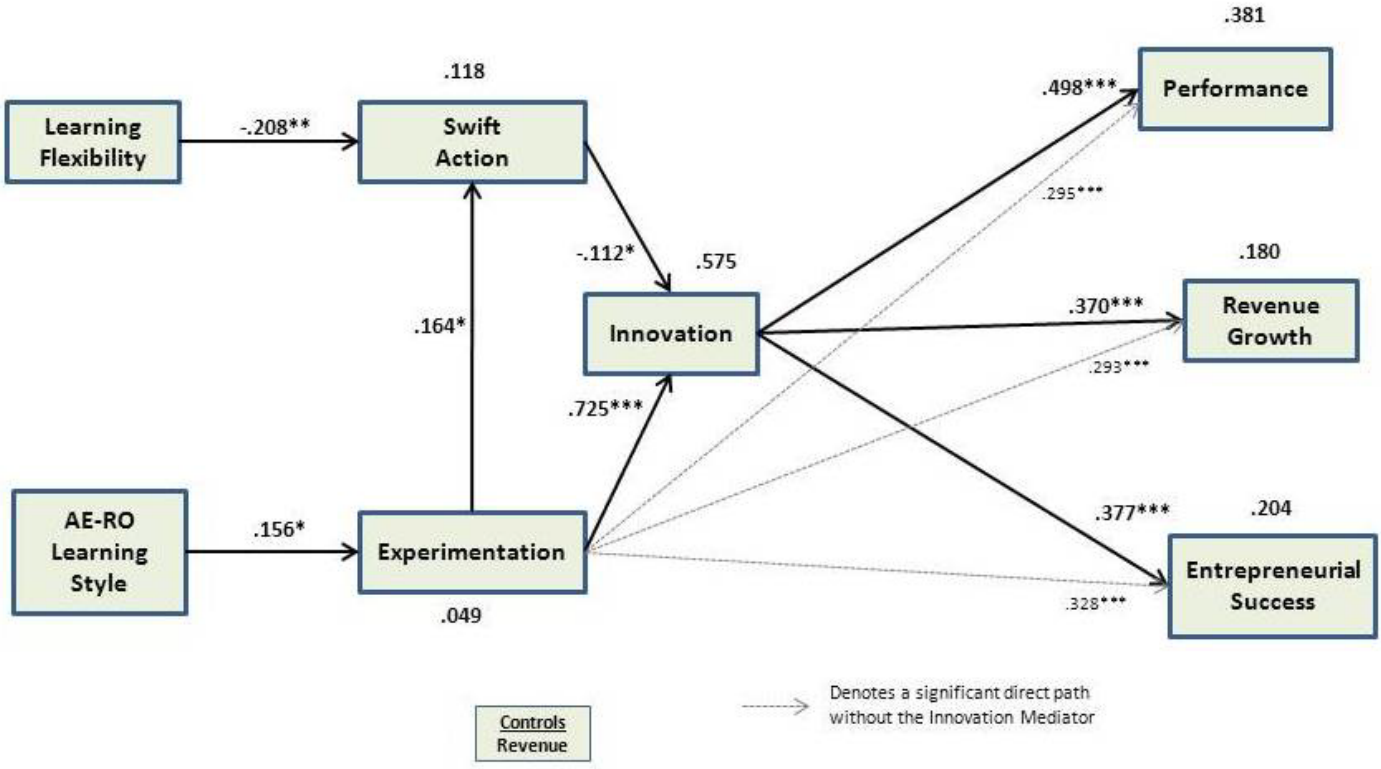
Another study by Mainemalis, Boyatzis, and Kolb (2002) examined the relationship between learning style as measured by the Kolb Learning Style Inventory (KLSI—Kolb 1999, 2005) and ASI adaptive flexibility. They tested the hypothesis that learners with equal preferences for dialectically opposed learning modes would be better able to integrate them into a flexible learning process. They proposed that a balanced learning style (as given by the absolute value for the dialectics of experiencing/ conceptualizing and acting/reflecting adjusted for population mean) would be related to learning flexibility. In other words, the more an individual is balanced on the conceptualizing/experiencing and acting/reflecting dialectics the more will he or she exhibit learning flexibility. This was supported for the dialectic of conceptualizing/experiencing. No significant result was found for the dialectic of acting/reflecting. However, they also found an equally strong relationship between learning flexibility and a preference for concreteness over abstraction, the KLSI AC-CE score. This raises the question whether learning flexibility is a function of balancing opposing learning modes or a function of contextual sensitivity, which is being more concrete in learning style.

In her comprehensive review of ASI research, Bell (2005) reported other construct validity evidence but suggested a need for revision of the original instrument and the creation of new measures of adaptive flexibility. Using an earlier version of the current LFI instrument, Akrivou (2008) found a relationship between learning flexibility and integrative development as measured by her Integrative Development Scale (IDS). She created this scale by identifying items that describe the integrative stage of adult development as defined in the works of Loevinger (1966, 1976, 1998), Rogers (1961), Perry (1999), Kegan (1982, 1994) and Kolb (1984, 1988, 1991). Another study by Moon (2008) using the early LFI examined sales performance in financial services, finding that learning flexibility influenced sales success as measured by monthly volume of sales.

Gemmell (2012) studied 172 technology entrepreneurs who were founders/CEO's of their current company. He examined the relationship between their KLSI and LFI 4.0 scores

and their company's innovation and performance. Results shown in Table 14 display a positive relationship between Active Experimentation (AE-RO) and experimentation which in turn influenced innovation and performance. Entrepreneurs with high learning flexibility were more likely to take longer to make key strategic decisions; however, in the process of doing so, they were more innovative. "Technology entrepreneurs who are flexible learners—in spite of the enormous environmental pressures—appear to achieve greater innovation by taking slightly longer to consider more alternatives, to reflect upon those alternatives and to ultimately converge to a solution and take action." (p 90)

**Figure 20. The Influence of Entrepreneur's Learning Style and Learning Flexibility on their Company Innovation and Performance**




## Validation of the KLSI 4.0 LFI

The validity of the LFI in the KLSI 4.0 was examined in an online diverse sample of 7536 with diversity in gender, age, education, profession, country of residence and birth and learning styles, and a second sample from Akrivou's (2008) study; consisting of 169 individuals 75% of whom are middle and senior level managers in three multinational companies and medium sized organizations based in the Midwestern United States (Sharma & Kolb 2010).

Six hypotheses were tested about the relationship of the LFI to variables comprising a nomological net of construct validity—the demographic variables of age, gender, educational level and educational specialization as well as learning style and integrative development:

**Demographic variables.**

*Hypothesis 1: Learning flexibility will decrease with age.*
*Hypothesis 2: Women will exhibit higher learning flexibility than men.*
*Hypothesis 3: Higher levels of education will result in lower learning flexibility.*
*Hypothesis 4: Learning flexibility will be lower for individuals in educational specializations that emphasize abstraction.*

**Learning Style.** ELT predicts relationships between learning style and learning flexibility. Specifically it draws on Piaget's theory that learning requires a balance or equilibrium between accommodation, external adaptation through active involvement in experience (CE & AE) and assimilation, internal cognitive organization through reflective abstraction (RO & AC). "The 'accord of thought with things' and the 'accord of thought with itself' expresses this dual functional invariant of adaptation and organization" (Piaget 1952:8). Accommodative adaptation, therefore, incorporates novelty and variability while assimilative organization promotes stability and consistency. Learning flexibility is the result of the integration of these two processes. The Mainemalis et al. (2002) study mentioned above found some support (significant only on the AC/CE dimension) for the hypothesis that learning flexibility is related to a balance between these two processes but also found equal support for the hypothesis that accommodative learning styles were more flexible than assimilative learning styles. Thus we propose to test two conflicting hypotheses to determine the relationship between assimilative and accommodative learning styles and learning flexibility:

*Hypothesis 5a: A balance between an assimilative and accommodative learning style will be related to higher learning flexibility.*
*Hypothesis 5b: A preference for the assimilative vs. the accommodative learning style will be related to lower learning flexibility.*

**Integrative Development.** Finally, as described above, learning flexibility is thought to be indicative of the higher order process oriented thinking related to higher stages of adult development. This hypothesis will be tested by examining the relationship between learning flexibility and Akrivou's Integrative Development Scale.

*Hypothesis 6: Learning Flexibility is positively related to integrative development.*

Table 14 gives the means and standard deviations for all variables and their inter-correlations. As predicted in Hypotheses 1-4 we see significant negative correlations of age, gender, educational level and educational specialization with learning flexibility. Correlations of other variables with learning flexibility are also significant and in the hypothesized direction. The accommodative learning orientation and integrative development are positively related to learning flexibility. In addition the correlation between age and integrative development in sample 2 (row 7 of Table 14) was significantly positive (.16, $p < .05$); the opposite of the relationship between age and learning flexibility in sample 1 (-.05, $p < .01$).

**Table 14. Means, Standard Deviations and Correlations**

| Variable | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Learning Flexibility Index | 0.71 | 0.17 | - | | | | | | |
| 2. Age | 3.73 | 1.13 | -0.05** | - | | | | | |
| 3. Gender | 0.47 | 0.50 | -0.08** | 0.08** | - | | | | |
| 4. Education | 3.28 | 0.86 | -0.06** | 0.22** | 0.06** | - | | | |
| 5. Specialization | 10.72 | 4.50 | -0.05** | -0.02 | 0.21** | 0.10** | - | | |
| 6. Acc-Assm | 0.29 | 18.23 | 0.25** | -0.04** | -0.16** | -0.07** | -0.13** | - | |
| 7. Integrative Development | 19.42 | 3.48 | 0.23** | 0.16* | -0.14 | -0.00 | -0.07 | 0.07 | - |

*N* = 7536 for Learning Flexibility Index; *N* = 169 for Integrative Development. For age 1=Under 19, 2=19-24, 3=25-34, 4=35-44, 5=45-54, 6=55-64, 7=65 and over; for education 1=Primary School, 2=Secondary School, 3=University Degree, 4=Master's Degree, and 5=Doctoral Degree; for Gender 1= Male, and 0=Female; for specialization in the increasing order of abstract conceptualization and decreasing order of concrete experience 1=Fine and Applied Arts, Humanities=2, Literature=3, Languages=4, Social Work=5, Nursing=6, Physical Education=7, Communications=8, Business=9, Social Sciences=10, Psychology=11, Medicine=12, Law=13, Agriculture=14, Accounting=15, Engineering=16, Computer Science and Information Science=17, Science and Mathematics=18; Acc-Assm = Accommodation-Assimilation = (AE+CE)-(AC+RO)
** $p < .01$, *$p<.05$

**Table15. Regression for Learning Flexibility Index**

| Variable | Learning Flexibility Index | | | Integrative Development |
|---|---|---|---|---|
| | *Hyp1-4* | *Hyp 5b* | *Hyp 5a* | *Hyp 6* |
| | Model 1 | Model 2 | Model 3 | Model 1 |
| Age | -0.03* | -0.02* | -0.02 | 0.18* |
| Gender | -0.07** | -0.04** | -0.04** | -0.18* |
| Education | -0.05** | -0.04** | -0.03** | 0.00 |
| Specialization | -0.03* | -0.01 | -0.02 | -0.03 |
| Acc-Assm | --- | 0.24** | 0.23** | 0.01 |

| | | | | |
|---|---|---|---|---|
| Square of Acc-Assm | --- | --- | -0.14** | --- |
| Learning Flexibility Index | | | | 0.25** |
| *R* | 0.11 | 0.25 | 0.29 | 0.36 |
| $R^2$ | 0.01 | 0.07 | 0.09 | 0.13 |
| Adj. $R^2$ | 0.01 | 0.06 | 0.08 | 0.10 |
| $R^2\Delta$ | 0.01** | 0.05** | 0.02** | 0.06** |

N=7536 for Learning Flexibility Index as the dependent variable. For integrative development as the dependent variable N=169. Values are standardized regression coefficients. Dashes indicate that the variable was not entered in the regression equation. Acc-Assm= Accommodation -Assimilation= (AE+CE)-(AC+RO)
***p<.001, *p<.05*

Hypotheses 1 to 5 focused on the impact of age, gender, education, educational specialization, and accommodating/assimilating learning style on learning flexibility. To test hypotheses 1-5 we ran hierarchical multiple regression (for the online sample with N=7536) in which age, gender, education and educational specialization were entered in the first step, the KLSI variable accommodation/assimilation was entered in the second step and the square of this variable was entered as the last step. Step 2 was added to test hypothesis 5b that states that a preference for accommodation over assimilation will lead to higher learning flexibility. The square of this variable was entered to test hypothesis 5a which states that a balance between assimilation and accommodation will lead to higher learning flexibility. The square term gives the equation an inverted-U form where as one moves from accommodation to assimilation learning flexibility increases, peaking at the balance point and then decreases afterwards. Thus, the linear term is entered to test hypothesis 5b while square term tests hypothesis 5a. These are entered in steps 2 and 3 of the regression to see their incremental effect in explaining learning flexibility (See Table 15). When we enter the linear variable for accommodation-assimilation in model 2 it significantly explains an additional 5% variance in learning flexibility ($F\Delta$ (7,530) = 104.48, $p < .001$) after that explained by age, gender, education and professional specialization. Accommodation- assimilation is positively related to learning flexibility ($\beta$=0.24, p<.01) implying that as preference for the assimilative learning style increases learning flexibility decreases. This supports hypothesis 5b.

In the model 3 in the regression we enter the square term for accommodation /assimilation. This variable significantly explains an additional 2% variance in learning flexibility ($F\Delta$ (7,529) =116.60, $p < .001$) after accounting for the other variables. The significant and negative coefficient for this variable ($\beta$=-0.14, p<.01) indicates an inverted U shape between accommodation-assimilation and learning flexibility consistent with the balancing hypothesis 5a.

To understand the findings in model 2 and 3 we plotted the regression predicted value of learning flexibility controlling for the demographic variables against the variable accommodation- assimilation (See Figure 21). The conflicting linear and curvilinear relationships between accommodative-assimilative learning style and learning flexibility found by Mainemalis, et al. (2002) are resolved by splitting the difference at the accommodative end of the learning style continuum. Both hypotheses agree at the assimilative end of the learning style continuum (that is balanced learning style is related to higher learning flexibility and assimilative learning style results in lower learning flexibility) and are confirmed in the result shown in Figure ???. At the accommodative end the relationship is neither linear nor curvilinear declining from the balance point only slightly. This suggests that inflexibility in learning occurs primarily when the assimilative process of internally organizing thought is not counter balanced by some external accommodative orientation. In other words, it is the assimilative learning style that is the most inflexible.

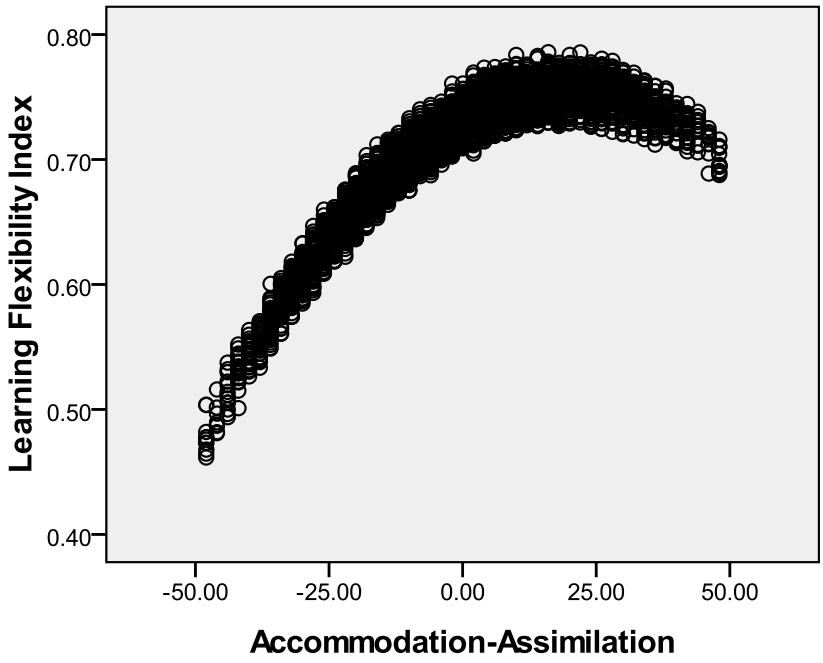



**Figure 21. Graph of Predicted Value of LFI from the regression and the variable for accommodation-assimilation**

To test hypothesis 6 we ran a separate regression (on the sample with N=166). Hypothesis 6 predicted a positive relationship between learning flexibility and integrative development. Under the column for Integrative Development in Table 2 we see the results for this regression. After controlling for the other variables learning flexibility is significantly and positively related to integrative development ($\beta$=0.25, $p<.01$) explaining 6% of the variance in integrative development, supporting hypothesis 6.

To test for discriminant validity of the LFI, we calculated Kendall's W using items from KLSI (items 1-12 that measure learning style). We then correlated integrative development variable with both LFI and 1-Kendall's W from the KLSI items. LFI will have

discriminant validity if the correlation of LFI with integrative development is significant while that of 1-Kendall's W from the LSI items is not. LFI and integrative development show a significant correlation ($\rho$ =0.23, $p<.01$) while 1-Kendall's W from the KLSI items does not show a significant correlation with integrative development ($\rho$=.09, $p>.01$). What these results show is that the LFI variability in response to different learning contexts that is hypothesized to relate to higher order decision rules for learning is related to integrative development; but the variability in response to general descriptions of oneself as a learner on the KLSI is not related to integrative development.

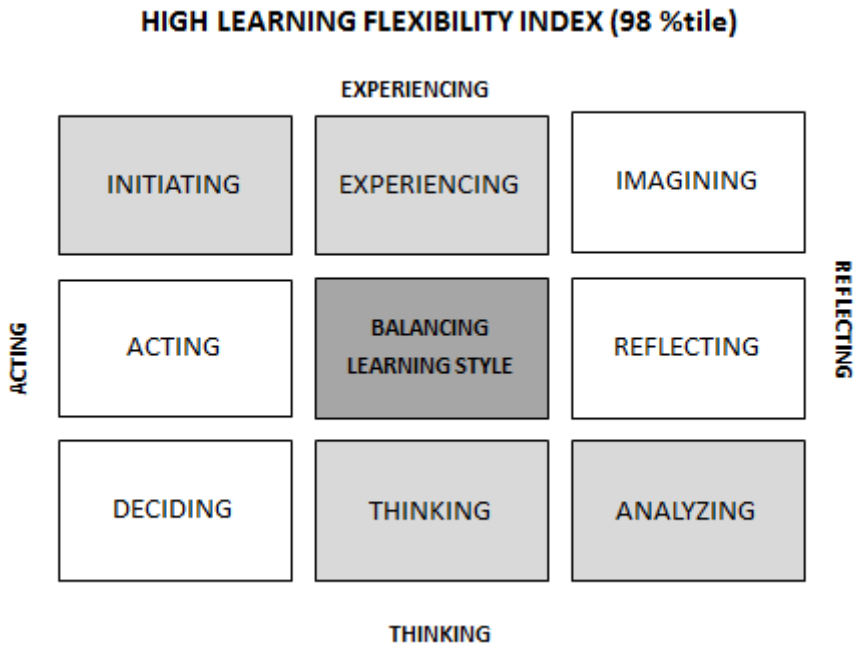
While the first order correlations and regressions showed statistical confirmation of the hypothesized nomological net of construct validation for the LFI, effect sizes for the demographic variables are negligible explaining less than 1% of the variance in each case. Effect sizes for the learning style variable and the LFI were somewhat larger but still small (explaining 6% of the variance for the correlations and 8% for the model 3 regression). For the correlation between LFI and IDS 5.3% of the variance was explained and the R square for the regression indicated 10% of the variance explained. These small effect sizes indicate little utility of the results for such practical applications as using the LFI to predict levels of adult development, although they are still of value for confirming construct validity of the LFI. Construct validation is not focused on an outcome criterion, but on the theory or construct the test measures. Here the emphasis is on the pattern of convergent and discriminant theoretical predictions made by the theory. Failure to confirm predictions calls into question the test and the theory. "However, even if each of the correlations proved to be quite low, their cumulative effect would be to support the validity of the test and the underlying theory" (Selltiz, Jahoda, Deutsch, & Cook, 1959, p. 160).

**Using the LFI for Personal Development.**

In the preceding analysis we have shown nomothetic construct validation for the LFI across a large sample of diverse individuals. The LFI also provides an idiographic profile describing each individual's unique way of responding to the different learning contexts. By scoring a person's learning style in each of the eight learning contexts (See Appendix 8), we can create a picture of how flexibly they move around the regions of the ELT learning space. This information coupled with one's learning style can provide a fuller picture of how one learns in different life situations and identify developmental needs for flexible adaptation to different learning demands.

To illustrate a profile of a person with a high LFI score along with excerpts from his self-analysis of how he learns is shown below (This report was written to describe the learning style results he was given and did not include his LFI score feedback). This is followed by the profile of another person with a low LFI score and excerpts from his self-analysis of how he learns. Figure 22 shows the LFI contextual learning style results for Mark, a mid-forties executive for an international non-profit organization, who had a high LFI score at the 98$^{th}$ percentile. Mark's learning style on the KLSI was Balancing but his high learning flexibility is shown by his use of Initiating, Experiencing, Thinking and Analyzing styles in different contexts. Thus Mark shows flexibility in all four learning modes in response to the learning demands of different situations.

**Figure 22.**




Mark's self-analysis provides support for this portrait of his learning flexibility. He mentions how taking the KLSI was difficult because his preference for all of the learning modes made ranking choices difficult:

> *I had a difficult time answering the LSI questions. I have had a difficult time with other types of indicators in the past, including the MBTI. I have wondered at times if maybe I don't know myself very well, but I prefer to think that I am a well-balanced person.*

He then describes how his educational experiences have shaped his ability to operate flexibly in all of the learning regions:

> *As I look back at my educational experience, I can see how I have grown toward the Balancing style. My exposure to a wide variety of learning experiences strengthened my skills in the different learning styles over the years. I majored in civil engineering in college. While I discovered that I didn't like engineering very much, the education strengthened my Deciding skills. Throughout college, I was heavily involved in the campus retreat program and other faith-related activities, which placed a strong emphasis on reflection and finding meaning in concrete personal experience. I believe these experiences strengthened my Imagining skills. After college I volunteered for a year with a Habitat for Humanity affiliate in Alabama. I began the year with almost no construction knowledge but learned to build houses exclusively through hands-on experience. This bolstered my Initiating skills and strengthened my confidence that I could learn through hands-on experience. After practicing engineering for a year and determining that it wasn't for me, I earned a master's*

*degree in Religion and Religious Education. This required a good deal of reading and research, which helped to develop my Assimilating skills. In my career experience since, I have used all of the learning styles at different times and to varying degrees.*

In his current career and personal life Mark prefers variety rather than specialized mastery in one area:

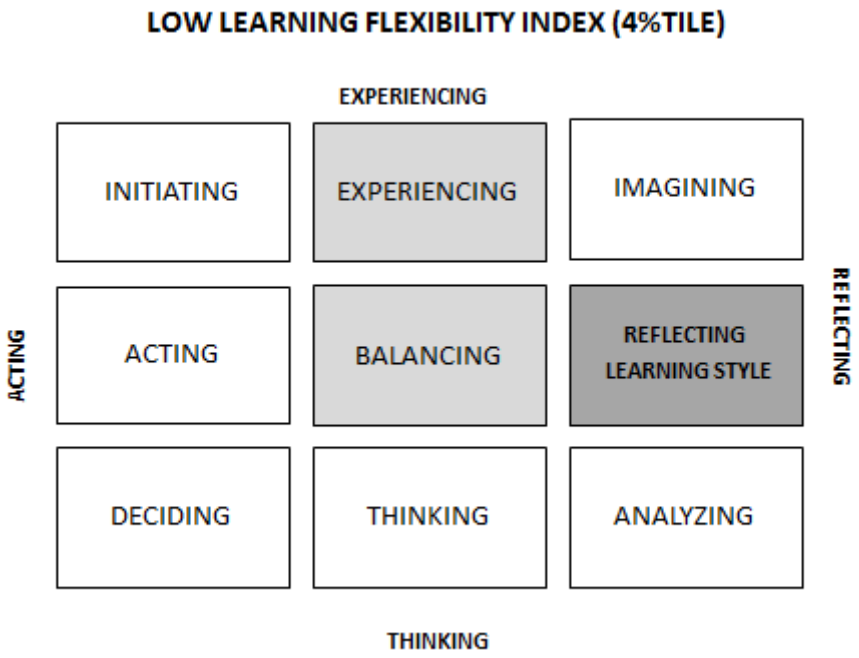
*I am most interested in a career that involves a variety of activities. I have a number of different functions in my current job, from one-on-one coaching to creating informational resources and developing training programs to facilitating trainings and planning meetings. I primarily work alone but also have a good deal of involvement with virtual teams. It is the variety of tasks and the balance of individual and group work that keeps me engaged. There is nothing I do that I would want to spend the majority of my time doing. I think I would become bored quickly. I need a career with variety.*

*In my life outside of work, I have numerous hobbies and interests. I run, play piano and guitar, enjoy traveling, photography and cooking. All of these activities seem to primarily involve learning through active experimentation. I also enjoy reflective activities like art viewing and meditation. I enjoy reading and "thinking" activities like sodoku, brain teasers and math problems. I enjoy personal time but also need interpersonal contact, so I spend a good deal of time with friends, going on dates, and attending social events. As in my work life, I need a wide variety of activities to keep me stimulated. I love learning new things, and I look for new challenges, but it is the variety of activities that I enjoy. I'm not striving for mastery of particular activities. In the past I've wondered why I seem to lack the drive that others have to be the absolute best at one thing. Now I realize that my drive is just as strong, but different. I'm driven to pursue many different interests and learn in a variety of ways.*

The skills that Mark has developed in the different regions of the learning space enable him to adapt to different learning contexts and tasks:

*I find that I am able to adapt my learning style to meet the demands of the task at hand. Because I am comfortable learning in a variety of ways, I am adaptable to different situations and contexts, which makes me a versatile team member. I am generally able to do whatever is needed to get the job done. In addition, I tend to pick up new skills or concepts quickly. I have learned that if I give conscious thought to my learning processes and am deliberate about moving through the stages, from experience to reflection to thinking to acting, I will become a more proficient learner. I am able to take different perspectives and bridge differences between people with different styles. In group settings, I can relate to those who want to jump right into action, as well as those who want to spend time processing and planning. I am fairly creative, and in the professional environment often come up with new ideas and solutions to common problems. This skill has earned me the appreciation of colleagues and supervisors. I do at times have difficulty making decisions because my ability to understand different perspectives often makes it challenging to commit to one of my own.*

**Figure 23.**




In contrast, Figure 23 provides an example of someone with a Low LFI score at the 4th percentile. Jason is a minister in his late thirties who recently became the head of a small congregation. His learning style on the KLSI is Reflecting and indifferent contexts he used the Experiencing and Balancing learning style. Jason's emphasis on reflection is important in all learning situations and there is no flexibility in abstraction and only moderate flexibility in action indicated.

In Jason's self-analysis he describes his reflecting learning style:

> *I have both a strong inter-personal orientation and a deep interest in increasing my understanding of the world by way of exposure to models and theories, the more abstract the better. I feel it's also important to note that despite my high level of attraction to both the interpersonal dimension of life and to abstract thinking, I have experienced a stronger sense of competence in the interpersonal arena whereas I have tended to see others who think well in the abstract as possessing a talent that I very much wanted, but did not come by so naturally .Another striking feature of my LSI report is the absolute absence of any preference for the AE side of the transforming experience spectrum. On one level, I think this is accurate in the sense that it reflects very much how I started out in life and who I am at my core. On the other hand, I feel that as I have grown into adulthood, I have made choices that have both grown out of a desire to be more AE oriented and have forced me to live on that side of the spectrum more frequently...when I am confronted with a challenge, my instinctive response remains to attend to lines of relationship and to gather information long before I feel ready to set a goal or take action. It also occurs to me that the more I feel grounded in an understanding on the level of theory or idea, the greater my comfort level with moving into active experimentation.*

Throughout his career, Jason has experienced challenge and stress in dealing with the action demands of his work. His reflective style requires more time for reflection than these situations allow:

> *In terms of implications for my career path, I began my professional journey as an educator working as a teacher and administrator of a pre-K through 8th grade school. Because it was my first real full time position, I didn't have much of a basis for comparing it to anything else. However, I did notice that I was constantly feeling a higher level of stress and anxiety than I had ever remembered feeling in my life. Looking back on that experience in light of the LSI, it strikes me that a position in a school requires a fairly high degree of AE focus. Eight and a half years ago, I made the switch from the school environment to the modest congregation I currently serve. While I have not eliminated stress from my work life, the ratio of moments that feel barely under control to moments when I feel I am making a solid and worthwhile contribution has undergone a profound shift in a positive direction. I have much more time now for both internal and interpersonal reflection which is much better suited to how I most comfortably function in the world. I have probably learned most of what I know about the "Initiating" style through my family experience and it has continued to feel like a stretch to me. As a "Imagining type", I think it would be helpful if in my family we could set aside some regularly scheduled time for a family meeting so that I could get beyond the constant sense that millions of decisions need to be made on the fly.*
>
> *The challenge here feels like more than mere lack of preference for or experience with the particular skill set involved. It feels like a deeper psycho-emotional discomfort with the experience of being at the center of things and of seeing myself as a or "the" driving force for an event or an organization. In meetings, I tend to sit back and listen and often even wait for someone to ask me a question before I open my mouth, but I have repeatedly received feedback from my lay leadership that they would like to hear more from me outside of the formal context of sermons and service leading.*

Rather than moving into the acting region of the learning space to deal with the action demands of his job, Jason uses his learning style strengths of reflection and abstraction to plan and set priorities in order to reduce the stress he feels in action and leadership positions.

> *I will begin to incorporate a weekly template of tasks and appointments into my planning process. Having this template will help to keep me from over scheduling myself, and it will also help to mitigate my tendency to allow meetings to last until the person I'm meeting with decides that it's time for them to go. Additionally, this template will contain built in time for stress reduction instead of going straight from one thing to the next and it will have time clearly set aside for preparation processes so that I do not find myself preparing for so many things at the last minute. Even though I actually fly fairly well by the seat of my pants, I usually feel less good about the job I do compared to when I give myself adequate time to prepare beforehand.*

The above cases illustrate how the LFI contextual learning style analysis relates to the lives of a high and low flexibility person. Coupled with learning style results the LFI can

give learners a rich portrait of how they learn in the many contexts of their life. By using the examples that they created to answer the LFI questions, individuals can plan strategies to deal with these real learning situations.

**Conclusion and Implications**

We have described the development of the Learning Flexibility Index and a measure of learning flexibility based on the Kendall's W statistic. We have shown construct validity for the LFI measure by testing six hypotheses about the place of the LFI in a nomological net. The LFI is negatively related to age and educational level. Women and those in concrete professions tend to be more flexible. Individuals with an assimilating learning style tend to be less flexible. Learning flexibility is positively related to Akrivou's Integrative Development Scale. Finally, the case study of an individual with a high LFI score illustrates how learning style and learning flexibility can combine to produce unique patterns of adaptation to different learning contexts.

From a practical perspective, the results portray an interesting pattern. Individuals who are men, older, highly educated, and specialists in abstract, paradigmatic fields are more assimilative in learning style and have less learning flexibility. The results further suggest that it is the orientation toward abstraction and reflection characteristic of the assimilative learning style that lead to inflexibility. Since it is the assimilative style that is the most favored and most developed in formal education systems, we might ask if this abstract approach is producing the unintended negative consequence of learning inflexibility. Emphasis on conceptual learning at the expense of contextual learning may lead to dogmatic adherence to ideas without testing them in experience, what Whitehead called "the fallacy of misplaced concreteness". Contextual learning approaches like experiential learning (Kolb, 1984), and situated learning (Lave, & Wenger, 1991) may help education to nurture integrated learners who are as sensitive to context as they are to abstract concepts.

A related issue concerns the priority placed on specialized over integrative learning in education. Specialization in subject matter and the learning style most suited to learning it may well produce higher levels of specialized mastery. Mainemalis et al. (2002) found that specialized learning styles led to greater development of learning skills related to the specialization than did balanced learning styles. We saw how Mark in the above case study was concerned that his balance and flexibility in learning kept him from achieving mastery in one particular area. However, learning flexibility leads to integrative development and perhaps greater personal fulfillment, better work-life balance and a broader, more tolerant and holistic perspective on the world. These too are important aims of education.

. The concept of learning flexibility shifts the focus from specialized development to the process of movement through all modes of the learning cycle. This holistic process oriented approach that combines a matching strategy with a corresponding emphasis on increasing learning skills in non-dominant learning styles may well prove to be the most effective educational strategy. Teachers can respond to the diversity of learning styles present in nearly every classroom by teaching around the cycle using approaches that fit with all four learning modes.

The Learning Flexibility Index provides a validated tool for investigating the important role that learning flexibility plays in education, management and personal development. Even the most specialized educational program has a curriculum that requires learning subject matter with different learning style demands. When we consider liberal education and multidisciplinary programs there are even greater demands for learning flexibility. In the contemporary management and leadership literature there are consistent calls for adaptability and flexibility in coping with the continually changing dynamics of the global community. Similarly, individuals throughout their lives face a multitude of learning and problem solving tasks that require a flexible approach in learning how to deal with them. The LFI can provide a self-development tool for individuals to understand their learning flexibility in order to become more effective learners and progress from specialization to integration in adult development.

## 7. EXPERIENTIAL LEARNING THEORY RESEARCH BY DISCIPLINE

Since its first statement in 1971 (D. Kolb, 1971; D. Kolb, Rubin, & McIntyre, 1971), there have been many studies using ELT to advance the theory and practice of experiential learning. Because ELT is a holistic theory of learning that identifies learning differences among academic specialties, it is not surprising to see that ELT research is highly interdisciplinary, addressing learning and educational issues in many fields.
Research on ELT has increased dramatically in recent years, tripling in number since 2000. The 2013 Experiential Learning Theory Bibliographies (Kolb & Kolb, 2013 www.learningfromexperience.com ) include 3564 entries.

The ELT holistic approach proposes that learning interventions that foster all four learning modes result in more effective learning outcomes. The holistic approach engages all learners by appealing to their preferred style at some point in the learning process, thus providing a way for all learners to enter the cycle. Additionally, a holistic approach enhances the learner's flexibility in enacting different styles over time, as well as increasing learning comprehension and retention. In this respect, the primary purpose of the LSI and ELT is to increase individuals' understanding of the process of learning from experience and their unique individual approach to learning. By providing a language for talking about learning styles and the learning process the inventory can foster conversation among learners and educators about how to create the most effective learning environment for those involved. There have been many studies that have used ELT and the LSI in this way to improve the learning process in education.

The following section summarizes the selected studies of experiential learning method and the LSI applied in thirty different professions and academic disciplines. The studies reported here cover a broad range of applications using ELT and the LSI. Some studies have used the LSI and the experiential learning cycle to understand and manage differences between students and faculty learning styles. Some educators have used an experimental design to compare the effectiveness of an experiential learning method with a more traditional course format, whereas others have developed and implemented instructional methods using the experiential learning model as a framework. While instructional strategies and methods were designed to fit the academic requirements of a specific field, many of the experiential activities reported in the studies can be broadly applied to different fields with adequate modifications.

### *Accounting*

There has been considerable interest in ELT/LSI research in accounting education, where there have been two streams of research activity. One is the comparative assessment of learning style preferences of accounting majors and practitioners, including changes in learning style over the stages of career in accounting and the changing learning style demands of the accounting profession primarily due to the introduction of computers. Other

research has been focused on using ELT to design instruction in accounting and studying relationships between learning style and performance in accounting courses.
In 1991 Stout and Ruble reviewed ELT/LSI research in accounting education. Reviewing the literature on predicting the learning styles of accounting students they found mixed results and concluded that low predictive and classification validity for the LSI was a result of weak psychometric qualities of the original LSI and response set problems in the LSI 1985. They tentatively recommended the use of the randomized version proposed by Veres, Sims, and Locklear (1991). They write, "researchers who wish to use the LSI for predictive and classification purposes should consider using a scrambled version of the instrument", and note, "…it is important to keep in mind that assessing the validity of the underlying theoretical model (ELT) is separate from assessing the validity of the measuring instrument (LSI). Thus, for example, the theory may be valid even though the instrument has psychometric limitations. In such a case, sensitivity to differences in learning styles in instructional design may be warranted, even though assessment of an individual's learning style is problematic" (p. 50).

Siegel, Khursheed, and Agrawal (1997) conducted a controlled field experiment to test the effectiveness of video simulation as a way to integrate experiential learning theory in the teaching of auditing in their accounting course. The videotape used in the experiment followed the principles of experiential learning in teaching the fundamental steps in auditing. The experiment involved four sections of an undergraduate course in auditing. Two sections were used as control groups and others two as the experimental group. The instructor presented the videotapes at various times during the semester to the experimental group while no videotape presentation was made to the control group. Both groups were given identical assignments, problems, and lecture material covering audit procedures and concepts. Examinations were scheduled and administered to both sections at the same time. The results of the experiment indicated significantly higher examination scores for the experimental groups supporting the value of experiential learning for improving effectiveness in teaching auditing. In auditing courses, the authors suggest, the initial learning phase, concrete experience is often missing from the learning process.

Specht (1991) examined the effect of an experiential learning method in student learning in an undergraduate accounting course compared to another class conducted using a traditional lecture method. The results were measured by quizzes in both classes to compare the students' knowledge of concepts, both specific and general, directly after the class and 6 weeks after the learning activities have taken place. The results revealed no significant differences in short-term learning between the two course formats; however the experiential class demonstrated retention of knowledge over a 6-week period whereas a significant decrease in the scores of the lecture class was observed. The authors concluded that students in the experiential learning classroom may have formed a better understanding of the concepts thus successfully retaining knowledge better than students in the lecture class.

In applying experiential learning in his accounting course Umapathy (1985) underscores the importance of the role of the experiential instructor for a successful adoption and implementation of experiential learning curricula. Experiential exercises have proven to be effective in generating considerable student involvement and participation in the learning

process with increased student capacity to retain knowledge for a longer period of time. However, for the experiential curricula to be effective the instructors need to be properly trained in the design and delivery of the experiential activities if both instructors and students are to be benefited from the experience.

### *Agriculture*

Baker, Blackburn and Robinson (2011) conducted an experimental study to determine the effects of order of abstraction and type of reflection on student knowledge acquisition. Students were assigned randomly to one of four treatment combinations in the completely randomized 2x2 design which included either abstraction prior to, or after an experience, and either reflection-in-action or reflection-on-action. A Lab-Aids® inquiry-based kit centered on the principles of biofuels served as the content for the treatment. The findings of this study indicate that order of abstraction does not have a statistically significant effect on knowledge acquisition scores, but that reflection-in-action did have a statistically significant effect on the increasing students' knowledge of the selected biofuel concepts. The authors recommend that teachers, at both the secondary and university level, focus on effective strategies of reflection-in-action to draw deeper, more enduring learning from students' experiences in agricultural education.

### *Anatomy*

Bentley and Pang (2012) piloted a novel teaching curriculum to yoga practitioners, based on Bruner's Theory of Instruction, which incorporated the four adaptive modes of experiential learning theory. Following the development of a curriculum appropriate for a spectrum of academic backgrounds, participants were recruited to attend a 2-hour learning session within the Department of Anatomy at Queen's University in Kingston, Ontario, Canada. The learning session guided participants through the bones and muscles of the lower limb pertaining to five specific yoga poses. Based on participant feedback, the sessions were positively received and consistent. In addition,
participants were able to apply the anatomical information they were taught to their yoga practice 1-month later. Bruner and Kolb's independent theories on curriculum design and effective learning practice were successfully incorporated to create a 2-hour learning session

### *Arts Education*

In her book dedicated to building a bridge between art inquiry and student processes of self-understanding, Rasanen developed a model of experiential art interpretation in which students reflect and construct aesthetic meaning through an integration of art history, criticism, and aesthetics guided by the experiential learning model. The author suggests that, "experiential art interpretation increases students' expressive skills and results in products that are meaningful both to their makers and others." (1997: 9)

***Business and management***

ELT/LSI research was first published in management and there has continued to be substantial interest in the topic in the management literature. Studies can be roughly grouped into four categories--management and organizational processes, innovation in management education, theoretical contributions to ELT including critique, and psychometric studies of the LSI. Cross-cultural ELT/LSI research has been done in Poland, New Zealand, Australia, Canada, UK, and Singapore. In the management/organization area, organizational learning is a hot topic. Dixon's (1999) book *The Organizational Learning Cycle* is an excellent example. Another group of studies has examined the relationship between learning style and management style, decision-making, and problem solving. Other work has measured work related learning environments and investigated the effect of a match between learning style and learning environment on job satisfaction and performance. ELT has been used as a framework for innovation in management education including research on matching learning styles and learning environments, program design and experiential learning in computerized business games (e.g., Boyatzis, Cowen, & Kolb, 1995; Lengnick-Hall & Sanders, 1997).

Certo (1976) designed series of experiential training activities for an undergraduate management course based on the four dimensions of the learning cycle. In conducting those activities, the instructor assumed the role of an experiential facilitator by "encouraging high levels of student participation; creating a learning environment conducive to learn new behaviors; providing theoretical clarification; and emphasizing both content and process" (Certo 1976: 22). In a later study he further articulates the value of experiential learning as a methodology of education that focuses on the whole person and emphasizes the critical role of the facilitator as an active experiential instructor who blends with a proper balance experience, reflection, conceptualization, and action in the classroom activities (Certo, 1977).

In order to respond to mounting criticism of the inadequacy of business education Sims & Sauser (1985) proposed experiential learning model as a theoretical basis to design management curricula intended to develop managerial competencies in business students. The authors offers seven core principles that need to be in place if such curricula are to be successfully implemented; 1. ability to face new situation and problems; 2.emphasis on both theory and practice; 3.opportunity to have a direct managerial experience; 4. relevant and reliable assessment methods; 5.effective feedback; 6. increased self-knowledge; and 7. reflection and integration as a key final step in the acquisition of competency.

In designing his organizational communication course, Pace (1977) emphasizes the relevance of experiential pedagogy that gives primacy to learners' experience, action, and opportunity for the students to test out their newly learned concepts and theories.

In his organizational behavior course McMullan& Cahoon (1979) applied Kolb's (1971) experience–based learning evaluation instrument. The Personal Application Assignment (PAA) was designed to raise student awareness of the distinct learning process involved at each step of the learning cycle. For example, students often have difficulty in differentiating objective experiences from personal reactions to those experiences. Similarly, the tendency to focus only on personally useful concepts makes it difficult for students to discriminate between abstract conceptualization and active experimentation in a given

situation. By discriminating between the abstract conceptualizing and the active experimentation students will be forced to clarify the implicit assumptions and values that guide their actions. The PAA requires students to rigorously evaluate their own learning process and encourage behavioral patterns that lead to meaningful and purposeful actions. Such rigorous examination of one's learning process was foreign to most of the students and consequently frustrating to many. PAA activities made the familiar and obvious way of learning uncertain and problematic for most of them. As the authors suggest, "such a situation is ripe for learning, challenging students to move beyond the safety of their predictable and familiar ways of learning." (McMillan and Cahon, 1979: 457).

Lipshitz (1983) designed and implemented an experiential behavioral science course in the Israeli Military Academy focused on the development of problem-solving, decision-making, and crisis-management in their officers. The aims was to use the experiential learning model to counter the organizational environment of the Israeli Defense Force characterized by overall, "lack of proper training, job pressures such as uncertainty and overload, competitiveness coupled with high regard for results, preference of action coupled with dislike of reflection, and preference for the concrete coupled with distrust of the abstract." (Lipshitz 1983: 125). A key finding from the experiential courses was that the success of the course was largely a function of the instructor, as students' reactions ranged from enthusiasm to deep disappointment. The instructors skilled in integrating the content of the course and the learning process were able to generate high level of satisfaction and achievement in their students. In those successful courses, there was a shift from the student tendency to analyze a case study purely in terms of its outcome to a more careful and thoughtful attention given to the problem solving and decision making process embedded in the case.

Lengnick-Hall and Sanders (1997) designed a learning system in the graduate and undergraduate level management courses structured around the learning cycle to give students a variety of ways to master each segment of the course material. Results indicate that despite their wide variety in learning styles, experiences, academic levels, and interests, students demonstrated consistently high levels of personal effectiveness, organizational effectiveness, ability to apply course materials, and satisfaction with both course results and learning process. The study also showed learning style differences in student ratings of various outcome measures; divergent learners rated their personal effectiveness higher than the non-divergent learners, while assimilating learners rated the lowest on the same outcome measure. Converging learners on the other hand, rated their ability to apply course material significantly higher than did the non-converging learners, an indication of their tendency to seek out opportunities to apply what they have learned. Looking at the positive learning outcomes generated by the courses, the authors contend that high –quality learning systems are ones in which extensive individual differences are matched with variety of options in learning methods thus creating opportunities for student behavioral, emotional, and intellectual transformation of a lasting impact.

Gopinah & Sawyer (1999) developed a computer-based enterprise simulation based on experiential learning in a business course to bridge the gap between knowledge and its

application in the business world. The results of the simulation show that the recursive nature of experiential learning promotes strategic decision-making and group behavior consistent with long term strategy.

Gilmore and Anderson (2012) conducted an analysis of the use of experiential learning in management education context dominated by the demand for learners' successful attainment of requirements and qualifications of a professional body. This study shows the tension occurring between experiential learning methods and the 'expert knowledge' requirements of professional bodies. The anxiety generated by this tension can stimulate meaningful learning outcomes but the findings also indicates that learning inaction is also possible, where tutors are unable to hold a learning space to balance the tension arising from experience-based learning methods and expert knowledge demands.

Hoover, Giambatista, and Belkin (2012) explored the concept of vicarious observational learning as a component of an experiential learning sequence. The authors compared measures of task performance when participants observe a task before engaging in direct experience versus immediate direct experience without observation. Two experimental studies were conducted using different types of tasks and different levels of performance analysis. Support was found for the hypothesis that experiential learning sequencing, with vicarious observation preceding direct experiential learning, enhances classroom performance. The benefits of vicarious observational learning to direct experience sequencing appeared to be generally robust across task types and levels of analysis.

Beyes and Michels (2011) suggest the need for rethinking management education and fostering a spatial understanding of educational practices. They propose Foucault's notion of heterotopic space and the spatial thought of Lefebvre into the debate about the current and future state of business schools. In particular, they conceptually and empirically discuss the potential for understanding space in a way that addresses its productive force, its multiplicity and its inherent contradictions. Using the example of an experimental teaching project dedicated to the conception and physical design of a city of the future, they reflect upon the possibility of the emergence of 'other', heterotopic spaces within an institution of management learning. Findings suggest that spatial interventions facilitate critically affirmative engagement with the business school by offering an imaginative approach to management education.

Kark (2011) explores the role of play in leadership development processes. Drawing on theories of leader and leadership development and theories of play, she developed a conceptual framework, suggesting that play can contribute to different components of leader and leadership development processes (i.e., leadership identity, cognitive abilities, and behavioral skills). Furthermore, the role of creating safe play spaces in leadership development processes is highlighted. The discussion examines the implications and applications of play for leadership development processes, points to the dangers of misuse of play, and outlines directions for further empirical research.

Li, Lee, and Law (2012) examine the role of information and communication technology (ICT) applications in management learning and development in hospitality

organisations. Managers who search for authentic social knowledge are most likely to use learning management systems, company intranets, email applications and search engines. Managers who look for personal knowledge are most likely to select search engines, online audio or video communication applications, telephone conferencing and customer online community websites. This study provides evidence that e-learning practices in management development do not fully support managers' learning. The paper lastly offers solutions to address this mismatch.

London and Hall (2011) suggest that while traditional instruction is instructor-driven, generative learning is learner-driven, collaborative, and problem-focused. Web 2.0 technologies can support both types of learning but are especially valuable for generative learning. In this article the author reviews learning processes and Web 2.0 capabilities, describes two case examples, outlines ways to design Web 2.0 training applications, and discusses the changing role of learning professionals from delivering structured, one-way adaptive learning to designing and facilitating generative learning opportunities. The article concludes with ideas for corporate education and research on Web 2.0-based learning processes, including utilizing the technology to track and improve learning.

***Biology***

In his book, “The Art of Changing the Brain”, Zull (2002) offers a link between the experiential learning cycle and the structure of the brain. Learning requires experience, reflection, developing abstractions, and active testing of the abstract ideas in the real word.

The cyclical learning process depicted in the learning cycle, argues Zull, naturally arises from the structure of the brain; the concrete experience comes through the sensory cortex, reflective observation involves the integrative cortex at the back, creating new abstract concepts occurs in the frontal integrative cortex, and active experimentation involves motor brain.

Bauerle and Park (2012) developed an experiential learning based undergraduate plant science course to provide students across a broad range of majors with an in-depth study of plant science both basic and applied. The authors examined whether experiential learning improved homework scores among students who participated in a field trip by asking if simply attending the field trip increased the homework score or if participation in the tree climbing exercise had any additional benefit. The results show participating in a field trip experience when coupled with a homework assignment increased student homework scores. Moreover, the tree-climbing portion of the field trip increased homework scores particularly for students not in a science major. This study supports experiential learning and the value of field trips within science courses focused on a comprehensive exploration of plants.

Antle et. al. (2011) introduced a collaborative learning game called Futura: The Sustainable Futures Game, which is implemented on a custom multi-touch digital tabletop platform. The goal of the game was to work with other players to support a growing population as time passes while minimizing negative impact on the environment. The design-

oriented research goal of the project was to explore the novel design space of collaborative, multi-touch tabletop games for learning. The focus of the investigation was to identify and understand key design factors of importance in creating opportunities for learning. The authors use four theoretical perspectives as based analysis. These perspectives were: experiential learning, constructivist learning, collaborative learning, and game theory. In this paper they discuss design features that enable collaborative learning, present the results from two observational studies, and compare findings to other guidelines in order to contribute to the growing body of empirically derived design guidelines for tangible, embodied and embedded interaction.

***Computer and Information Science***

The LSI has been used widely in computer and information science particularly to study end-user software use and end-user training (e.g., Bostrom, Olfman, & Sein, 1990; Davis & Bostrom, 1993). Other studies have examined the relationship between learning style and problem solving and decision-making, online search behavior, and performance in computer training and computer assisted instruction. In recent years, there has been a significant focus on designing e-learning systems that deliver educational experiences that meet the learning goals, needs, and interests of the individual learners.

Spring (2012) promotes experiential learning cycle as a useful theory when planning information literary or other teaching sessions. The author then considers how the concept of learning styles can be utilized when planning teaching and learning activities.

Shaw (2012) conducted a study focused on the relationships among learning styles, participation types and learning performance in a programming language learning course supported by online forum for supporting the students' social activities and participation. Kolb's learning style inventory was used in this study to determine a learner's learning style. Social Learning Theory was also used to define four participation types: replier, asker, watcher, and no activity. Additionally, learning score and satisfaction were used to measure learning performance. The results of this study were the following: (1) different learning styles were associated with significantly different learning scores and that the accommodator style was associated with superior learning scores; (2) participation types were also associated with significantly different learning scores and that the replier type is associated with superior learning scores; (3) learning satisfaction is not significantly different among the different learning styles or different participation types, but the average is significantly higher than average values (3.5) of 7-point Likert scale; (4) there is no significant association between learning styles and participation types. Based on the results of this study, the author proposes that programming language learning, supported with online forums and students' active participation, increases learning performance as measured by student learning scores.

Klasnja-Milicevic, Vesin, Ivanovic, and Budimac (2011) contend that personalized learning occurs when e-learning systems make deliberate efforts to design educational experiences that fit the needs, goals, talents, and interests of their learners. Researchers had recently begun to investigate various techniques to help teachers improve e-learning systems. In this paper, the authors describe a recommendation module of a programming tutoring system - Protus, which can automatically adapt to the interests and knowledge levels of

learners. This system recognizes different patterns of learning style and learners' habits through testing the learning styles of learners and mining their server logs. Firstly, it processes the clusters based on different learning styles. Next, it analyzes the habits and the interests of the learners through mining the frequent sequences by the AprioriAll algorithm. Finally, this system completes personalized recommendation of the learning content according to the ratings of these frequent sequences, provided by the Protus system. Some experiments were carried out with two real groups of learners: the experimental and the control group. Learners of the control group learned in a normal way and did not receive any recommendation or guidance through the course, while the students of the experimental group were required to use the Protus system. The results show suitability of using this recommendation model, in order to suggest online learning activities to learners based on their learning style, knowledge and preferences.

Akbulut and Cardak (2012) contend that implementing instructional interventions to accommodate learner differences has received considerable attention. Among these individual difference variables, the empirical evidence regarding the pedagogical value of learning styles has been questioned, but the research on the issue continues. Recent developments in Web-based implementations have led scholars to reconsider the learning style research in adaptive systems. The current study involved a content analysis of recent studies on adaptive educational hypermedia (AEH) which addressed learning styles. After an extensive search on electronic databases, seventy studies were selected and exposed to a document analysis. Study features were classified under several themes such as the research purposes, methodology, features of adaptive interventions and student modeling, and findings. The analysis revealed that the majority of studies proposed a framework or model for adaptivity whereas few studies addressed the effectiveness of learning style-based AEH. Scales were used for learning style identification more than automatic student modeling. One third of the studies provided a framework without empirical evaluation with students. Findings on concrete learning outcomes were not strong enough: however, several studies revealed that suggested models influenced student satisfaction and success. Current trends, potential research gaps and implications were discussed.

Aljojo, Adams, Saifuddin, and Alsehaimi (2011) present an approach to integrate learning styles into adaptive e-learning hypermedia system and an approach to evaluate the impact of such a learning system. The main objective was to develop an adaptive e-learning system based on individual student's learning style, then to try and assess the effectiveness of the system on the students' learning. From a technical perspective, the system development involved the combination of SQL server 2005, SQL database and Active Server Pages were used to implement the system based on learning styles to present the appropriate subject matter, including the content, Teaching strategies and Electronic Media. The system was organized into 3 models; domain model, learner model and adaptation model. The 3 models interact together to perform adaptively. From an experiment design perspective, experiments involved applying using the system on two cohorts of students and evaluating the impact on learning achievement. Inferential statistics were applied to make inferences from the sample data to more general conditions. Descriptive statistics were applied simply to describe what's going on in the sample data. Results showed that students taught using learning style adaptive system performed significantly better in academic achievement than students taught

the same material without adaptation to learning style. Measuring the effect of providing educational experiences individualized to the learning style of the students is an open research issue: There are many potential influences on any learning achieved other than the adaptive learning system. The authors hope to make contribution by presenting a case study of a dedicated adaptive educational system and providing guidance and discussion on both development issues and how to evaluate the effectiveness of an adaptive learning system. First, the adaptation logic, methods and techniques employed in the system, the Teacher Assisting and Subject Adaptive Material (TASAM), are briefly presented. Next, the validity and effectiveness of the system are assessed by means of an empirical evaluation approach, involving experiment with 53 undergraduate students of the Arts and Humanities faculty at the King Abdul-Aziz University in Saudi Arabia. The results obtained are analyzed and discussed. This paper covers Test-Retest Reliability of student`s first evaluation survey, result of Student`s First evaluation Survey and the final evaluation and assessment of the adaptive learning system by students. The findings support the use of learning styles as guideline for adaptation into the adaptive e-learning hypermedia systems. This paper provides discussion and guidance on how to evaluate the impact of adaptive learning systems. The overall results of the experimental study indicate a positive effect of adaptation to learning styles on the learning process.

***Dentistry***

Alcota, Munoz, and Gonzalez (2011) conducted an educational intervention to diagnose the learning style of a group of low marks (i.e., grades) dental students in Chile and improve their academic achievement by means of remedial teaching. The intervention group was composed of ten students in endodontics and eleven in pedodontics with low marks. These two groups were mutually exclusive. The Kolb learning styles test was applied to the low mark students group and to the rest of the class (n=72). Diverse methodologies were applied to the low marks students, such as seminars, case-based learning and problem-based learning, directed study, plenary discussions and debate, integration and questions, and web-based learning in an effort to cover all learning styles. Students' perceptions of the educational intervention were assessed by means of a questionnaire. The learning styles of the low marks group were mainly divergent (52.4 percent) and convergent (19 percent). Accommodators and assimilators were 14.3 percent each. The rest of the class showed a very distinct frequencies distribution: divergent 18 percent, convergent 20 percent, accommodators 28 percent, and assimilators 34 percent. After the educational intervention, the mean of the scores obtained by the intervention group in formal evaluations was higher than the average scores obtained before the intervention for both courses. Students' perceptions of the activities were that they were effective for their learning process (76 percent) and that the teaching methodologies were useful mainly to clarify concepts and contents from both courses (82 percent). The authors concluded that the use of diverse and participative teaching methodologies in a remedial teaching intervention, to cover all the different learning styles of the students, contributes to improve their marks in formal evaluations.

Kanthan and Senger (2011) studied the students' awareness and understanding of the reflective process and the meaning of 'self-reflection' within the contextual framework of

their learning environment in the first-year of their medical/dental education. Over two years, students registered in first-year pathology at the University of Saskatchewan were introduced to a self-reflection assignment which comprised in the submission of a one-page reflective document to a template of reflective questions provided in the given context of their learning environment. This was a mandatory but ungraded component at the midterm and final examinations. These documents were individually analyzed and thematically categorized to a "5 levels-of-reflection-awareness" scale using a specially-designed rubric based on the accepted major theories of reflection that included students' identification of: 1) personal abilities, 2) personal learning styles 3) relationships between course material and student history 4) emotional responses and 5) future applications. Four hundred and ten self-reflection documents were analyzed. The student self-awareness on personal learning style (72.7% level 3+) and course content (55.2% level 3+) were well-reflected. Reflections at a level 1 awareness included identification of a) specific teaching strategies utilized to enhance learning (58.4%), b) personal strengths/weaknesses (53%), and c) emotional responses, values, and beliefs (71.5%). Students' abilities to connect information to life experiences and to future events with understanding were more evenly distributed across all 5 levels of reflection-awareness. The authors concluded that the exposure to self-reflection assignments in the early years of undergraduate medical education increases student awareness and promotes the creation of personal meaning of one's reactions, values, and premises in the context of student learning environments. Early introduction with repetition to such cognitive processes as practice tools increases engagement in reflection that may facilitate proficiency in mastering this competency leading to the creation of future reflective health professionals.

***Economics***

McGoldrick, Battle, and Gallagher ( 2000) developed a managerial economics course based on experiential methods applied to one form of service learning, student-based instruction. Service learning is an example of an experiential activity many educators have embraced as a valuable venue to link the theory and its application to the real world (Rubin, 2000; Stanton, and Grant, 2000). While service learning creates powerful learning opportunities for students outside of the classrooms it also introduces new challenges to properly assess those learning experiences and outcomes. The service learning course was aimed at engaging business students in a student-based instruction project as an opportunity for them to master some fundamental economic concepts by teaching these concepts to second and third grade elementary school children. The project was highly structured to respond to the high degree of coordination needed between faculty, students, and grades school teachers. Students were required to form teaching groups, choose their economic topic and lesson, coordinate a teaching time and location, complete their lesson plan, turn in all required materials, and were asked to follow a strict deadline for the completion of each component of the project. To assess the impact of student-based instruction on the economic student, each individual student was required to complete a two to five page reflective summary of their teaching experience consisting of two main components: (1) a description of the lesson and the teaching environment, (2) a presentation of their opinion on the “success” of the project. In addition to students’ reflective summaries, each teacher was asked to complete an evaluation form to assess the overall performance of each individual student as well as to offer their perspective on the quality of the experience for the children.

As an experiential activity outside the classroom, student based-instruction has a number of positive learning outcomes for students, teachers, and faculty, concluded the authors. The students need to master the basic economic concepts as well as develop lesson plans appropriate to the intellectual level of their young audience. The teachers benefit from an exposure to alternative lesson topics to teach young children and take advantage of the resources available to support their classroom activities. The school children gain knowledge about the world in which they live through examples of the economic decision making process drawn from the most basic aspects of everyday life. Finally, by expanding their learning activities into the real world college professors can enrich their students' experiences which cannot be replicated in the classrooms. The main challenge to the student-based instruction project is the significant start up costs involved. Still the project is worth the effort, contend the authors, given the support that can be drawn from outside organization and "the potential for self perpetuation once a network of local school teachers are enlisted." ( McGoldrick, Battle, and Gallagher 2000: p. 49)

***Education***

The education category includes the largest number of ELT/LSI studies. The bulk of studies in education are in higher education (excluding professional education in the specific fields). K-12 education accounts for a relatively small number, as it does adult learning alone. However, in many cases adult learning is integrated with higher education. A number of studies in the education category have been done in other cultures--UK, Canada, Australia, Finland, Israel, Thailand, China, Melanesia, Spain, Malta, and American Indian.

Many of the studies in higher education use ELT and the LSI as a framework for educational innovation. These include research on the matching of learning style with instructional method and teaching style and curriculum and program design using ELT (e.g., Claxton & Murrell, 1987). A number of publications assess the learning style of various students, faculty and other groups. Other work includes theoretical contributions to ELT, ELT construct validation, LSI psychometrics and comparison of different learning style assessment tools. In adult learning there are a number of publications on ELT and adult development, moral development, and career development. The work of Sheckley and colleagues on adult learning at the University of Connecticut is noteworthy here (e.g., Allen, Sheckley, & Keeton 1992; Travers, 1998). K-12 education research has been primarily focused on the use of ELT as a framework for curriculum design, particularly in language and science. (e.g., McCarthy, 1996; Hainer, 1992)

Svinicki and Dixon (1987) published an influential paper describing a comprehensive instructional model to deal with the constraints and challenges instructors and students encounter in adopting experiential learning as an instructional design framework. The instructional design model incorporates a broad range of classroom activities that lead students through the full cycle of learning, thus giving instructors a rich array of instructional choices that give students a more complete learning experience gained from multiple learning perspectives. It broadened the scope of application of experiential activities to a wide range of academic fields by illustrating possible course design options suited to the

learning objectives of different disciplines. Using the model instructors are able to design their classroom activities based upon how much student involvement would be appropriate given the time constraints most instructors face. The model has been successfully applied in various academic fields such as Geography (Healey and Jenkins, 2000), Theatre (Grassler, 2002), and Political Science (Brock and Cameron, 1999) and affords instructors great flexibility in designing courses based on the specific educational goals, knowledge and skill demand of their academic discipline.

As part of a counseling curriculum, Pelsma & Borgers (1986) developed an experience-based ethics course around the experiential learning cycle with focus on the "how" rather than "what" of learning. The authors suggest that the emphasis on four modes of the cycle promotes learning and development of skills for a responsible, ethical reasoning.

Sugarman (1995) promotes the usefulness of the experiential learning model for curriculum planning, implementation, and evaluation in the counseling field. The experiential learning framework, the author contends, help students expand their repertoire of learning skills thorough the conceptualization of the total learning process.

Hatcher and Bringle (1997) report the effectiveness of the learning cycle to design reflection activities in the service learning settings.

McGlinn (2003) used experiential learning cycle in the teacher education program emphasizing the reflective component of the cycle to overcome students' lack of reflection on their teaching. The author claims that experiential learning model is effective in promoting change and development in students' self-knowledge about their teaching practices by providing time for reflection.

Shein, and Chiou (2011) Examined the likelihood that students will identify with a particular teaching model over other competing models. The modeling advantage, a concept developed by Chiou and Yang (2006) was used to examine the likelihood that students will identify with a particular teaching model over other competing models. In this research we examined the effects of 2 kinds of teaching styles on students' learning styles during the collaborative teaching of technical courses. Undergraduates in a 1-semester course (229 women, 264 men; average age = 20.8 years, SD = 1.5) were given pretests and posttests to investigate how their learning styles related to their teachers' learning styles. The findings showed that the learning styles of students were associated with their role models, which reinforced Chiou and Yang's previous work with undergraduates in different subject areas. After a semester, the learning styles of students became congruent with those of their role models.

Kablan (2012) utilized a relational survey model that determines the effects of the theoretical and applied studies on skill of the principles and methods course on teacher candidates. The study had two basic aims: the first aim was to determine the effects of the theoretically-oriented cognitive learning, which was acquired based on instructors' lecture, and the level of concrete experience provided by microteaching applications, which are adopted from Kolb's learning model, on the skills of lesson plan preparation and application.

The other aim was to test the mediating effect of the skill of lesson plan preparation on the relationship between the application of lesson plan and cognitive learning with concrete experience.
The research used the scores of 96 teachers who were sophomores at the department of Teaching Mathematics at Primary School at Kocaeli University. The result indicates that, in terms of regression value, lesson plan preparation was affected more by theoretical learning; and lesson plan applications were affected more by concrete experience. It was also found that lesson plan preparation skill is an important mediating variable.

Kinchin and Miller (2012) reports a study in which in an attempt to reveal potential threshold concepts in the field of higher education pedagogy, groups of university teachers (in the UK and in Panama) were encouraged to develop personal reflection upon their conceptions of teaching. This was initiated through concept mapping activities. It was hoped that this would help participants to address the perceived differences of teaching between their disciplines whilst coming to recognize the generic factors that may be applicable to teaching across the university context. Consideration of emergent personal models allowed the authors to identify common themes across the disciplines and to align this to established learning theories that may act as a baseline for comparison. The emergent generic model was a modification of Kolb's learning cycle in which two learning cycles (one for the student and one for the teacher) are linked by the shared concrete experience of the classroom and considered in the context of knowledge structures. The transformation of the morphology of these knowledge structures (oscillating between linear and hierarchical) is seen as fundamental to the successful negotiation of the cycle. The participants' recognition of this structural transformation is proposed as a threshold concept for the evolution of university teaching. Personal models are described in the study in relation to the double Kolb cycle to illustrate the potential of this approach to stimulate discussion about university teaching that may encourage a transformation in perspective from delivery and receipt of content towards structural transformation of content.

Slavich and Zimbardo (2012) propose transformation learning as a broad classroom instruction approach that unifies seemingly different learning principles and instructional methods strategies that includes active learning, student-centered learning, collaborative learning, experiential learning, and problem-based learning. Transformational teaching involves creating dynamic relationships between teachers, students, and a shared body of knowledge to promote student learning and personal growth. From this perspective, instructors are intellectual coaches who create teams of students who collaborate with each other and with their teacher to master bodies of information. Teachers assume the traditional role of facilitating students’ acquisition of key course concepts, but do so while enhancing students’ personal development and attitudes toward learning. They accomplish these goals by establishing a shared vision for a course, providing modeling and mastery experiences, challenging and encouraging students, personalizing attention and feedback, creating experiential lessons that transcend the boundaries of the classroom, and promoting ample opportunities for pre-reflection and reflection.

Bellotti, Ott, Arnab, Berta, de Freitas, Kiili and & De Gloria (2011) addresses the importance of integration of educational and game design principles and proposes

techniques, methods and mechanisms that allow designers with different background to dialogue among each other and to define games that are able to integrate - by design - entertainment and educational features. In particular, the paper follows a design path that starts from the definition of reference frameworks and then analyses the typical categories of design patterns, before focusing on the user-interaction modalities - seen from a pedagogical point of view - given their relevance for the end-users. In the end, they discuss the sandbox serious game model that looks suited to implement joint pedagogical and entertainment features. They contend that the indications provided in this paper can be useful for researchers and stakeholders to understand the typical issues in SG design and to get inspiration about possible solutions that take into account the need to implement tools that are effective both as an entertainment medium and as an education tool.

Charsky and Ressler (2011) examined students' motivation to learn history concepts while playing a commercial, off-the-shelf computer game, Civilization III. The study examined the effect of using conceptual scaffolds to accompany game play. Students from three ninth-grade classrooms were assigned to one of three groups: one group used an expert generated concept map, one group constructed their own concept maps, and a control group used no map. It was predicted that the use of concept maps would enhance the educational value of the game playing activity, in particular students' motivational levels; however, the opposite happened. Students who used a concept map showed lower motivation on the task relative to their baseline motivation for regular classroom instruction. In contrast, the levels of motivation in playing the game, for students in the control group, met or exceeded their levels of motivation during regular classroom instruction. These results suggest that using a conceptual scaffold can decrease students' motivation to learn classroom material through game play, perhaps because conceptual maps can (a) focus students' attention on the difficulty of learning the concepts and on the extrinsic rewards for playing the game and (b) make game play less autonomous, less creative, and less active. All of these can negate the primary property that provides playing its principal potential pedagogical power: fun.

Chatterjee, Mohanty, Atasi and Bhattacharya (2011) investigated how different components of a computer game-based learning environment might influence the learning outcomes from educational computer games. This paper presents initial findings from an empirical study conducted as part of an ongoing PhD research which aims to explore whether and how factors such as the context of gameplay and individual learner characteristics influence learning. Employing a quasi-experimental design, this study sought to address the following research question: What is the relationship, if any, between the learning outcomes from educational computer games and the pedagogical context within which the games are played? How do differences in learning styles contribute to differences in learning gains from educational computer games? Pedagogical context, for the purpose of this study, comprised two components - facilitator intervention and peer collaboration. Accordingly, four pedagogical contexts were defined: collaborative with active facilitation; collaborative without active facilitation; individualistic with active facilitation; and individualistic without active facilitation. The participants were 231 students from grades seven and eight of five schools in a town in eastern India, assigned to four groups each corresponding to one of the four pedagogical contexts. Two educational computer games - Global Conflicts: Sweatshops and Playing History: The Plague, both based on social science topics were played. Learning

outcomes, as measured by scores on post-game assessment tools specific to each of the two games were analyzed and findings presented. Initial findings suggest that computer game-based learning was influenced by the learning context within which the actual game-play activity is situated. Specifically, peer collaboration and facilitator support are found to be effective in promoting learning through computer game-play. However, there is a need to further explore the relationship between individual learning styles and game-based learning outcomes.

Dickey (2011) addressed the pragmatics of integrating virtual worlds for teaching and learning for K-12 education. This qualitative investigation focused on a reflective dialogue gathered from a group of K-12 (primary and secondary school) educators about their experiences using both Active Worlds Educational Universe and Second Life. Reflections consisted of both their experiences as (a) a learner within both applications, (b) developing instructional content in both applications, and (c) perceptions of value of each application for teaching and learning. The goal of this research was to investigate how K-12 teachers' perceptions of virtual worlds may impact the integration of new tools for teaching and learning.

Hwang, Sung, Hung, Huang, and Tsai (2012) build their research on previous studies that have shown that, there is a benefit in taking learning styles into account to craft a personalized learning content presentation that matches the information perceiving and processing styles of individuals. The authors propose a personalized game-based learning approach based on the Felder and Silverman sequential/global dimension learning style. To evaluate the effectiveness of the proposed approach, a role-playing game has been implemented based on the approach; moreover, an experiment has been conducted on an elementary school natural science course. From the experimental results, it is found that the personalized educational computer game not only promotes learning motivation, but also improves the learning achievements of the students.

Dorca, Lima, Fernandes and Lopes (2012) argue that one of the most important features of adaptive e-learning systems is the personalization according to specific requirements of each individual student. In considering learning and how to improve student learning, these systems must know the way in which an individual learns. In this context, the authors introduce a new approach for consistent evolution of student models by automatic detection of student learning styles. Most of the work in this field presents complex and inefficient approaches. Our approach is based on learning styles combination and dynamic correction of inconsistencies in the student model, taking into account the non-deterministic aspect of the learning process. Promising results were obtained from tests, and some of them are discussed in this paper.

Chen, Kinshuk, Wei, and & Liu (2011) attempted to explore whether learners' reflection levels can be improved if teaching strategies are adapted to fit with learners' thinking styles in an online learning environment. Three teaching strategies, namely constructive, guiding, and inductive, were designed to match with three thinking styles, namely legislative, executive, and judicial respectively. An online reflection learning system was subsequently developed to reflect this scenario. An experiment was then conducted

where the learners were classified into fit or non-fit group in order to analyze whether there was a good fit between the teaching strategies designed by the teacher and the thinking styles of learners. A total of 223 graduate and undergraduate students participated in the experiment. The results revealed that the reflection levels of the fit group had outperformed the non-fit group.

Westera (2011) re-examines contextual learning from a stand point of virtual learning environment. Digital media tend to bring about new dimensions of context: internet connections and mobile devices enable learners to overcome restrictions of time and location, and neglect the physical boundaries and limitations of the learning environment. In this paper the author takes a theoretical stand by conceptualizing the notion of learning context in the light of its virtualized extensions. It explains the historical and pedagogical backgrounds of contextual learning and reviews existing models that deal with context parameters. The paper identifies and discusses the constituting components of context for learning and it demonstrates how attributes of virtual representations affect the nature of context. The overall purpose of the paper is re-establishing the notion of contextual learning in the light of emerging digital media and making explicit the various dimensions involved.

Willems (2011) sets out to investigate the following questions: What are the differences in learning styles between students and educators who teach and/or design their e-learning environments? Are there variations in the learning styles of students at different levels of study? How may we use this learning styles data to inform the design in e-learning environments? In this paper the author details mixed-methods research with three cohorts teaching and learning in e-learning environments in higher education: novice undergraduate e-learners, graduate e-learners, and educators teaching in, or designing for, e-learning environments (Willems, 2010). Quantitative findings from the Index of Learning Styles (ILS) (Felder & Silverman, 1988; Felder & Soloman, 1991, 1994) reflect an alignment of the results between both the graduate e-learner and e-educator cohorts across all four domains of the ILS, suggesting homogeneity of results between these two cohorts. By contrast, there was a statistically significant difference between the results of the graduate and educator cohorts with those of the undergraduate e-learners on two domains: sensing-intuitive and the global-sequential, suggesting divergent learning style preferences. Qualitative data was also gathered to gain insights on participants' responses to their learning style results.

Huang, Lin, and Huang (2012) tests a model that examines the mediating processes in the relationship between learning style and e-learning performance and the moderating effects of prior knowledge. The results show that the sensory/intuitive dimension of learning style predicts learning performance indirectly through the mediation of online participation. However, other types of learning styles do not affect online participation. Sensory students demonstrate a higher level and intuitive students a lower level of online participation. Prior knowledge plays an important role as a moderator between online participation and learning performance. This study was conducted in the context of software usage instruction using empirical data from 219 undergraduate students.

Altinkurt and Yilmaz (2012) investigated the impact of prospective teachers' computer anxiety and learning styles on computer anxiety. Survey model was used as the research method. The total number of participants consisted of 195 prospective teachers who

attend formation courses. Data was collected by "Computer Anxiety Scale" and "Kolb's Learning Style Investory". The research findings showed that prospective teachers with "accommodating" and "converging" learning style have lower anxiety levels, based on experiential learning, a component of "active Experimentation". The participants' views vary according to gender, major and personal computer ownership.

Chen (2011) investigated the differences of students' learning outcome and satisfaction in a class using an online social networking tool-Facebook among different learning styles. Results show that participants in the Converger group performed better than participants with other learning styles. Moreover, the Converger group had a more positive attitude toward Facebook because in their perception, Facebook facilitates their interaction with others and improves content understanding in the class. Suggestions of integrating Facebook into class as well as recommendations for future research are provided.

Czeczotkova, Kostolanyova, and Sarmanova (2011) suggest that teaching by standard eLearning is being gradually replaced by a new form - personalized eLearning. Personalized eLearning is understood as not only an instruction tailored to each student according to his characteristics, but it is also adaptable according to the actual conditions under which the learning takes place. Pilot testing of students and subsequent analysis determined a group of student's characteristics to which the eLearning study environment can be adapted. These characteristics must be put into accord with forms and variants of created learning materials. In this paper they introduce the assignment of an appropriate method of learning management to students' individual learning styles.

According to Dedic, Markovic, and Kuleto (2012), user interface becomes the major channel to convey information in e-learning context: a well-designed and friendly interface is thus the key element in helping users to get the best results quickly. In this paper they investigate the importance of a certain choice offered: if several graphical user interface designs are offered to distance learning students of known learning styles, should we find any preferences? In search for response to their question they devised a procedure for determining association between learning styles and GUI. A total of 51 participants were tested to find out if there was any correlation between students' learning styles and their GUI preferences. They have found that the fact of having any preference towards a GUI is associated with AC score of Kolb's model.

Markovic, and Jovanovic (2012) investigated the factors affecting the acceptance and use of e-learning system. There are a number of implicit and explicit frameworks designed to inform e-learning practice. Some of them suggest key components that influence the quality of the e-learning experience: technology, pedagogy, organizational context and creativity. Instructor feedback and student learning styles, significantly affect the perceived learning outcomes of e-learning students. Namely, quality of education will significantly be enhanced if instructors modify their teaching styles to accommodate the learning styles of all students in their classes. When the teacher creates the lesson plan, it is desirable that he or she puts as many activities as possible which will reflect different learning styles. Whereas, students have diverse backgrounds, abilities, and knowledge bases, teachers who are able to use

various instructional strategies have been shown to be more effective than those who just use single strategies.

Mohr, Holtbrugge, and Berg (2012) uses data gathered from 953 students to investigate in how far individuals' preferences for a particular learning style are associated with the perceived usefulness of e-learning. Their findings reveal the effect of individuals' learning styles as well as their gender and professional experience on the perceived usefulness of different forms of e-learning. The study's findings enhance their understanding of the usefulness of different e-learning tools from a learner perspective and thus have implications for curriculum design. The study also contributes to the empirical basis on the relevance of learning styles in the design of virtual learning environments.

***Engineering***

In order to revitalize the engineering education, in 1989 the College of Engineering and Technology at Brigham Young University initiated a faculty training program based on the experiential learning model (Harb, Terry, Hurt, and Williamson,1995). Volunteer faculty members were introduced to the concepts of experiential learning model and methods of teaching to four different learning modes and asked to implement experiential methods in their courses. Volunteers were encourage to visit each other classes, individual teaching was videotaped for a later review, and a follow up support was offered through peer discussions about the successes and problems encountered in their teaching. The benefits of the program have been many. Several faculty members redesigned their courses to reach the full spectrum of the experiential learning cycle using a variety of teaching strategies. Furthermore, there was a renewed interest and enthusiasm toward teaching throughout the engineering school and students responded positively to the new learning strategies used.

Stice (1987) argues that the low knowledge retention rate of the engineering students can be attributed to the ineffective teaching methods used by most faculty in engineering courses. The most frequently used teaching methods rely heavily on abstract ideas and concepts without providing opportunities to test the practical value of a theory. As an alternative teaching strategy, the author designed a mathematics course on differential equations to use all four stages of the learning cycle beginning with lecture (RO); followed by the students' thinking about the ideas presented (AC); completing homework assignment (AE); and closing the cycle with demonstration (CE). At the end of the experiment Stice concluded, "the rewards are sizeable: students learn more and derive intellectual satisfaction from the experience." (1987: 296)

Fowler, McGill, Armarego, and Allen ( 2002) report a learning style initiative at The School of Engineering at Murdoch University, Australia. The school decided to include a section on 'understanding your learning styles' in the newly developed Foundation units in the first year with aim of empowering the students in their pursuit of the university and life long learning requirements. Due to the broad interdisciplinary nature of the Foundation units, the school decided that students needed to master some fundamental meta-cognitive skills to succeed in various courses.

Engineering educators have also paid close attention to the impact of dialectical tension created by the diverse learning style composition of the student teams and have capitalized on the differences to broaden students' skill levels and competencies associated with learning in teams. Halstead and Martin (2002) found that engineering student teams that were formed randomly to include all learning styles performed better than self-selected teams. Furthermore, in her studies of engineering students, Sharp stated, "Classroom experience shows that students can improve teamwork skills with Kolb theory by recognizing and capitalizing on their strengths, respecting all styles, sending messages in various ways, and analyzing style differences to resolve conflict and communicate effectively with team members" (2001, F2C-2).

As a response to Taiwanese government policies and initiatives that support advanced and innovative nanotechnology research and budgets on human resource development in this field, Chen, Sheen, Yueh, Chiang, and Chang (2012) implemented a nano-biotechnology summer camp in 2009 to take advantage of Kolb's experiential learning theory. The curriculum integrates conceptual knowledge into practical activities for a complete learning experience. Fifty-two senior high school students attended this camp, and each student completed a questionnaire survey aiming to explore students' responses to this learning experience. Results of the present study revealed that the students were satisfied with the teaching and learning in the camp. They were also largely in favor of both 'hands-on experiments and laboratory experiences' and believed that more learning and better experiences occurred through these two course activities.

Considering gaming as experiential learning, Andreu-Andres and Garcia-Casas (2011) introduced games in the third year engineering class at the Universitat Politecnica de Valencia (Spain). Their main objective was to help students gain knowledge in subjects of their degree program throughout a semester, to reinforce previously covered material, and to help learners develop problem-solving skills, communication and teamwork skills. A review of the advantages and drawbacks of using games as a teaching and learning technique revealed that as a whole, engineering students support experiential learning and confirm that they learn and have fun when there is gaming in class activities as opposed to more conventional strategies.

Fernandez-Samaca and Ramirez (2011) Proposed Hands-On sessions as a didactic strategy for lectures in theoretical courses, where students can construct and understand control concepts when they play a game designed by the teacher. The teacher uses a game to introduce the topic in order to motivate the students to learn in a fun way and improve their knowledge retention. Students develop activities in groups of three to five members; they follow instructions from a guideline describing the game. According to the authors, Hands-On sessions offer an alternative to learning control theory from concrete experiences so students can grasp knowledge and relate the concepts to simple events. The game can be seen as a road to achieving concepts; it has key issues that allow students to construct knowledge. This approach proposes employing Hands-On sessions using simple materials instead of high-technology complex elements, software, or a specialized space. This work describes a model to design and develop Hands-On sessions. It also introduces activities designed for students to learn topics such as: describing a typical control loop, analysis in the time

domain, stability, root locus analysis, and frequency analysis, for control courses in an engineering program.

Newson and Delatte (2011) advocate the shift from a traditional deductive based instruction in engineering education to case-based inductive learning methods. Using the Kansas City Hyatt Regency walkway collapse as an exemplar, the benefits of case based learning approach are improved retention of knowledge, better reasoning and analytical skills, development of higher-order skills, greater ability to identify relevant issues and recognize multiple perspectives, higher motivation and awareness of non-technical issues.

Alejos, Fernandez, Sanchez, and Cuinas (2011) introduce an approach of play-based learning within electrical engineering. The proposed methodology tries to develop a play-based experience by two stages: firstly, the learning by doing theory will teach the 'rules of the game' and then, it is completed with a final practice that implements the rhetoric of the learning-through-play theory. Both techniques have resulted in positive learning outcomes by enhancing the student role in the learning process through increasing the motivation. An experimental play-based Wireless Sensor Network (WSN) platform is introduced as an aid in teaching location techniques based on RSSI (Received Signal Strength Indicator) in the frame of a radiolocation course at graduate level. The platform is implemented using low-cost commercial modules and one easy-to-use software program. They deepen in the layout challenges facing instructors in the frame of a play-based learning experience. The authors outline critical points as the teacher's role, the time constraint and the trade-off between actual advantages and efficiency. They propose also one method to correctly evaluate the cognitive and affective dimensions of the play-based settings by the development of a smart learning route chart that represents a study guidance indicating the flow expected for the objectives and its evaluation.

Delarue, Laga, Meeus, Belmans, and D'Haeseleer (2011) report the development of a techno-economic education package, consisting of two simulation games, to simulate both the trading and the generation of electricity in a liberalized market. They present six attributes (storytelling; players as problem solvers and explorers; feedback; challenges that fit the student characteristics; competition; appropriate graphics and sounds) that are relevant in order for simulation games to achieve their learning potentials. These attributes are identified within both developed simulation games.

Andreu-Andres, and Garcia-Casas (2011) refers to the origins of games, and supports the idea of gaming as one of the techniques included in the simulation and gaming methodology endorsed by associations such as ISAGA, NASAGA, JASAG, ABSEL or SAGSET. Considering gaming as experiential learning this study offers the perceptions of forty seven engineering students in their third year of studies at the Universitat Politecnica de Valencia (Spain) regarding the use of games as part of their activities to gain knowledge in subjects of their degree program throughout a semester, to reinforce previously covered material, and to help learners develop problem-solving skills, communication and teamwork skills. A review of the advantages and drawbacks of using games leads us to carry out the statistical analysis of the answers to a survey concerning the use of gaming as a teaching-learning technique with these engineering students, the students' experience with games in

different subjects attended before and during their university studies, and the students' perceptions on using games to learn or just for fun. The study of the relation among the variables analyzed reveals students' feelings regarding gaming as opposed to more conventional strategies. As a whole, engineering students participating in the experiment back experiential learning and confirm that they learn and have fun when there is gaming in class activities.

### *Entrepreneurship*

Bager (2011) advocates that moving people from their normal work place or school environment to a camp site can be an efficient means for team building, creativity training and innovation boosting purposes. The camp model is increasingly used in the entrepreneurship education field as a supplement to classroom teaching. Some camps focus at the generation of ideas while others focus at the turning of ideas into concepts and rudimentary plans. The author conducted in-depth studies of three quite different camps, all demonstrating convincing results and learning outcomes.

Balan and Ionita (2011) studied the organizational learning process of small enterprises within the service sector in Bucharest to identify the potential implications for the economic higher education. According to the research results, organizational learning is rudimentary, substantiated on the individual learning of the entrepreneur. Learning is experiential and the main outcomes are skills and concepts. Knowledge dissemination is deficient, the main flow being oriented only from entrepreneur to employees. The entrepreneur cannot control knowledge absorption but can evaluate and encourage it. The research revealed a relationship between learning and entrepreneurial orientation, according to which learning enhancement leads to innovation and opportunity identification.

Gemmell (2012) explored how technology entrepreneurs use social behaviors, techniques and cognitive processes to attain, develop, refine, validate and filter (for usefulness) creative ideas for successful new products, processes or services. The results reveal a complex, cyclical and recursive multi-level social process with emphasis on iterative active and social experimentation. Successful entrepreneurs use experimentation to facilitate and accelerate learning, preferring to succeed or fail quickly. Greatest ideational productivity occurs when strong social ties interactively solve problems in an environment of trust – in particular, when “Trusted Partners” exchange and refine ideas through a form of shared cognition.
In the second study, he studied 172 technology entrepreneurs to determine the effects of learning style and learning flexibility on iterative decision methods and innovation decision speed, behavioral mediators hypothesized to produce entrepreneurial innovation and success. The Kolb learning style preference for active experimentation predicted the entrepreneur’s use of iterative methods to innovate and achieve success. The anticipated positive indirect influence of learning flexibility on innovation surprisingly occurred via a chain of two consecutive negative effects. Entrepreneurs with high learning flexibility move less swiftly to make key strategic innovation decisions; however, in doing so they are more innovative.

Pittaway, Rodriguez-Falcon, Aiyegbayo and King (2011) Studied the role of student entrepreneurship clubs and societies and explored their impact on student learning in order to understand the extent to which such activities simulate entrepreneurial learning. The study explored three different forms of clubs: entrepreneurship clubs; SIFE ( Students In Free Enterprise) teams; and investment clubs. Data from 10 unstructured interviews, a series of telephone interviews and an e-mail postcard are reported. The results show that students' motivations for engaging in clubs vary and that they differ between different types of clubs. In terms of entrepreneurial learning students' engagement in clubs and societies provides enhanced opportunities for 'learning by doing' through action and experience. The data show that increased action leads to reflective practice and that social learning is important. The study highlights the capacity of entrepreneurship education to simulate entrepreneurial learning, illustrating the value of entrepreneurship clubs and societies and explaining why students engage in them.

Roberts (2011) explored the research methods used to investigate the professional practice of an entrepreneur. As a practitioner researching his own entrepreneurial experience a retrospective review of critical incidents was undertaken with the objective of understanding the particular learning from critical incidents and how this learning influenced subsequent practice. As the research and reflection progressed it emerged that a number of critical incidents that were highlighted, whilst affording potential transformational learning opportunities, merely taught the entrepreneur 'what not to do'. These incidents did not result in profound experiential learning that made a significant positive impact of future activities; they merely acted as focal points for blame, rationalization, and rumination. Further analysis of the data revealed that there were two distinct categories of learning that occurred around these critical events. This learning was compared to single and double loop learning (Argyris and Schon, 1978). Double loop learning resulted in profound changes and improvement of practice; single loop learning resulted in rumination, rationalization and blame. The research was then further developed with a new framework to revisit and reflect upon these critical incidents with the intention of exploring and realizing double loop learning opportunities.

***Geography***

Healey & Jenkins (2000) applied the Svinick and Dixon model to the teaching of a geography course. In their view, there are two central practical applications of the experiential learning theory relevant to different types of learning environment, be it a lecture course or a seminar- based course: (1) how a session, or a whole course can be designed to take students systematically around the learning cycle, and (2) selection of teaching methods appropriate to different stages of the cycle.

Fuller (2012) offers a personal reflection on physical geography fieldtrip design in New Zealand, Britain and Spain involving New Zealand and British students over a period of 14 years, spanning two contrasting university systems and two institutions. A wide range of learning experiences is considered: residential and day trips, Cook's Tours and detailed investigations. These cover a range of academic and altitudinal levels from first year to final year undergraduate and from sea level to mountain top. Key drivers in the design and development of these field courses are considered in order to explore the reason for taking

students to a plethora of high places, defined not only in the sense of altitude, but also in the sense of perceived intrinsic geographical value. The role played by the great outdoors in fostering development of geographical knowledge is discussed by considering the notion that taking students outside to learn in high places will automatically be of a cognitive advantage and intrinsically foster deeper levels of learning.

Krakowka (2012) uses Kolb's (1984) experiential learning model to discuss how students learn and how field trips can help enhance learning. The author suggests that using Kolb's experiential learning theory as a guide in the design of field trips helps ensure that field trips contribute to internalizing relevant geographical theory and concepts. Three types of field trips are presented: an informal survey of a neighborhood, a more formal scavenger hunt, and a virtual field trip using Google Earth.

***History***

Sprau and Keig (2001) contend that "for many undergraduates, history courses are inherently uninteresting and the required papers are boring."(2001: 101) According to the author, students overall lack of interest in history can be attributed to the way courses are generally taught. History educators have typically relied on lectures, note-taking, textbooks, tests, and term papers as the main teaching methods in the history course. What often is lacking is the mechanism that allows for students' emotional as well as intellectual engagement in the learning process. He suggests, "appealing to students' hearts and their minds both deserve consideration by history teachers; teaching devoid of emotion is quite dull, not to mention virtually impossible." (2001: 103)
In their attempt to create an intellectually stimulating as well as emotionally appealing learning experience, the authors introduced films in the history survey courses based on experiential learning model. The film served as a tool for the students to distinguish between historical fact and fiction, reflect upon its themes and characters, research an issue from it, and write an analysis paper based on those reflections and research. The authors recommend that the experiential learning model can best serve the students' interests if instructors envision the learning cycle not as simple stages to be followed sequentially but as a conical structure, so that students are guided to acquire higher order thinking skills to deal with subsequent learning experiences.

***Language Education***

Ng, Chow, and Chu (2011) contend that the introduction of online games in the implementation of Japanese language education at the elementary level is both desirable and challenging. It meets various demands from the population amongst many learners of Japanese language as a second language who are motivated mainly through playing online games but without any knowledge of Japanese language and also underlines some practical issues which involve the actual operations in Japanese classrooms, with respect to the possible outcomes realized through second language acquisition. In this paper, authors attempt to I-elate Fleming's model of VARK with its applications in different learning styles in elementary Japanese learning. They are illustrated with two different kinds of online games in each of the VARK strategies; namely visual, aural, read/write and kinesthetic.

Above all, this article can as well be a reference for those Japanese teachers who are struggling in conducting elementary Japanese lessons in a more pleasant way as perceived by the learners.

Guillen-Nieto, and Aleson-Carbonell (2012) created a game called It's a Deal! for the purpose of teaching intercultural business communication between Spaniards and Britons in business settings in which English is used as the lingua franca. They hypothesized the immersive, all-embracing and interactive learning environment provided by the video game to its users may contribute to develop and enhance their intercultural communicative competence. Findings of this study demonstrate that the video game is an effective learning tool for the teaching of intercultural communication between Spaniards and Britons in business settings in which English is used as the main language. In particular, whereas the game had a small learning effect on intercultural awareness and a medium learning effect on intercultural knowledge, it had a large learning effect on intercultural communicative competence. The study also documents correlating factors that make serious games effective, since it shows that the learning effectiveness of It's a Deal! stems from the correct balance of the different dimensions involved in the creation of serious games, specifically instructional content, game dimensions, game cycle, debriefing, perceived educational value, transfer of learnt skills and intrinsic motivation.

Chen, Chuang, Nurkhamid, and Liu (2012) proposed the effective use of learning playground called Digital Play Ground (DLP), an application of digital technology to build a Mixed Reality environment with game-based-learning ingredient for classroom context. The authors proposed experiential learning theory as the conceptual base to describe the learning process embedded in the game. Although the experiment was applied in the context of learning English, the authors suggest it may open a possibility to extend for the purpose of learning other subjects, such as Math.

***Law***

To help students deal with difficulties caused by faculty/student learning style differences, John Reese at the University of Denver Law School conducts "Connecting with the professor" workshops in which students select one of four teaching styles based on the four predominant learning styles that they have difficulty connecting with. The workshop gives multiple examples of remedial actions that the learner may take to correct the misconnection created by differences in teaching/learning styles. Peer group discussions among law students give an opportunity to create new ideas about how to get the most from professors with different learning/teaching styles (Reese, 1998).

In their attempt to open a new educational field dedicated to personal and professional delopment for judges Brooks, Nelson and Murrell (2011) described the interview study conducted on the role that participation in the Institute for Faculty Excellence in Judicial Education (IFEJE) played in the personal and professional development of four judges. Judicial education is a relatively new field of adult and continuing professional education. There is limited literature devoted to this area of study outside of the arena of substantive legal or judging topics. Interviews served as the primary

data source for this study along with program evaluations, photographs, and e-mail correspondence from Institute participants. The findings revealed that the combined safe environment, challenges, and support participants experienced at the Institute and learning about adult learning helped them: feel less isolated in their work; stretch their normal work boundaries resulting in the completion of projects for which they had great passion; and benefited them as judges, supervisors, teachers, and in other social relationships.

### *Marketing*

Dissatisfied with the application of experiential methods in business classrooms, Dyer & Schumann (1993) developed an experiential learning laboratory classroom in their marketing course. In order to create a true laboratory experience in marketing classrooms, the authors developed the Knowledge/Experience Integration Learning Model in a senior-level marketing advertising/promotion class. In this class, the text assignments and lectures were integrated with experiences generated from two types of learning tasks, multiple group projects and multiple individual case studies. The traditional performance evaluations (multiple choice and essay exams) were eliminated altogether to give central focus on the recursive cycle of lecture, discussion, feedback, and hands on experiences. At the completion of the course students reported an increased level of critical thinking ability and capacity to apply and connect theoretical knowledge with real-life business application.

Matsuo (2011) conducted a study to examine developmental experience at different career stages and to clarify the role of sales beliefs in promoting experiential learning of salespeople. By applying the theoretical framework of expertise research and cognitive psychology, data from Japanese real estate salespeople were analyzed. Results suggest that (1) experiential learning is activated in the later stage (from 6 to 10 years) of a career, and (2) salespeople who balance customer and goal achievement orientations learn from others in the early stage (from 1 to 5 years) of their careers.

### *Mathematics*

Travers (1998) investigated the impact of experiential learning methods on students' self-regulation of their own learning process in mathematics. The author contends that the critical difference between academically low and high-achieving students resides on the capacity to self-regulate their learning by actively processing and controlling information, affect, and behavior to acquire critical knowledge and skills. The purpose of the study was to examine whether the treatment group taught mathematics through an experiential learning method demonstrated higher level of self-regulation compared to the control group which was taught mathematics through a traditional lecture format. The results indicate that experiential learning group demonstrated a higher level of self-regulation. The difference was explained by how the two groups regulated the learning outcomes. Students in the traditional lecture format were taught rule-based learning, in which the rules given by the teacher were the only guide to deal with the new experiences. In the rule-based learning students are only given information as to what they are to do, but not how to deal with unexpected situations when things do not work the way they should. Students taught experientially, on the other hand, were exposed to a variety of situations from which to

compare a new experience with previous ones, thus developing ability to critically evaluate what works and doesn't work in a given learning situation.

Ozgen, and Alkan (2012 examined the relationship between 1st and 5th year secondary school pre-service mathematics teachers' skills in understanding, method, modeling, verification, and extension dimensions of problem solving and their learning style characteristics. The data consisted of the skills pre-service teachers demonstrated in the solution process of open-ended problems. For this purpose, a graded scoring rubric was developed specific to each problem. Regarding the relationship between problem solving dimensions and the characteristics of McCarthy's learning styles, it was assumed that type 1 learners' skills were more dominant in the understanding dimension, type 2 learners' skills in the method and modeling dimensions, type 3 learners' skills in the verification dimension, and type 4 learners' skills in the extension dimension. On the basis of this assumption, problem-solving skills and learning style characteristics were associated and interpreted. The results obtained suggested that 5th year pre-service teachers were better in representing the skills pertaining to type 1 and type 2 learning styles, while 1st year pre-service teachers were better in representing the skills pertaining to type 1 learning style only. On the other hand, it was observed that a great majority of the pre-service teachers had a low level of the skills pertaining to type 3 and type 4 learning styles.

Ozgen and Bindak(2012) conducted a study to identify the opinions of high school students, who have different learning styles, related to computer use in mathematics education. High school students' opinions on computer use in mathematics education were collected with both qualitative and quantitative approaches in the study conducted with a survey model. For this purpose, 388 high school students were included in the study. A learning style inventory, questionnaire form and interview questions were used as the data collection instruments. The results of the study showed that students with a diverging and accommodating learning styles have more positive opinions regarding computer use in the mathematics education compared to the students with assimilating and converging learning style.

A tangible example of ELT's application in is found in the research of Hutt (2007), the associate dean of business, mathematics and technology at Cuyahoga Community College. Hutt implemented an experiential "learning-to-learn" course designed to reduce math anxiety and increase student performance in developmental mathematics courses. Results showed that the experiential course reduced students' mathematics anxiety -- the students felt safer, and more self-confident about learning. Subsequently these students on average performed nearly a whole letter grade better than other students in the regular math course. Typically in mathematics courses, students with the abstract "thinking" learning style preference that tends to match their instructors teaching style, perform better than students with other learning style preferences. This learning style effect was erased for students in the experiential course where students of all styles earned better grades than those who had not taken the course.

Shih, Chang, Chen, Chen, and Liang (2012) explored an application of Lego NXT in the subject of mathematics. The principle is based on Kolb's innovative learning cycle that

the user's active learning and cooperative learning concepts complete the whole process of learning experience. In order to compare the effectiveness of learning, they used an experimental group and a control group and give then pre- and posttests. In addition, they proposed the technology acceptance model to investigate users' degree of acceptance of Lego. The results show that this approach can improve the users' mathematical achievements and strengthen the users' intention to use.

Wei, Hung, Lee and Chen (2011) conducted a research to design and evaluate the Joyful Classroom Learning System (JCLS) which is implemented by using robot and RFID technology. This research demonstrates the design of a Joyful Classroom Learning System (JCLS) with flexible, mobile and joyful features. The theoretical foundations of this research include the experiential learning theory, constructivist learning theory and joyful learning. The developed JCLS consists of the robot learning companion (RLC), sensing input device, mobile computation unit, mobile display device, wireless local network and operating software. The developed JCLS system has been applied in real world for supporting children to learn mathematical multiplication. Both pilot experiment and formal experiment were conducted and the results showed that the JCLS can provide learners with more opportunities for hands-on exercises and deepening their impressions about the learning contents. Having many opportunities for hands-on exercises, learners can have more thinking time for knowledge construction. Using robot to design RLC can simultaneously increase learners' motivations and offer a more joyful perception to learners during the learning process. On the other hand, the JCLS can support instructors to immediately acquire the learning statuses of every learner for adjusting his/her in-class instructional strategy and giving after-school assistances.

Ozgen and Bindak (2012) set out to identify the opinions of high school students, who have different learning styles, related to computer use in mathematics education. High school students' opinions on computer use in mathematics education were collected with both qualitative and quantitative approaches in the study conducted with a survey model. For this purpose, 388 high school students were included in the study. A learning style inventory, questionnaire form and interview questions were used as the data collection instruments. The results of the study showed that students with diverging and accommodating learning styles have more positive opinions regarding computer use in the mathematics education compared to the students with assimilating and converging learning style.

### *Medicine*

The majority of studies in the medicine in 1980s and 1990s have focus on learning style analysis in many medical education specialties--residency training, anesthesia education, family medicine, surgical training, and continuing medical education. Studies have also focused on learning style differences among students and faculties and the implications of such discrepancy on the students' overall learning process and outcome. Of significance here is the program of research by Baker and associates (e.g., Baker, Cooke, Conroy, Bromley, Hollon, & Alpert, 1988; Baker, Reines, & Wallace, 1985). Also Curry (1999) has done a number of studies comparing different measures of learning styles. Other research has examined clinical supervision and patient/physician relationships, learning style

and student performance on examinations, and the relationship between learning style and medical specialty career choice. In recent years, with the rapid improvement and availability of simulation technology, there has been an increased interest and focus on applying simulation as an experiential learning tool to enhance medical education.

Leonard and Harris (1979) used the knowledge of learning style in a small group teaching and clinical supervision conducted in a primary care internal medicine residency program at the University of Minnesota. They found that knowledge of learning style can be effectively used to recognize distinct patterns of behaviors, attitudes, and reactions learners exhibit in a given learning context and thus allow the teacher to flex one's teaching approach to fit the learner's immediate learning needs. It is also important to point out that the in his clinical session, instructor was equally effective in creating learning situations in which student can function within the safety of his preferred learning mode but also be challenged to recognize the weaknesses associated with his learning styles.

In their study of learning style differences among pediatric residents and faculty, Kosower and Berman (1996) found that that while most residents preferred accommodating or diverging style (81%), most faculty preferred either converging or assimilating learning strategies (73%).

In their study of differences and similarities of perception of learning among internal medicine residents and faculty, White, and Anderson (1995) found that one of the restraining factors that prevented learning from occurring was related to the discrepancies in what residents and faculty perceived to be the most relevant aspect of the learning process. In most situations, faculty tended to focus on abstract and reflective modes of the learning process while residents emphasized the concrete mode of learning.

Sadler, Plovnick, & Snope (1978) report some of the difficulties of teaching in an environment in which the learning style of the faculty and the students differ. Their study suggests that faced with such a situation, instructors may be required to use instructional methods valuable to the students but not necessarily appealing or intellectually rewarding to the instructors themselves.

Cleave-Hogg, and Morgan (2002) designed an anesthesia simulation based on experiential learning for undergraduate medical students. Students reported high levels of satisfaction with the anesthesia simulation experience based on three grounds: 1. it provides opportunity to activate relevant prior knowledge and raise awareness of the gaps in their knowledge, 2. offers a learning context that closely resembles a real life anesthesia practice, and 3. provides freedom to integrate their knowledge, to improve their skills and exercise their judgment without endangering a patient. The authors contend that the results of the study support the value of integrating the experiential simulation exercise in the anesthesia undergraduate curriculum.

Sandmire and Boyce (2004) investigated the performance of two-person collaborative problem-solving teams in an allied health education anatomy, physiology, and pathology course. They compared a group of high abstract/high concrete student pairs with a group of abstract pairs and a group of concrete pairs. The abstract/concrete pairs performed

significantly better on a simulated clinical case than did the abstract pairs and slightly better than the concrete pairs; indicating the value of integrating the abstract and concrete dialectics of the learning cycle. However, a similar study by Sandmire, Vroman, and Sanders (2000) investigating pairs formed on the action/reflection dialectic showed no significant performance differences.

Yardley, Teunissen, and Dornan (2012a) created a guide that provides an overview of educational theory relevant to learning from experience. It considers experience gained in clinical workplaces from early medical student days through qualification to continuing professional development. Three key assumptions underpin the Guide: learning is 'situated'; it can be viewed either as an individual or a collective process; and the learning relevant to this Guide is triggered by authentic practice-based experiences. They provide an overview of the guiding principles of experiential learning and significant historical contributions to its development as a theoretical perspective. They then discuss socio-cultural perspectives on experiential learning, highlighting their key tenets and drawing together common threads between theories. The second part of the Guide provides examples of learning from experience in practice to show how theoretical stances apply to clinical workplaces.

In another article, Yardley, Teunissen, and Dornan (2012b) introduce readers to the theories underpinning experiential learning, which are then expanded further in an AMEE Guide, which considers the theoretical basis of experiential learning from a social learning, constructionist perspective and applies it to three stages of medical education: early workplace experience, clerkships and residency. This article argues for the importance and relevance of experiential learning and addresses questions that are commonly asked about it. First, they ask 'what is experiential learning?' and 'how does it relate to social learning theory?' to orientate readers to the principles on which our arguments are based. Then, they consider why those ideas (theories) are relevant to educators - ranging from those with responsibilities for curriculum design to 'hands-on' teachers and workplace supervisors.

Mann (2011) introduces a new educational framework for medical education that recognizes the complexity of education that fosters development of knowledge, skills and professional identity in medicine. The author suggests situated learning as a useful theoretical framework that allows the incorporation of other learning perspectives and includes workplace learning and experiential learning. Viewing medical education through the lens of situated learning suggests teaching and learning approaches that maximize participation and build on community processes to enhance both collective and individual learning.

Caulley, Wadey, and Freeman (2012) investigated the learning styles of orthopedic residents and their surgical educators. They investigated the learning styles of the 2009-2010 year 1 orthopedic surgical residents. A cross-sectional survey using the Kolb Learning Style Inventory was completed by 13 first year orthopedic residents. Direct 1-to-1 interviews were completed with the primary investigator and each participant using the Kolb Learning Style Inventory and learning styles were determined. The results indicated that Converging learning style was the most common among the residents (53.8%). Residents demonstrated a high tendency toward the learning skill of abstract conceptualization combined with active

experimentation, and a transition from action-oriented to more reflective learning style with age and postgraduate education. The authors concluded that these results may be useful in creating strategies specific to each learning style that will be offered to residents to enhance future teaching and learning.

Gurpinar,Alimoglu, Mamakli, and Aktekin (2010) conducted a study to determine the learning styles of our medical students and investigate the relation of learning styles with satisfaction with traditional training (lectures) method and problem-based learning (PBL) method. The study involved participation of 170 first-year medical students (the participation rate was 91.4%). The researchers prepared socio-demographic and satisfaction questionnaires to determine the characteristics of the participants and their satisfaction levels with traditional training and PBL. The Kolb learning styles inventory was used to explore the learning styles of the study group. The participants completed all forms at the end of the first year of medical education. Indicators of academic achievement were scores of five theoretical block exams and five PBL exams performed throughout the academic year of 2008–2009. The majority of the participants took part in the "diverging" 84 ( 47.7%) and "assimilating" 73 (41.5%) groups. Numbers of students in the "converging" and "accommodating" groups were 11(6.3%) and 8 (4.5%), respectively. In all learning style groups, PBL satisfaction scores were significantly higher than those of traditional training. Exam scores for "PBL and traditional training" did not differ among the four learning styles. In logistic regression analysis, learning style (assimilating) predicted student satisfaction with traditional training and success in theoretical block exams. Nothing predicted PBL satisfaction and success.

Bernard, Gorgas, Greenberger, Jacques, and Khandelwal (2012) investigated the use of reflection in emergency medicine education. Abstract Reflection is a cognitive process in which new information and experiences are integrated into existing knowledge structures and mental models, resulting in meaningful learning. Reflection often occurs after an experience is over, promoting professional development and lifelong learning. However, a reflective emergency physician (EP) is also able to apply reflection in real time: self-monitoring, coping with the unexpected, and quickly thinking on his or her feet to solve complicated, unique, and challenging clinical problems. Reflection is a skill that can be taught and developed in medical education. Evidence demonstrating the value of teaching reflection is emerging that substantiates longstanding educational theories. While a few educators have started to explore the use of reflection for emergency medicine (EM) learners, the potential for broader application exists. This review summarizes the literature regarding reflection in medical education and provides a basic primer for teaching reflection.

Breaud, Chevallier, Benizri, Fournier, Carles, Delotte, and Benchimol (2012) argue that surgical training relies on medical school lectures, practical training in patient care and in the operating room including instruction in anatomy and experimental surgery. The authors suggest that training with different techniques of simulators can add to the effectiveness in surgical training. Simulator-based training, widely used in North America, can be applied to several aspects of surgical training without any risk for patients: technical skills in both open and laparoscopic surgery, the notion of teamwork and the multidisciplinary management of acute medicosurgical situations. They report the curriculum developed in the Simulation Center of the Medical School of Nice Sophia-Antipolis. All

residents in training at the Medical School participated in this curriculum. Each medical student was required to pursue theoretical training (familiarization with the operating room check-list), training in patient management using a high fidelity mannequin for various medical and surgical scenarios and training in technical gestures in open and laparoscopic surgery over a 2-year period, followed by an examination to validate all technical aptitudes. This curriculum has been approved and accredited by the prestigious American College of Surgeons, making this the first of its kind in France.

In response to the reductions in training hours in medical education and the demands of modern healthcare delivery, Grant, and Marriage (2012) reports the need for medical educators to look towards simulation as a means of providing safe and reproducible situations for clinical skills teaching, decision-making and team training. The tools available for simulation-based training have developed rapidly over the past 15 years. There is an increasing range of manikins and part-task trainers - devices that permit selected elements of a skill or task to be practiced independently of a whole-body manikin. Those interested in simulation have also focused significantly on adult learning theory to ensure that the training offered through simulation is appropriate, effective and complementary to other educational approaches. By mapping simulated scenarios to the Royal College of Pediatrics and Child Health Curriculum for General Pediatric Training at Level 1, the authors have developed two complementary courses aimed at preparing the general pediatric trainee for progression to the middle grade role. It is hoped that such approaches will become integral to pediatric training in the future.

Gurpinar, Bati, and Tetik (2011) investigated if any changes exist in the learning styles of medical students over time and in relation to different curriculum models with these learning styles. This prospective cohort study was conducted in three different medical faculties, which implement problem-based learning ( PBL), hybrid, and integrated curriculum models. The study instruments were Kolb's Learning Style Inventory ( LSI) and a questionnaire describing the students' demographic characteristics. Sample selection was not done, and all first-year students ( n = 547) were targeted. This study was designed in two phases. In the first year, the study instruments were delivered to the target group. The next year, the same instruments were delivered again to those who had fully completed the first questionnaire ( n = 525). Of these, 455 students had completed the instruments truly and constituted the study group. The majority of the students were assimilators and convergers in both the first and second years. A change in learning style was observed between 2 yr in 46.9% of the students in the integrated curriculum, in 49.3% of the students in the hybrid curriculum, and 56.4% of the students in the PBL curriculum. The least and most changes observed between the learning style groups were in assimilators and divergers, respectively. Curriculum models and other independent variables had no significant effect on the change between learning styles.

Mukhopadhyay, Smith, and Cresswell (2011) advocate the need for a new medical educational strategy based on the concept of lifelong learning. Lifelong learning refers to the systematic acquisition, renewal, updating and completion of knowledge. It is synonymous with the term 'self-directed learning'. This is a new educational strategy meant to consolidate knowledge in a fashion that is reproducible for a lifetime with successful application to both

known and unknown clinical exercises. The development of lifelong learning is based on the principles of andragogy (autonomy and independence in one's learning activities), reflection and learning from experience. This paper deals with the development of these theories culminating in the advent of self-directed learning. Evidence to support experiential, reflective and self-directed learning is provided, including the use of rating scales. An example from obstetrics is used to highlight the application of these principles. There are barriers to adopting a new educational paradigm, however, lifelong learning remains an excellent tool for continuous professional development.

Southers et. al. (2012) assessed the predominant learning style preferences of students enrolled in the Advanced Medical Imaging Technology (AMIT) baccalaureate program at the University of Cincinnati, in Cincinnati, OH. There are three medical imaging modality concentrations of study: Magnetic Resonance Imaging (MRI), Nuclear Medicine Technology (NMT), and Sonography. Within the Radiation Science baccalaureate program at UC, a fourth AMIT-affiliated medical imaging modality option is also available for select AMIT students - Computed Tomography (CT). The purpose of the study was to assess and locate any correlation between preferred learning styles and medical imaging modality concentrations.

Varela, Malik, Laeeq, Pandian, Brown,Weatherly, and Bhatti (2011) conducted a study to determine a predominant learning style within otolaryngology fellowships and to identify any differences between otolaryngology fellows and residents. They conducted a survey of otolaryngology fellows at 25 otolaryngology fellowship programs accredited by the Accreditation Council for Graduate Medical Education using the Kolb Learning Style Inventory 3.1to survey 6 pediatric otolaryngology (PO) and 24 otology/neurotology (ON) fellows. Results were then analyzed and compared between each subspecialty and the previously reported preferred styles of otolaryngology residents. The result showed that 10 PO and 20 ON fellows completed the survey, with an overall response rate of 75%. PO and ON fellows (60% of each group) preferred a learning style that was "balanced" across all four styles. For ON fellows, 35% preferred converging and 5% preferred accommodating styles. For PO fellows, converging and accommodating styles accounted for 20% each. Conclusions: It was previously reported that 74.4% of otolaryngology residents prefer either converging or accommodating styles. They believe that the fellowship training environment calls for fellows to use more than one learning style to become proficient physicians, hence the trend toward potentially developing a balanced style when at this level.

Weber and Armstrong (2012) describe the process of introducing plastic surgeons to a theory of adult education. According to the authors, most surgeons have been hired by their parent institution because of their clinical skills, and rightly so. At the same time, these same surgeons choose or are expected to be involved to varying degrees in the surgical education process with medical students, surgical residents, fellows, and allied health workers. Likewise, busy surgical residents are also expected to teach other residents and students, and yet these two groups of teachers of surgery have little or no training in the theory and practice of adult education. The first section was designed to bring to mind a context and set of ideas with which the reader is already familiar. The second section provides new information, Kolb's theory of adult learning and Arseneau and Rodenberg's teaching

principles, and discusses their implications. The third section is designed to give the reader an opportunity to work with the new knowledge and practice possible applications, and the fourth encourages the reader to use the new knowledge in concrete ways in a real-world environment.

Zwolsman, van Dijk, Verhoeven, de Ruijter, and Wieringa-de Waard (2011) conducted a study to determine whether there is a relationship between an individual's learning style and Evidence-based medicine (EBM) competence (knowledge/skills, attitude, behaviour). Evidence-based medicine (EBM) involves the management of information in clinical practice. As a consequence, the way in which a person uses EBM can be related to his or her learning style. In order to tailor EBM education to the individual learner, they conducted a survey among 140 novice GP trainees in order to assess their EBM competence and learning styles (Accommodator, Diverger, Assimilator, Converger, or mixed learning style). The results indicate that trainees' EBM knowledge/skills were adequate and their attitudes towards EBM) were positive. They found no relationship between their knowledge/skills or attitudes and their learning styles. Of the trainees, 40% used guidelines to answer clinical questions and 55% agreed that the use of guidelines is the most appropriate way of applying EBM in general practice. Trainees preferred using evidence from summaries to using evidence from single studies. There were no differences in medical decision-making or in EBM use for the various learning styles. However, they found a link between having an Accommodating or Converging learning style and making greater use of intuition. Moreover, trainees with different learning styles expressed different ideas about the optimal use of EBM in primary care. They concluded that EBM knowledge/skills and EBM attitudes did not differ with respect to the learning styles of GP trainees. However, they found differences relating to the use of intuition and the trainees' ideas regarding the use of evidence in decision-making.

Zigmont, Kappus, and Sudikoff (2011a) contend that experiential learning process involves participation in key experiences and analysis of those experiences. In health care, these experiences can occur through high-fidelity simulation or in the actual clinical setting. The most important component of this process is the post experience analysis or debriefing. During the debriefing, individuals must reflect upon the experience, identify the mental models that led to behaviors or cognitive processes, and then build or enhance new mental models to be used in future experiences. On the basis of adult learning theory, the Kolb Experiential Learning Cycle, and the Learning Outcomes Model, they structured a framework for facilitators of debriefings entitled “the 3D Model of Debriefing: Defusing, Discovering, and Deepening.” It incorporates common phases prevalent in the debriefing literature, including description of and reactions to the experience, analysis of behaviors, and application or synthesis of new knowledge into clinical practice. This process can be used to enhance learning after real or simulated events.

Zigmont, Kappus, and Sudikoff (2011b) contend that health care simulation is a powerful educational tool to help facilitate learning for clinicians and change their practice to improve patient outcomes and safety. To promote effective life-long learning through simulation, the educator needs to consider individuals, their experiences, and their environments. Effective education of adults through simulation requires a sound

understanding of both adult learning theory and experiential learning. This review article provides a framework for developing and facilitating simulation courses, founded upon empiric and theoretic research in adult and experiential learning. Specifically, this article provides a theoretic foundation for using simulation to change practice to improve patient outcomes and safety.

Auerbach, Kessler, and Foltin (2011) compared the effectiveness of repetitive pediatric simulation (RPS) training (scenario-debriefing-scenario) to standard pediatric simulation (STN) training (scenario-debriefing). Pediatric and emergency medicine residents prospectively participated in simulated pediatric resuscitation training sessions in an in situ simulation room. Residents anonymously reported their knowledge, skills, and confidence after each session. Four learners and 2 faculty preceptors (1 pediatric emergency medicine attending physician and 1 pediatric emergency medicine fellow) participated in each session. Scenarios were performed on a high-fidelity simulator (SimBaby; Laerdal Medical, Stavanger, Norway), and video debriefing was used for all training sessions. Standard pediatric simulation was used in the initial 6 months of the study, whereas RPS was used in the second 6 months of the study. One hundred fifteen subjects completed simulation sessions during the study period. The RPS group reported higher overall debriefing quality and were more likely to report that the simulation session was an excellent method of teaching. The RPS group reported greater improvement in knowledge and skills than did the STN group. Similar scores were reported for confidence, overall performance, stress levels, and realism of the simulator in both the STN and RPS groups. Feedback is a key feature of effective medical simulation. Repetitive pediatric simulation provides learners with a discrete opportunity to apply the knowledge and skills discussed during debriefing in an immediate second simulation session and thereby complete Kolb's experiential learning cycle. In this study, the RPS debriefing format was associated with higher self-reported knowledge and skills. The RPS group reported more positive attitudes toward simulation than the STN group.

Avis, Lozano, White, Youngblood, Zinkan, Niebauer and Tofil (2012) used high-fidelity simulation to investigate whether sleep technologists' (STs) knowledge of and comfort level in managing emergent pediatric respiratory events would improve with this innovative method. They designed a course that utilized high-fidelity human patient simulators (HPS) and that focused on rapid pediatric assessment of young children in the first 5 minutes of an emergency. The study was followed by an assessment of knowledge of and comfort with critical emergencies that STs may encounter in a pediatric sleep center utilizing a pre/post-test study design. The results indicate that there was a significant improvement in Sts' performance after the educational intervention. Participant ratings indicated the course was a well-received, innovative educational methodology. The authors conclude that a simulation course focusing on respiratory emergencies requiring basic life support skills during the first 5 min of distress can significantly improve the knowledge of STs. Simulation may provide a highly useful methodology for training STs in the management of rare life-threatening events.

Bearman, O'Brien, Anthony, Civil, Flanagan, Jolly, and Nestel (2012) describe the result of a pilot course funded by the Australian federal Department of Health and Aging

course in simulation-based education to address competencies across 9 domains for surgical trainees. Although structured training is provided in several domains, there is little or no formal program for professionalism, communication, collaboration, and management and leadership. The content and methods drew on best-evidence for teaching and learning these competencies from other disciplines. As part of the course evaluation, participants completed surveys using rating scales and free text comments to identify aspects of the course that worked well and those that needed improvement. Eleven of 12 participants completed evaluation forms immediately after the course. Participants reported largely meeting learning objectives and valuing the educational methods. High levels of realism in simulations contributed to the ease with which participants immersed themselves in scenarios. The authors concluded that this study demonstrates that a simulation course designed to teach competencies in communication, teamwork, leadership, and the encompassing professionalism to surgical trainees is feasible.

Bressmann, and Eriks-Brophy (2012) describe a student learning experience about managing difficult patients in speech-language pathology. In 2006, 40 students participated in a daylong learning experience. The first part of the experience consisted of presentations and discussions of different scenarios of interpersonal difficulty. The theoretical introduction was followed by an active learning experience with simulated patients. A similar experience without the simulated patients was conducted for 45 students in 2010. Both years of students rated the experience with an overall grade and gave qualitative feedback. There was no significant difference between the overall grades given by the students in 2006 and 2010. The qualitative feedback indicated that the students valued the experience and that they felt it added to their learning and professional development. The students in 2006 also provided detailed feedback on the simulation activities. Students endorsed the experience and recommended that the learning experience be repeated for future students. However, the students in 2006 also commented that they had felt inadequately prepared for interacting with the simulated patients. A learning experience with simulated patients can add to students' learning. The inclusion of simulated patients can provide a different, but not automatically better, learning experience.

Cendan and Lok (2012) state that the demonstration of patient-based cases using automated technology [virtual patients (VPs)] has been available to health science educators for a number of decades. Despite the promise of VPs as an easily accessible and moldable platform, their widespread acceptance and integration into medical curricula have been slow. Here, the authors review the technological underpinnings of VPs, summarize the literature regarding the use and limitations of VPs in the healthcare curriculum, describe novel possible applications of the technology, and propose possible directions for future work.

Dieckmann (2012) describes an experience-based debriefing workshop concept that was tested with approximately 80 participants during the Annual Meeting of the Society in Europe for Simulation Applied to Medicine (SESAM), June 2 to 4, 2011, in Granada, Spain. On a meta-level, the goal of the workshop was to raise the awareness of debriefing as an important part of simulation-based learning and to increase the awareness about different styles of debriefing-possibly stimulating further investigations of debriefings.

Arora, Ahmed, Paige, Nestel, Runnacles, Hull, Darzi, & Sevdalis (2012) attempted to identify the features of effective debriefing and to use this to develop and validate a tool for assessing such debriefings applied to surgical skill acquisition. The end result was a creation of the Objective Structured Assessment of Debriefing (OSAD) tool. Key components of an effective debriefing identified included: approach to debriefing, learning environment, learner engagement, reaction, reflection, analysis, diagnosis of strengths and areas for improvement, and application to clinical practice. OSAD was tested for feasibility, reliability, and validity by 2 independent assessors who rated 20 debriefings following high-fidelity simulations. It was concluded that OSAD provides an evidence-based, end-user informed approach to debriefing in surgery. By quantifying the quality of a debriefing, OSAD has the potential to identify areas for improving practice and to optimize learning during simulation-based training.

### *Nursing*

ELT/LSI research in nursing saw a dramatic 81% increase during the 1980-2000 period. In 1990 Laschinger reviewed the experiential learning research in nursing and concluded, "Kolb's theory of experiential learning has been tested extensively in the nursing population. Researchers have investigated relationships between learning style and learning preferences, decision-making skills, educational preparation, nursing roles, nursing specialty, factors influencing career choices and diagnostic abilities. As would be expected in a human service profession, nursing learning environments have been found to have a predominantly concrete learning press, matching the predominating concrete styles of nurses…Kolb's cycle of learning which requires the use of a variety of learning modalities appears to be a valid and useful model for instructional design in nursing education" (p. 991). In recent years, the nursing educational research focus has expanded to the area of clinical simulation and experiential learning model has been used as a design framework for the simulation based nursing curricula.

Kalsbeek (1989) conducted a longitudinal study comparing undergraduate nursing students' learning styles and faculty learning styles and found that nursing students preferred concrete thinking (59%) over abstract thinking (41%), while their faculty preferred abstract thinking (82%) over concrete thinking (18%).

Shinnick and Evangelista (2012) investigated the gains in knowledge and self-efficacy using human patient simulation (HPS) in the education of pre-licensure nursing students through experimental design. Variables considered were age, gender, learning style, baseline critical thinking, baseline self-efficacy, group membership (control or experimental). Membership in the experimental group was the only statistically significant independent predictor. Members of the control group were two times less likely than those in the experimental group to be in the higher scored group, yet this changed once the control group participated in HPS. Our findings show that HPS can independently improve test scores. This study provides evidence that HPS; is an effective teaching methodology for prelicensure nursing students regardless of age, learning style, or critical thinking ability.

Stienborg, Zaldivar, & Santiago (1996) conducted a pre-test post-test quasi-experimental design study to assess the comparative effectiveness of didactic teaching and

experiential learning in a HIV/AIDS training program for nursing students in the Philippines. The program focused on improvement of HIV/AIDS knowledge levels and attitudinal change toward HIV/AIDS patients. The authors hypothesized that experiential learning would yield significantly higher knowledge levels and favorable attitude changes in the students than didactic teaching. Three groups of nursing students participated in the study: the first group received didactic teaching in the form of lectures, while the second group had training with an experiential learning approach. Both groups included participation by a person with HIV/AIDS. The third group served as a control group which did not receive any formal HIV/AIDS training. Both didactic and the experiential groups covered the same content including AIDS epidemiology, infection control, socio-ethical issues related to HIV infection, and nursing care of patients in the hospital and community. The didactic group had a 2-hour presentation by the instructors, followed by 30-minutes Q & A session on the presentation. The session finished with 30 minutes with the AIDS patient. The experiential learning group had the presentation and discussion of a number of short case situations and a number of role-plays with student participation. The session ended with 30 minutes with an AIDS patient. Knowledge post-test scores indicate that both didactic and experiential learning approach produced a significant increase in the students' knowledge levels. However, the experiential learning group achieved significantly a higher knowledge level than the didactic group. While both groups reduced fear of attracting HIV (an indication of a positive attitude change), only the experiential learning group showed a consistent positive change on all attitudinal scales.

The authors concluded that experiential learning approach was more effective than the didactic approach for the knowledge acquisition in five significant ways: first, the problem-posed approach prompted students to get actively involved in the learning process through role-play. Second, it emphasized personal involvement through reflection. Third, the cases reflected the real world and encouraged integration of theory/policy and their practical application. Fourth, the experiential learning session was flexible and learner centered. Fifth, the participation of an AIDS patient formed an integral part of the experiential learning session whereas in the didactic session, the lecture, the Q & A session, and the PWHA testimonial were separate parts with no opportunity for integration.

Alfes (2011) conducted a quasi-experimental study to evaluate and compare the effectiveness of simulation versus a traditional skills laboratory method in promoting self-confidence and satisfaction with learning among beginning nursing students. A single convenience sample of 63 first-semester baccalaureate nursing students learning effective comfort care measures were recruited to compare the two teaching methods. Students participating in the simulation experience were statistically more confident than students participating in the traditional group. There was a slight, non-significant difference in satisfaction with learning between the two groups. Bivariate analysis revealed a significant positive relationship between self-confidence and satisfaction. Students in both groups reported higher levels of self-confidence following the learning experiences. The author concluded that there is an added value in using simulation experiences for beginning nursing students and encourage the implementation of simulation as a strand from beginning to end in nursing curricula.

Bland, Topping, and Wood (2011) conducted a literature review to develop a deeper understanding and define the concept of simulated learning as a strategy used in the education of undergraduate nursing students. The definition offered is a work in progress and presents a theoretically grounded understanding of what simulated learning currently represents. The identified antecedents, critical attributes and consequences are presented as a basis to stimulate further research, development and understanding.

Bowling (2011) examined the effect of two educational interventions on measures of knowledge, self-confidence, and skill performance in junior level BSN nursing students. An asynchronous nonequivalent control group pretest posttest design was used to examine and compare the effects of the two educational interventions, medium fidelity simulation and pencil-paper based case scenario, in a pediatric nursing course. The student's knowledge was measured with a multiple choice test, self-confidence measured utilizing the Self-Confidence in Learning Using Simulations Scale, and skill-performance was measured utilizing an objective structured clinical examination (OSCE). The OSCE has been routinely used in medicine to assess medical student's clinical abilities and is just beginning to be utilizing in nursing to assess student's ability to perform skills.

Bott, Mohide, and Lawlor (2011) trace the origins of a preceptor- specific teaching strategy knows as One Minute Preceptor (OMP) that has been used for more than 15 years in clinical medical education. In this article, they investigate the origins of the OMP and describe an adaptation to nursing education, referred to as the Five Minute Preceptor (5MP). The 5MP steps are the following: (1) get the student to take a stand, (2) probe for supporting evidence, (3) teach general rules, (4) reinforce the positives, and (5) correct errors or misinterpretations. In addition, they explore the relationship between the 5MP and experiential learning and provide a detailed example of the 5MP's use in undergraduate clinical nursing education. Recommendations are provided for the development of a 5MP educational package and the evaluation of the 5MP's use in baccalaureate nursing programs.

Cant, and Cooper (2011) explored the nursing literature to identify the educative process and essential features of debriefing. Studies of debriefing in nurse education were located in peer reviewed journals between 1990 and May 2010. Primary argument Formative feedback is important in experiential learning and is often applied in nursing in the form of facilitated structured debriefing. Debriefing is most commonly reported in relation to clinical skills development and as part of individual and team-based simulation training. Educational outcomes are dependent upon the skills of the facilitator in offering feedback in accordance with best practice. Although a key component of higher level education, there is a lack of published evidence with regard to the effectiveness of debriefing techniques in nurse education. The authors offer a framework for debriefing and conclude that structured facilitated debriefing is an important strategy to engage students in learning and is essential in simulation training.

Crider and McNiesh (2011) present a theory-based application of clinical simulation in psychiatric-mental health nursing education. As described by Benner, Sutphen, Leonard, and Day, a three-pronged apprenticeship that integrates intellectual, practical, and ethical aspects of the professional role is critical in the development of practical reasoning in nursing

education and training. Clinical encounters are often fraught with ambiguity and uncertainty. Therefore, educating for a practice discipline requires experiential and situated learning. Using the three-pronged experiential model in simulated psychiatric-mental health nursing practice supports the development of critical nursing skills, ethics, and theoretical concepts. A clinical scenario is presented that demonstrates the application of this model of professional apprenticeship in psychiatric-mental health education. The authors suggest that applications of the concept presented may be used in training nurses new to the practice of psychiatric-mental health nursing.

Fleming, McKee, and Huntley-Moore (2011) report on the main findings of a longitudinal study of the learning styles of one cohort of undergraduate pre-registration nursing students at an Irish university. The Honey and Mumford (2000a) Learning Styles Questionnaire was administered to a sample of students in their first (n=202) and final year of study (n = 166), the final sample number (58) was based on matched pairs. The most common dominant learning style in first year was the dual learning category (35%) while a large proportion of the students (53%) in their final year had no dominant learning style. The preferred learning style of students in their first (69%) and final (57%) year was reflector. Learning styles were significantly different at the two time points and there was a significant relationship between some learning styles and students' age but not with academic achievement. Total scores of all learning styles showed significant improvements across the two time points of the study. An important implication for nurse education practice is the need for nurse educators to be aware of students' learning styles and in an attempt to maximize students' learning potential, utilize a range of teaching and learning methodologies and assessments that develop all learning styles.

Roberts and Greene (2011) promote high-fidelity simulation as a useful mechanism to aid progression, development and skill acquisition in nurse education. However, nurse lecturers are daunted by sophisticated simulation technology. The authors present a new method of introducing human patient simulation to students and educators, whilst seeking to demystify the roles, responsibilities and underpinning pedagogy. The analogy of simulation as theatre outlines the concepts of the theatre and stage (simulation laboratory); the play itself (Simulated Clinical Experience, SCE); the actors (nursing students); audience (peer review panel); director (session facilitator); and the production team (technical coordinators). Performing in front of people in a safe environment, repeated practice and taking on a new role teaches students to act, think and be like a nurse. This in turn supports student learning and enhances self-confidence.

Bergero, Hargreaves, and Nichols (2012) describe in this article an innovation representing a paradigm shift away from the traditional nursing skills fair passive method of learning toward a dynamic, immersive learning experience utilizing simulation. There are many hospitals that review yearly competencies through a skills fair methodology. The authors’ contention is that there is no evidence to support that this method of education and training has any direct correlation to better nursing care at the bedside, enhanced patient outcomes, or retained knowledge or skills. They describe the process of successfully transitioning from traditional skills fairs to simulation-based skills fairs called CHILD (Collaborative Healthcare Immersive Learning Dynamic). With this pioneering approach, institutions can reallocate funds and utilize simulation to more effectively provide education,

training, and competency validation.

Bowling (2011) investigated the effect of two educational interventions on measures of knowledge, self-confidence, and skill performance in junior level BSN nursing students. An asynchronous nonequivalent control group pretest posttest design was used to examine and compare the effects of the two educational interventions, medium fidelity simulation and pencil-paper based case scenario, in a pediatric nursing course. The student's knowledge was measured with a multiple choice test, self-confidence measured utilizing the Self-Confidence in Learning Using Simulations Scale, and skill-performance was measured utilizing an objective structured clinical examination (OSCE). The OSCE has been routinely used in medicine to assess medical student's clinical abilities and is just beginning to be utilized in nursing to assess student's ability to perform skills.

In a previous systematic review, Cook (2012) proposed that adaptation to learners' cognitive and learning styles (CLSs) could improve the efficiency of computer-assisted instruction (CAI). In the present article, he questions that proposition, arguing that CLSs do not make a substantive difference in CAI. To support this argument, the author performed an updated systematic literature search, pooled new findings with those from the previous review, and reinterpreted this evidence with a focus on aptitude-treatment interactions. (An aptitude-treatment interaction occurs when a student with attribute 1 learns better with instructional approach A than with approach B, whereas a student with attribute 2 learns better with instructional approach B). Of 65 analyses reported in 48 studies, only 9 analyses (14%) showed significant interactions between CLS and instructional approach. It seems that aptitude-treatment interactions with CLSs are at best infrequent and small in magnitude. There are several possible explanations for this lack of effect. First, the influence of strong instructional methods likely dominates the impact of CLSs. Second, current methods for assessing CLSs lack validity evidence and are inadequate to accurately characterize the individual learner. Third, theories are vague, and empiric evidence is virtually nonexistent to guide the planning of style-targeted instructional designs. Adaptation to learners' CLSs thus seems unlikely to enhance CAI. The author recommends that educators focus on employing strong instructional methods. Educators might also consider assessing and adapting to learners' prior knowledge or allowing learners to select among alternate instructional approaches.

Stutsky and Lashinger (1995) examined the effect of the preceptorship experience on the learning styles, adaptive competencies, and environmental press perception of senior baccalaureate nursing students to investigate the nature of learning style/learning environment interaction in nursing education. The results, according the authors, support Kolb's (1984) assertion that an effective learner is able to apply skills from each of the learning modes in whatever combination the learning is required. The study also suggests that students' successful learning experience is dependent upon careful design and selection of instructional strategies that allow them to demonstrate mastery of knowledge and skills associated with each learning mode.

### *Pharmacy*

McGivney, Hall, Stoehr, and Donegan (2011) developed an introductory pharmacy practice experience (IPPE) in providing pharmaceutical care to patients at senior centers (Silver Scripts). First-year pharmacy students learned and practiced the pharmaceutical care process in the classroom to prepare for participation in the Silver Scripts program, in which the students, under faculty mentorship, conducted comprehensive medication reviews for senior citizens attending senior centers in Pittsburgh, Pennsylvania. Students, preceptors, and senior center staff members indicated the experience was positive. Specifically, first-year students felt they gained benefit both from an educational standpoint and in their own personal growth and development, while staff contacts indicated the patients appreciated the interaction with the students. The authors suggest that the Silver Scripts experience is a model for linking classroom experiences and experiential learning. The cycle of experiencing, reflecting, and learning has provided not only a meaningful experience for our P1 students but also a worthwhile focused review of seniors' medication use. This experience could be used as a model for other colleges and schools of pharmacy and their communities.

Robles, Cox, and & Seifert (2012) investigated the preceptors' and students' learning styles to determine how these impact students' performance on pharmacy practice experience assessments. Students and preceptors were asked to complete a validated Pharmacist's Inventory of Learning Styles (PILS) questionnaire to identify dominant and secondary learning styles. The significance of "matched" and "unmatched" learning styles between students and preceptors was evaluated based on performance on both subjective and objective practice experience assessments. Results. Sixty-one percent of 67 preceptors and 57% of 72 students who participated reported "assimilator" as their dominant learning style. No differences were found between student and preceptor performance on evaluations, regardless of learning style match. The authors concluded that determination of learning styles may encourage preceptors to use teaching methods to challenge students during pharmacy practice experiences; however, this does not appear to impact student or preceptor performance.

### *Physical Education*

In their book, *"A little book about skiing"*, Vigani and Heaton (2010) offers a simple and straight forward approach for skiing better based on experiential learning model. The authors suggest that learning slows down if learners try to over-complicate the process by being overly analytical about each move they make or if they do not follow the experiential learning model steps in an orderly manner.

Ristori et. al. (2011) investigated whether approved clinical instructors' prior knowledge of athletic training students' learning styles may enhance students' clinical education experiences. The researcher assessed the relationship between ACIs' estimates of ATSs' learning styles and the actual learning styles of the ATSs. The variables analyzed by this investigation were (a) ACIs' perceptions of ATSs' learning styles on the basis of results from the ACI Student Assessment Questionnaire and (b) the ATSs' learning styles on the

basis of results from the Kolb Learning Style Inventory. The research findings suggest that ACIs are able to identify ATSs' learning styles, but it may have little impact on the ACI-ATS relationship. The modeling of professional behavior has been identified as the most helpful ACI characteristic. Involvement with students, being clear and organized, an emphasis on problem-solving, mentoring, good communication, positive attitude, and feedback have been identified as good ACI characteristics. The author concluded that mentoring qualities may be far more important than the ability to identify a student's learning style.

Bethell and Morgan (2011) conducted a study to employ a combined problem-based learning (PBL) and experiential learning theory (ELT) methodology as a means of engaging students on an undergraduate physical education (PE) and sport pedagogy module. Focus groups were conducted to investigate the students' and tutors' responses to the teaching approach. The results indicated that the method of teaching was associated with students feeling confident about their critical knowledge and understanding of contemporary issue in PE, their presentation and discussion skills, and a positive engagement with the module. Overall the approach was highly beneficial to the student learning experience.

Caglayan (2011) carried out a study to determine the academicians' learning styles in school of physical education and sports and whether there was a relationship between their learning styles and gender, age, appellation and the department they worked or not. In the study survey method was used. The sample of the study consisted of 206 academicians who were working in public Schools of Physical Education and Sports (n=183) and Schools of Sport Science and Technology (n=23). The Kolb Learning Styles Inventory adapted to Turkish by Aska and Akkoyunlu (1993) was used as data collection tool.
The results revealed that, the academicians in the School of Physical Education and Sports had 47.6% converging, 30.1% assimilating, 11.7% diverging, 10.7% accommodating learning styles and there was no significant difference between their learning styles and gender, age, appellation and the department they worked.

Tamminen and Holt (2012) developed a grounded theory study to investigate the ways adolescent athletes learned about coping in sport. They subsequently focused on the roles of parents and coaches within this process. Interviews were conducted with 17 athletes (8 females, 9 males), 10 parents (6 mothers, 4 fathers), and 7 male coaches. The result indicated that learning about coping was an experiential process consisting of the athletes' sport experiences and learning through trial and error, reflective practice, and coping outcomes (consistent performance, independence in coping, and persistence in coping). Learning was facilitated by athletes being exposed to multiple situations and reflecting on their coping efforts. Parents and coaches helped athletes learn about coping by creating a supportive context for learning (listening and monitoring their own reactions, establishing trust and respect, reading the athlete, and fostering independence). Parents and coaches also used specific strategies to help athletes learn about coping, including questioning and reminding, providing perspective, sharing experiences, dosing stress experiences, initiating informal conversations, creating learning opportunities, and direct instruction. The authors concluded that adolescent athletes must gain personal experience in dealing with stressors in

order to learn how to cope. Parents and coaches represent key sources of influence within the process of learning about coping.

Timken and McNamee (2012) conducted a study to gauge pre-service physical education teachers' perspectives during one physical activity pedagogy course, teaching outdoor and adventure education. Teacher belief, occupational socialization and experiential learning theories overlaid this work. Over three years 57 students (37 males; 20 females) participated in the course. Each student wrote four reflections during their term of enrollment based on semi-structured questions regarding their own participation, thoughts on K-12 students, and teaching and learning in physical education. Reflections were analyzed using constant comparative methods. Three main themes emerged from the data: I) fear, risk and challenge, (subthemes of skill and motivation; self-awareness); 2) lifetime activity; and 3) teaching physical education (subthemes of K-12 students; curriculum). Implications for physical education teacher education suggest the inclusion of novel physical activities that elicit strong emotional responses due to challenges with perceived and/or actual risk as a viable method for inducing belief change.

Kolb and Kolb (2010) propose an experiential learning framework to explore how play can potentially create a unique ludic learning space conducive to deep learning. The framework is developed by integrating two perspectives. First, the multidisciplinary theories of play are presented as a basis to uncover the underlying play principles that contribute to the emergence of the ludic learning space. Then the formation of a ludic learning space through a case study of a pick-up softball league where for 15 years, a group of individuals diverse in age group, gender, level of education, and ethnic background have come together to play are examined. The case study suggests that play in a ludic learning space can promote deep learning in the intellectual, physical, spiritual, and moral realms.

### *Physics*

Alias and Siraj (2012) designed and developed a Physics module based on learning style and appropriate technology in secondary educational setting by employing Isman Instructional Design Model and to test the effectiveness of the module. The paper draws attention to the design principles which employs Isman Instructional Design Model. The prototype module was tested among two teachers and 14 participants. The findings from interviews with the teachers and students show a positive response in Physics when their learning styles are matched with appropriate technology. In the evaluation phase, two instruments were used to collect data for this study. The pre-posttest designed to identify students' achievement score and Felder Silverman's Learning Style Inventory to measure students' learning style. Findings from evaluation of the module conducted among 120 participants involving 30 participants of each learning style (visual/verbal, active/reflective) suggested that the module is effective for visual, active, reflective and not for verbal learners. The researchers also compared the effectiveness of the module according to gender. The verbal and reflective modules were effective for female learners and not for male learners. The findings from this study suggest that Isman Instructional Design Model which pays attention to instruction from the learner perspective than from content perspective is suitable in designing and developing Physics module based on learning style and appropriate

technology in secondary educational setting in Malaysia. The findings of this study is also hoped to provide insights to promote teaching and learning of Physics based on learning style and appropriate technology.

Ergin and Sari (2012) Examine the effect of 4MAT (4 Mode Application Techniques) instruction on the achievement of high school students with different learning styles on the subjects of work, power and energy in physics education. The subjects were 124 students from four 10th grade classes of two high schools located in Ankara. The two of the four classes were selected as experimental group and the remaining two classes as control group. The students were taught for 7 weeks. The experimental group was taught via 4MAT instruction method prepared by the researcher, whereas the control group was taught using lecturing and question-answer methods. A quasi-experimental design with pretest-posttest control group was used in this study. Pilot applications were carried out for validity and reliability of the measurement tools used in this study. Prior to the study, in order to determine the equivalence of the experimental group and the control group, Work-Power-Energy Achievement Test (WPEAT) was applied. Similarly, prior to the study, so as to determine the learning styles of the students, Kolb Learning Style Inventory (KLSI) was applied. Following the application, WPEAT was applied to both groups also as a posttest. The following findings were obtained in this study. The students had different learning styles and 4MAT instruction method increased students' achievement significantly. In addition, the answers given by the students to the open-ended questions asked in the classes where 4MAT instruction method was applied indicate that this method was welcomed by the students. It is of importance that the 4MAT instruction method should be used in physics lessons with a view to boost the students' achievements and to help students develop positive attitudes toward physics.

***Physiology***

Eagleton and Muller (2011) developed a whole brain learning model based on Curry's onion model. Curry described the effect of personality traits as the inner layer of learning, information-processing styles as the middle layer of learning, and environmental and instructional preferences as the outer layer of learning. The model that was developed elaborates on these layers by relating the personality traits central to learning to the different quadrants of brain preference, as described by Neethling's brain profile, as the inner layer of the onion. This layer is encircled by the learning styles that describe different information-processing preferences for each brain quadrant. For the middle layer, the different stages of Kolb's learning cycle are classified into the four brain quadrants associated with the different brain processing strategies within the information processing circle. Each of the stages of Kolb's learning cycle is also associated with a specific cognitive learning strategy. These two inner circles are enclosed by the circle representing the role of the environment and instruction on learning. It relates environmental factors that affect learning and distinguishes between face-to-face and technology-assisted learning. This model informs on the design of instructional interventions for physiology to encourage whole brain learning.

### *Political Science*

Building on Svinick and Dixon model, Brock & Cameron (1999) developed instructional sequences for political science course based on the experiential learning cycle. The authors contend that teaching to all learning modes is crucial for students' acquisition of higher order thinking and problem solving skills. They offer as an illustrative example, how each phase of the cycle can be designed as a process of exploration of the experience of involvement in a political campaign. During the CE phase, students could explore their reactions about the various experiences during the election: Did they vote on policy or personality? Was the ballot clear or confusing? If discrimination and representation are key themes of the course, the instructor can encourage students to consider what role the race, gender, sexual orientation, or religion of the candidates and the voters played in the determining the outcome of the election. In the RO phase of the class, discussion, brainstorming sessions, and journals can be used to encourage reflection about the political situations or policies. The AC phase of the learning process can be devoted to intellectual modeling by the instructors in lectures. It is very important, emphasize the authors, that students observe the instructor "thinking out loud", for it is by seeing the instructor's mind at work that students learn how to think like political scientists. When instructors only present conclusions or solutions to problems, students' ability to develop higher order thinking can be substantially diminished. Finally, in the AE phase of the learning cycle, students could be asked to project the outcome of the election in a specific district using the data generated by the polling firms or an analysis of socio-political and income profile of the target area. Next, they could track the fortunes of the parties following the development of the campaign, adjust their model, and offer final predictions on voting day. The cycle can be re-started when the election results were known (CE phase), students are encouraged to reflect on the election outcomes (RO phase) and analyze the strength and weakness of their prediction model. The authors concluded that, while there is a great merit in following the four-stage learning cycle, the purpose of the model is not to set a rigid learning pattern that takes away spontaneity and flexibility from both students and instructors.

Ahmadov (2011) examines a mock trial he has developed and used in teaching the history of political thought. Mock trials have been underused but have great potential to become an effective and exciting tool for student learning in this area. In this mock trial, the plaintiff, defendant, attorneys, and witnesses are eminent political or economic thinkers or political leaders of the past. Active engagement in this mock trial helped his students immensely in gaining deeper insight into and a more nuanced understanding of the ideas of the thinker they represented, as well as enhancing their critical and analytical abilities and improving their research skills. As a teaching tool that is amenable to creative adaptation, a mock trial can be an engaging and effective exercise for delving into the history of political thought and making it more relevant.

Lindsey (2011) argues that instructors should introduce students to abstract concepts only after they have provided concrete illustrations of them. The advantages of working from the concrete to the abstract are twofold: (1) students have an easier time conceptualizing abstractions from within a particular context, and (2) such a context provides them with a greater motivation to do so. In an effort to mirror the pedagogical approach he defends, he

begins by reviewing the manner in which Plato introduces the concept of justice to his readers in Book I of the *Republic*. He then examines the common model of teaching abstract concepts, demonstrate how an effective alternative differs from this model and review the education theories that support the alternative model.

***Psychiatry***

Milne, James, Keegan, and Dudley (2002) developed an empirical method of assessing the effectiveness of mental health trainers' transaction patterns and their impact on student learning. The instrument, Teacher's PETS (Process Evaluation of Training and Supervision) was derived through operationalization of the experiential learning theory with the main purpose of providing empirically valid and reliable data on the trainers' behaviors during training sessions. The instrument was designed around the four dimensions of learning cycle and "is an explicitly transactional one in which learners play an essential role in relation to the trainers, who will be at times responsive and at times proactive" (2000: 189) in any given learning situation. The key feature of the model, the authors suggest, is the fluid, dynamic transactions that occurs between the levels of the model as learners move backward and forwards between different learning modes, and trainers using several methods to move the learner on to a new mode of the experiential learning cycle. The authors summarize the usefulness of the instrument to measure trainers' effective behaviors as follows: "….the effectiveness of the trainer can be assessed *functionally*, in terms of the learner's mini-outcomes (a 'good' profile would show that the learner made use of all four learning modes); *structurally*, in terms of the trainer's use of the observed facilitating behaviors (i.e. a 'good' profile would tend to show that the leader had utilized a range of such behaviors)." (2000: 91)

The study was conducted to assess one trainer's performance in a 8-day in service workshop on psychosocial interventions for severe mental illness held at psychiatric hospital in UK. Participants of the workshop were 31 mental health professionals who were allocated to two different training groups. The workshops lasted for three months, and were scheduled in four blocks of 2 days each. There was a 2-month interval between the workshops that were attended by the two groups. The study was conducted in three distinct phases: a baseline phase where the workshop leader served as his own control, the intervention phase consisted of consultancy where the leader received feedback on his performance based on PETS instrument followed by discussion and modeling of alternative teaching techniques, and finally, the maintenance phase where the consultancy was withdrawn from the training session. The workshop was video-recorded for the duration of the study. A random selection of segments of the training was analyzed using PETS. Four baseline sample sessions, followed by two from intervention, and one from the maintenance period were selected for analysis. The relevant behaviors of the trainers and the participants were coded from the tapes. The results of the study indicate that during the baseline phase, the observed teaching method was primarily didactic in nature and accounted for the greatest impact (46.4%) on learner behavior in the reflection mode of the learning cycle, followed by smaller overall impacts on the remaining phases of the cycle (range from means of 12.2% for abstract conceptualization to 5.7% for active experimentation). In the intervention phase by contrast, the greatest impact of the trainer's behavior on learners' was on the concrete experience (59. 5%), followed by reflective observation (33%), and active experimentation (4.5%) phases of

the learning cycle. The authors conclude that the intervention phase produced trainer's behaviors that promote learners' ability to take advantage of the full range of the experiential learning cycles thus maximizing their learning outcomes. Finally, PETS yielded a good inter-rater reliability as well as adequate empirical and concurrent validity indicating its effectiveness as observational instrument in educational settings. As such, PETS serves as an exemplary model for assessing and enhancing trainers' skills in mastering experiential learning methods that is applicable in diverse teaching and training situations.

***Psychology***

Wolf and Mehl (2011) introduced exposure to a high-ropes course as an adjunct intervention in the therapy of psychotherapy patients. A controlled study was conducted to investigate the effectiveness of high-ropes exposures as an add-on to inpatient treatment in a naturalistic setting. In a sample of 247 patients, depressive symptoms, trait anxiety, locus of control and self-efficacy were assessed at admission and discharge of treatment and at 24-month follow-up. Follow-up data were available for 104 patients who attended the ropes courses and 53 control patients who underwent an inpatient treatment program as usual. At the end of treatment, more high-rope participants showed clinically significant change on trait anxiety than controls but not regarding depressive symptoms. High-rope participants showed better follow-up outcomes than controls in trait anxiety and self-efficacy but not in depressive symptoms and external locus of control. Moreover, during follow-up, in the high-rope group, more patients showed reliable improvements and fewer patients showed reliable deteriorations in trait anxiety as compared with controls. The study gives a preliminary indication that the high-rope interventions are a feasible and valuable add-on to inpatient psychotherapy.

Van Doorn, McManus, and Yiend (2012) suggest that one factor influencing the differential effectiveness of CBT intervention techniques may be the patient's preferred learning style, and whether this is 'matched' to the intervention. They conducted a study using a retrospective analysis to examine whether the impact of two common CBT interventions (thought records and behavioral experiments) is greater when the intervention is either matched or mismatched to the individual's learning style. Results from this study give some indication that greater belief change is achieved when the intervention technique is matched to participants' learning style, than when intervention techniques are mismatched to learning style. Conclusions are limited by the retrospective nature of the analysis and the limited dose of the intervention in non-clinical participants. Results suggest that further investigation of the impact of matching the patient's learning style to CBT intervention techniques is warranted, using clinical samples with higher dose interventions.

Biswas-Diener, and Patterson (2011) argue that an experiential approach to teaching positive psychology is, potentially, the most impactful form of instruction for this subject. We provide examples of how to increase experiential learning including syllabus development, creating practical assignments, and using course relevant technology. The undergraduate classroom can act as a laboratory in which students can personally experience the interventions associated with this field.

### *Science*

Bertacchini, Bilotta, Pantano and Tavernise (2012) present an Edutainment (education plus entertainment) secondary school setting based on the construction of artifacts and manipulation of virtual contents (images, sound, and music) connected to Chaos. This interactive learning environment also foresees the use of a virtual theatre, by which students can manipulate 3D contents (parameterized models of expressive faces called "Talking Heads"), in order to realize a computer performance on the explanation of Chaos concepts. After an entry assessment of subjects' information on Chaos, 30 high school students aged between 16 and 18 have manipulated real and virtual objects related to Chua's circuit. Then they have written a script on Chaos topic, manipulated the Talking Heads for the realization of a virtual theatre performance, and filled a Chaos knowledge questionnaire and a motivation test. The control group (30 students) has attended traditional lessons on Chaos, and compiled the same tests. Results enhance the great potentiality of the realized setting for science education and motivation. In particular, very positive results in learning, as well as an increase of motivation linked to interest/enjoyment and competence, have been demonstrated.

### *Social Work*

Kruzich, Friesen, and Soest (1986) conducted a study of student and faculty learning styles in social work at two universities and two private colleges and found significant learning style differences among undergraduate students, graduate students, field instructors, and social work faculty. Overall, faculty most often had converging learning styles whereas the majority of graduate students and field instructors were diverging learners. The undergraduate students were mostly accommodating learners, suggesting preference for action.

In a similar study conducted in the field of social work, Raschick, Mypole, and Day (1998) found that students whose learning styles' were similar to their field supervisors along the active experimentation-reflective observation continuum would rate their field experience with them higher. The authors suggest that the finding is most relevant for the supervisors at the beginning point of the learning cycle, when matching their teaching techniques to their students' preferences presents with added benefits to encourage students to move through the rest of the learning cycle.

### *Theatre*

In his book, *Theatre as the essential liberal art in the American University*, Gressler makes a compelling argument that theatre is the only liberal arts discipline that is almost entirely based on an experiential learning approach to education. It requires students, whether working individually or in groups, to integrate all its part in order to communicate the end result to the audience: "Fortuitously, nearly every theatre course and production activity I can think of disallows passivity; nearly every course and activity follows the active-based,

experiential learning patterns proposed by Kolb and others. For example, the acting students has 1) personal involvement with a script, 2) reflects on its meaning by searching for internal and external evidence, 3) decides logically as well as intuitively how it should be played and, 4) offers these conclusions to the class or audience. Their responses or non-responses and critiques help inform the next scene or play that student reads/and or acts. The costume design student experiences a play in a manuscript form, reflects on its meaning by investigating internal and external sources, draws logical conclusions as to the form, color, line, and texture that will most accurately reflect to new and more informed perceptions, or to an audience or critic whose response indicates whether or not those conclusions were logical, acceptable and valid." (2002: 79-80)

For those who want to adopt experiential learning methodologies in the classrooms, Gressler has one important message to share: "One caveat must be mentioned when accepting the superior quality of experiential learning methodologies: they take time. More active strategies such as experiential learning techniques, take more time because there is more active exploration, testing, discovering, and hypothesizing. However, there are also likely to be higher retention rates, a higher degree of motivation, and more potential for integrating new ideas into the learner's store of knowledge. It seems clear that, because the modern world has made comprehension of all knowledge a useless quest, as measured by standardized tests, it may be more efficacious to study through methods that are apprehensive, as measured by motivation levels, retention levels and integrative capabilities." (2002: p. 84)

***Urban Planning***

Dearden and Wilson (2011) explored the effectiveness of computer simulation to capture the response of private market and private individuals to the urban planning intervention. This response is difficult to predict due to the fact that the city is a nonlinear system of organized complexity. Models of cities which seek to explain this response are necessarily complicated and dynamic. Where an analytical solution is not possible the authors turned to computer simulation and interactive visualization in order to understand their output. Allowing human participation in such simulations provides a sandbox in which to experiment with the dynamic behavior of an urban model and play a part in its evolution. Two possible options for structuring this participation were: (1) toy retail systems, which allow unconstrained experimentation, and (2) games, which impose rules and involve role-play and competition. To explore these ideas they construct a toy retail system and a two-player retail game, both of which are derived from an existing agent-based retail model. The authors explored the application of these systems to the metropolitan county of South Yorkshire in the UK.

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# APPENDICES 1-11

## APPENDIX 1
## KLSI 4.0 Raw Score to Percentile Conversion

| Concrete Experience | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 11.00 | 199 | 1.9 | 1.9 | 1.9 |
| | 12.00 | 574 | 5.5 | 5.5 | 7.4 |
| | 13.00 | 773 | 7.4 | 7.4 | 14.8 |
| | 14.00 | 797 | 7.6 | 7.6 | 22.5 |
| | 15.00 | 828 | 7.9 | 7.9 | 30.4 |
| | 16.00 | 817 | 7.8 | 7.8 | 38.3 |
| | 17.00 | 717 | 6.9 | 6.9 | 45.1 |
| | 18.00 | 638 | 6.1 | 6.1 | 51.3 |
| | 19.00 | 624 | 6.0 | 6.0 | 57.2 |
| | 20.00 | 516 | 5.0 | 5.0 | 62.2 |
| | 21.00 | 466 | 4.5 | 4.5 | 66.7 |
| | 22.00 | 445 | 4.3 | 4.3 | 70.9 |
| | 23.00 | 394 | 3.8 | 3.8 | 74.7 |
| | 24.00 | 377 | 3.6 | 3.6 | 78.3 |
| | 25.00 | 299 | 2.9 | 2.9 | 81.2 |
| | 26.00 | 278 | 2.7 | 2.7 | 83.9 |
| | 27.00 | 252 | 2.4 | 2.4 | 86.3 |
| | 28.00 | 235 | 2.3 | 2.3 | 88.5 |
| | 29.00 | 217 | 2.1 | 2.1 | 90.6 |
| | 30.00 | 168 | 1.6 | 1.6 | 92.2 |
| | 31.00 | 147 | 1.4 | 1.4 | 93.6 |
| | 32.00 | 117 | 1.1 | 1.1 | 94.8 |
| | 33.00 | 98 | .9 | .9 | 95.7 |
| | 34.00 | 93 | .9 | .9 | 96.6 |
| | 35.00 | 77 | .7 | .7 | 97.3 |
| | 36.00 | 59 | .6 | .6 | 97.9 |
| | 37.00 | 56 | .5 | .5 | 98.4 |
| | 38.00 | 46 | .4 | .4 | 98.9 |
| | 39.00 | 41 | .4 | .4 | 99.3 |
| | 40.00 | 23 | .2 | .2 | 99.5 |
| | 41.00 | 20 | .2 | .2 | 99.7 |

| | | | | | |
|---|---|---|---|---|---|
| | 42.00 | 18 | .2 | .2 | 99.9 |
| | 43.00 | 7 | .1 | .1 | 99.9 |
| | 44.00 | 7 | .1 | .1 | 100.0 |
| | Total | 10423 | 100.0 | 100.0 | |

**Reflective Observation**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | 11.00 | 43 | .4 | .4 | .4 |
| | 12.00 | 97 | .9 | .9 | 1.3 |
| | 13.00 | 130 | 1.2 | 1.2 | 2.6 |
| | 14.00 | 141 | 1.4 | 1.4 | 3.9 |
| | 15.00 | 186 | 1.8 | 1.8 | 5.7 |
| | 16.00 | 269 | 2.6 | 2.6 | 8.3 |
| | 17.00 | 315 | 3.0 | 3.0 | 11.3 |
| | 18.00 | 363 | 3.5 | 3.5 | 14.8 |
| | 19.00 | 430 | 4.1 | 4.1 | 18.9 |
| | 20.00 | 409 | 3.9 | 3.9 | 22.9 |
| | 21.00 | 484 | 4.6 | 4.6 | 27.5 |
| | 22.00 | 501 | 4.8 | 4.8 | 32.3 |
| | 23.00 | 514 | 4.9 | 4.9 | 37.2 |
| | 24.00 | 526 | 5.0 | 5.0 | 42.3 |
| | 25.00 | 535 | 5.1 | 5.1 | 47.4 |
| | 26.00 | 526 | 5.0 | 5.0 | 52.5 |
| | 27.00 | 566 | 5.4 | 5.4 | 57.9 |
| | 28.00 | 510 | 4.9 | 4.9 | 62.8 |
| | 29.00 | 486 | 4.7 | 4.7 | 67.5 |
| | 30.00 | 449 | 4.3 | 4.3 | 71.8 |
| | 31.00 | 470 | 4.5 | 4.5 | 76.3 |
| | 32.00 | 399 | 3.8 | 3.8 | 80.1 |
| | 33.00 | 346 | 3.3 | 3.3 | 83.4 |
| | 34.00 | 294 | 2.8 | 2.8 | 86.2 |
| | 35.00 | 309 | 3.0 | 3.0 | 89.2 |
| | 36.00 | 258 | 2.5 | 2.5 | 91.7 |
| | 37.00 | 210 | 2.0 | 2.0 | 93.7 |
| | 38.00 | 168 | 1.6 | 1.6 | 95.3 |
| | 39.00 | 154 | 1.5 | 1.5 | 96.8 |
| | 40.00 | 112 | 1.1 | 1.1 | 97.9 |
| | 41.00 | 88 | .8 | .8 | 98.7 |
| | 42.00 | 58 | .6 | .6 | 99.3 |
| | 43.00 | 43 | .4 | .4 | 99.7 |
| | 44.00 | 34 | .3 | .3 | 100.0 |
| | Total | 10423 | 100.0 | 100.0 | |

| Abstract Conceptualization | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 11.00 | 3 | .0 | .0 | .0 |
| | 12.00 | 8 | .1 | .1 | .1 |
| | 13.00 | 28 | .3 | .3 | .4 |
| | 14.00 | 35 | .3 | .3 | .7 |
| | 15.00 | 70 | .7 | .7 | 1.4 |
| | 16.00 | 76 | .7 | .7 | 2.1 |
| | 17.00 | 154 | 1.5 | 1.5 | 3.6 |
| | 18.00 | 164 | 1.6 | 1.6 | 5.2 |
| | 19.00 | 252 | 2.4 | 2.4 | 7.6 |
| | 20.00 | 284 | 2.7 | 2.7 | 10.3 |
| | 21.00 | 350 | 3.4 | 3.4 | 13.7 |
| | 22.00 | 397 | 3.8 | 3.8 | 17.5 |
| | 23.00 | 505 | 4.8 | 4.8 | 22.3 |
| | 24.00 | 497 | 4.8 | 4.8 | 27.1 |
| | 25.00 | 561 | 5.4 | 5.4 | 32.5 |
| | 26.00 | 542 | 5.2 | 5.2 | 37.7 |
| | 27.00 | 547 | 5.2 | 5.2 | 42.9 |
| | 28.00 | 591 | 5.7 | 5.7 | 48.6 |
| | 29.00 | 565 | 5.4 | 5.4 | 54.0 |
| | 30.00 | 563 | 5.4 | 5.4 | 59.4 |
| | 31.00 | 569 | 5.5 | 5.5 | 64.9 |
| | 32.00 | 501 | 4.8 | 4.8 | 69.7 |
| | 33.00 | 433 | 4.2 | 4.2 | 73.8 |
| | 34.00 | 432 | 4.1 | 4.1 | 78.0 |
| | 35.00 | 362 | 3.5 | 3.5 | 81.4 |
| | 36.00 | 318 | 3.1 | 3.1 | 84.5 |
| | 37.00 | 352 | 3.4 | 3.4 | 87.9 |
| | 38.00 | 287 | 2.8 | 2.8 | 90.6 |
| | 39.00 | 241 | 2.3 | 2.3 | 92.9 |
| | 40.00 | 236 | 2.3 | 2.3 | 95.2 |
| | 41.00 | 181 | 1.7 | 1.7 | 96.9 |
| | 42.00 | 138 | 1.3 | 1.3 | 98.3 |
| | 43.00 | 120 | 1.2 | 1.2 | 99.4 |
| | 44.00 | 61 | .6 | .6 | 100.0 |
| | Total | 10423 | 100.0 | 100.0 | |

| Active Experimentation | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | 11.00 | 5 | .0 | .0 | .0 |
| | 12.00 | 9 | .1 | .1 | .1 |
| | 13.00 | 9 | .1 | .1 | .2 |
| | 14.00 | 22 | .2 | .2 | .4 |
| | 15.00 | 20 | .2 | .2 | .6 |
| | 16.00 | 32 | .3 | .3 | .9 |
| | 17.00 | 51 | .5 | .5 | 1.4 |
| | 18.00 | 55 | .5 | .5 | 1.9 |
| | 19.00 | 88 | .8 | .8 | 2.8 |
| | 20.00 | 123 | 1.2 | 1.2 | 4.0 |
| | 21.00 | 155 | 1.5 | 1.5 | 5.5 |
| | 22.00 | 203 | 1.9 | 1.9 | 7.4 |
| | 23.00 | 238 | 2.3 | 2.3 | 9.7 |
| | 24.00 | 263 | 2.5 | 2.5 | 12.2 |
| | 25.00 | 346 | 3.3 | 3.3 | 15.5 |
| | 26.00 | 401 | 3.8 | 3.8 | 19.4 |
| | 27.00 | 422 | 4.0 | 4.0 | 23.4 |
| | 28.00 | 433 | 4.2 | 4.2 | 27.6 |
| | 29.00 | 517 | 5.0 | 5.0 | 32.5 |
| | 30.00 | 591 | 5.7 | 5.7 | 38.2 |
| | 31.00 | 584 | 5.6 | 5.6 | 43.8 |
| | 32.00 | 644 | 6.2 | 6.2 | 50.0 |
| | 33.00 | 660 | 6.3 | 6.3 | 56.3 |
| | 34.00 | 679 | 6.5 | 6.5 | 62.8 |
| | 35.00 | 751 | 7.2 | 7.2 | 70.0 |
| | 36.00 | 648 | 6.2 | 6.2 | 76.3 |
| | 37.00 | 594 | 5.7 | 5.7 | 82.0 |
| | 38.00 | 550 | 5.3 | 5.3 | 87.2 |
| | 39.00 | 468 | 4.5 | 4.5 | 91.7 |
| | 40.00 | 342 | 3.3 | 3.3 | 95.0 |
| | 41.00 | 263 | 2.5 | 2.5 | 97.5 |
| | 42.00 | 156 | 1.5 | 1.5 | 99.0 |
| | 43.00 | 70 | .7 | .7 | 99.7 |
| | 44.00 | 31 | .3 | .3 | 100.0 |

| Abstract Conceptualization – Concrete Experience | | | | | |
|---|---|---|---|---|---|
| | | Frequency | Percent | Valid Percent | Cumulative Percent |
| Valid | -29.00 | 2 | .0 | .0 | .0 |
| | -28.00 | 2 | .0 | .0 | .0 |
| | -27.00 | 3 | .0 | .0 | .1 |
| | -26.00 | 5 | .0 | .0 | .1 |
| | -25.00 | 6 | .1 | .1 | .2 |
| | -24.00 | 11 | .1 | .1 | .3 |
| | -23.00 | 12 | .1 | .1 | .4 |
| | -22.00 | 17 | .2 | .2 | .6 |
| | -21.00 | 21 | .2 | .2 | .8 |
| | -20.00 | 26 | .2 | .2 | 1.0 |
| | -19.00 | 25 | .2 | .2 | 1.2 |
| | -18.00 | 26 | .2 | .2 | 1.5 |
| | -17.00 | 37 | .4 | .4 | 1.9 |
| | -16.00 | 50 | .5 | .5 | 2.3 |
| | -15.00 | 56 | .5 | .5 | 2.9 |
| | -14.00 | 61 | .6 | .6 | 3.5 |
| | -13.00 | 67 | .6 | .6 | 4.1 |
| | -12.00 | 77 | .7 | .7 | 4.8 |
| | -11.00 | 63 | .6 | .6 | 5.4 |
| | -10.00 | 86 | .8 | .8 | 6.3 |
| | -9.00 | 92 | .9 | .9 | 7.1 |
| | -8.00 | 101 | 1.0 | 1.0 | 8.1 |
| | -7.00 | 117 | 1.1 | 1.1 | 9.2 |
| | -6.00 | 125 | 1.2 | 1.2 | 10.4 |
| | -5.00 | 155 | 1.5 | 1.5 | 11.9 |
| | -4.00 | 134 | 1.3 | 1.3 | 13.2 |
| | -3.00 | 160 | 1.5 | 1.5 | 14.7 |
| | -2.00 | 187 | 1.8 | 1.8 | 16.5 |
| | -1.00 | 195 | 1.9 | 1.9 | 18.4 |
| | .00 | 221 | 2.1 | 2.1 | 20.5 |
| | 1.00 | 240 | 2.3 | 2.3 | 22.8 |
| | 2.00 | 225 | 2.2 | 2.2 | 25.0 |
| | 3.00 | 245 | 2.4 | 2.4 | 27.3 |
| | 4.00 | 286 | 2.7 | 2.7 | 30.1 |
| | 5.00 | 338 | 3.2 | 3.2 | 33.3 |
| | 6.00 | 330 | 3.2 | 3.2 | 36.5 |
| | 7.00 | 371 | 3.6 | 3.6 | 40.1 |
| | 8.00 | 367 | 3.5 | 3.5 | 43.6 |
| | 9.00 | 397 | 3.8 | 3.8 | 47.4 |
| | 10.00 | 406 | 3.9 | 3.9 | 51.3 |
| | 11.00 | 380 | 3.6 | 3.6 | 54.9 |
| | 12.00 | 395 | 3.8 | 3.8 | 58.7 |

| | | | | | |
|---|---|---|---|---|---|
| | 13.00 | 382 | 3.7 | 3.7 | 62.4 |
| | 14.00 | 375 | 3.6 | 3.6 | 66.0 |
| | 15.00 | 345 | 3.3 | 3.3 | 69.3 |
| | 16.00 | 379 | 3.6 | 3.6 | 72.9 |
| | 17.00 | 361 | 3.5 | 3.5 | 76.4 |
| | 18.00 | 334 | 3.2 | 3.2 | 79.6 |
| | 19.00 | 307 | 2.9 | 2.9 | 82.5 |
| | 20.00 | 284 | 2.7 | 2.7 | 85.3 |
| | 21.00 | 272 | 2.6 | 2.6 | 87.9 |
| | 22.00 | 238 | 2.3 | 2.3 | 90.2 |
| | 23.00 | 214 | 2.1 | 2.1 | 92.2 |
| | 24.00 | 178 | 1.7 | 1.7 | 93.9 |
| | 25.00 | 159 | 1.5 | 1.5 | 95.4 |
| | 26.00 | 141 | 1.4 | 1.4 | 96.8 |
| | 27.00 | 100 | 1.0 | 1.0 | 97.8 |
| | 28.00 | 84 | .8 | .8 | 98.6 |
| | 29.00 | 62 | .6 | .6 | 99.2 |
| | 30.00 | 46 | .4 | .4 | 99.6 |
| | 31.00 | 26 | .2 | .2 | 99.8 |
| | 32.00 | 12 | .1 | .1 | 100.0 |
| | 33.00 | 4 | .0 | .0 | 100.0 |
| | Total | 10423 | 100.0 | 100.0 | |

**Active Experimentation – Reflective Observation**

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|
| Valid | -33.00 | 1 | .0 | .0 | .0 |
| | -31.00 | 1 | .0 | .0 | .0 |
| | -30.00 | 2 | .0 | .0 | .0 |
| | -29.00 | 2 | .0 | .0 | .1 |
| | -28.00 | 1 | .0 | .0 | .1 |
| | -27.00 | 3 | .0 | .0 | .1 |
| | -26.00 | 6 | .1 | .1 | .2 |
| | -25.00 | 5 | .0 | .0 | .2 |
| | -24.00 | 10 | .1 | .1 | .3 |
| | -23.00 | 11 | .1 | .1 | .4 |
| | -22.00 | 18 | .2 | .2 | .6 |
| | -21.00 | 23 | .2 | .2 | .8 |
| | -20.00 | 40 | .4 | .4 | 1.2 |
| | -19.00 | 31 | .3 | .3 | 1.5 |
| | -18.00 | 59 | .6 | .6 | 2.0 |
| | -17.00 | 64 | .6 | .6 | 2.7 |
| | -16.00 | 74 | .7 | .7 | 3.4 |
| | -15.00 | 94 | .9 | .9 | 4.3 |
| | -14.00 | 97 | .9 | .9 | 5.2 |
| | -13.00 | 117 | 1.1 | 1.1 | 6.3 |

| | | | | | |
|---|---|---|---|---|---|
| | -12.00 | 112 | 1.1 | 1.1 | 7.4 |
| | -11.00 | 133 | 1.3 | 1.3 | 8.7 |
| | -10.00 | 141 | 1.4 | 1.4 | 10.0 |
| | -9.00 | 174 | 1.7 | 1.7 | 11.7 |
| | -8.00 | 182 | 1.7 | 1.7 | 13.4 |
| | -7.00 | 157 | 1.5 | 1.5 | 14.9 |
| | -6.00 | 207 | 2.0 | 2.0 | 16.9 |
| | -5.00 | 224 | 2.1 | 2.1 | 19.1 |
| | -4.00 | 237 | 2.3 | 2.3 | 21.4 |
| | -3.00 | 240 | 2.3 | 2.3 | 23.7 |
| | -2.00 | 267 | 2.6 | 2.6 | 26.2 |
| | -1.00 | 271 | 2.6 | 2.6 | 28.8 |
| | .00 | 287 | 2.8 | 2.8 | 31.6 |
| | 1.00 | 313 | 3.0 | 3.0 | 34.6 |
| | 2.00 | 327 | 3.1 | 3.1 | 37.7 |
| | 3.00 | 295 | 2.8 | 2.8 | 40.5 |
| | 4.00 | 334 | 3.2 | 3.2 | 43.7 |
| | 5.00 | 340 | 3.3 | 3.3 | 47.0 |
| | 6.00 | 329 | 3.2 | 3.2 | 50.2 |
| | 7.00 | 324 | 3.1 | 3.1 | 53.3 |
| | 8.00 | 363 | 3.5 | 3.5 | 56.8 |
| | 9.00 | 338 | 3.2 | 3.2 | 60.0 |
| | 10.00 | 389 | 3.7 | 3.7 | 63.7 |
| | 11.00 | 341 | 3.3 | 3.3 | 67.0 |
| | 12.00 | 345 | 3.3 | 3.3 | 70.3 |
| | 13.00 | 345 | 3.3 | 3.3 | 73.6 |
| | 14.00 | 333 | 3.2 | 3.2 | 76.8 |
| | 15.00 | 314 | 3.0 | 3.0 | 79.8 |
| | 16.00 | 314 | 3.0 | 3.0 | 82.8 |
| | 17.00 | 298 | 2.9 | 2.9 | 85.7 |
| | 18.00 | 239 | 2.3 | 2.3 | 88.0 |
| | 19.00 | 230 | 2.2 | 2.2 | 90.2 |
| | 20.00 | 213 | 2.0 | 2.0 | 92.2 |
| | 21.00 | 180 | 1.7 | 1.7 | 94.0 |
| | 22.00 | 165 | 1.6 | 1.6 | 95.6 |
| | 23.00 | 126 | 1.2 | 1.2 | 96.8 |
| | 24.00 | 99 | .9 | .9 | 97.7 |
| | 25.00 | 80 | .8 | .8 | 98.5 |
| | 26.00 | 58 | .6 | .6 | 99.0 |
| | 27.00 | 46 | .4 | .4 | 99.5 |
| | 28.00 | 34 | .3 | .3 | 99.8 |
| | 29.00 | 8 | .1 | .1 | 99.9 |
| | 30.00 | 6 | .1 | .1 | 99.9 |
| | 31.00 | 2 | .0 | .0 | 100.0 |
| | 32.00 | 3 | .0 | .0 | 100.0 |
| | 33.00 | 1 | .0 | .0 | 100.0 |

| | | | | | |
|---|---|---|---|---|---|
| | **Total** | **10423** | **100.0** | **100.0** | |

**The nine types are defined by:**
**Initiating—ACCE <6, AERO >11**
**Experiencing—ACCE <6, AERO > 0 & < 12**
**Imagining—ACCE <6, AERO <1**
**Reflecting—ACCE > 5 & < 15, AERO <1**
**Analyzing—ACCE >14, AERO <1**
**Thinking—ACCE >14, AERO > 0 & < 12**
**Deciding—ACCE >14, AERO >11**
**Acting—ACCE > 5 & < 15, AERO >11**
**Balancing—ACCE > 5 & < 15, AERO > 0 & < 12**

## APPENDIX 2. Learning Style and Age

**KLSI 4.0 SCALE SCORES**

| Age | | CE4 | RO4 | AC4 | AE4 | AERO4 | ACCE4 |
|---|---|---|---|---|---|---|---|
| 19-24 | Mean | 19.6670 | 26.8736 | 28.2309 | 32.7477 | 5.8741 | 8.5639 |
| | N | 2057 | 2057 | 2057 | 2057 | 2057 | 2057 |
| | Std. Deviation | 6.21036 | 6.83744 | 6.86201 | 5.55272 | 10.42932 | 10.88344 |
| 25-34 | Mean | 19.8305 | 26.1407 | 28.6559 | 32.1984 | 6.0577 | 8.8254 |
| | N | 2979 | 2979 | 2979 | 2979 | 2979 | 2979 |
| 35-44 | Mean | 19.8343 | 26.1389 | 29.4503 | 31.4017 | 5.2628 | 9.6160 |
| | N | 2656 | 2656 | 2656 | 2656 | 2656 | 2656 |
| | Std. Deviation | 6.52196 | 7.18729 | 6.54388 | 6.10555 | 11.39608 | 10.82858 |
| 45-54 | Mean | 19.6384 | 25.7983 | 29.7368 | 31.1876 | 5.3893 | 10.0984 |
| | N | 1839 | 1839 | 1839 | 1839 | 1839 | 1839 |
| | Std. Deviation | 6.40136 | 6.81786 | 6.49812 | 5.93821 | 10.77834 | 10.71820 |
| 55-64 | Mean | 20.2731 | 26.1827 | 29.6661 | 30.6790 | 4.4963 | 9.3930 |
| | N | 542 | 542 | 542 | 542 | 542 | 542 |
| | Std. Deviation | 6.85600 | 7.13313 | 6.71448 | 6.00495 | 10.97986 | 11.12285 |
| 65 and o | Mean | 22.0400 | 23.7000 | 30.0000 | 30.8200 | 7.1200 | 7.9600 |
| | N | 50 | 50 | 50 | 50 | 50 | 50 |
| | Std. Deviation | 6.98091 | 6.05502 | 6.99854 | 6.11686 | 9.83671 | 11.79581 |
| Under 19 | Mean | 21.6917 | 26.0301 | 25.7444 | 34.6241 | 8.5940 | 4.0526 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | N | 133 | 133 | 133 | 133 | 133 | 133 |
| | Std. Deviation | 6.55187 | 6.46546 | 6.25185 | 4.85643 | 9.19489 | 10.89295 |
| Total | Mean | 19.8380 | 26.2234 | 28.9954 | 31.8452 | 5.6218 | 9.1574 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| | Std. Deviation | 6.46673 | 7.02489 | 6.66492 | 5.92756 | 10.92400 | 10.86578 |

**ANOVA Table**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| CE4 * Age | Between Groups | 1085.279 | 7 | 155.040 | 3.714 | .001 |
| | Within Groups | 434748.026 | 10415 | 41.742 | | |
| | Total | 435833.305 | 10422 | | | |
| RO4 * Age | Between Groups | 1613.781 | 7 | 230.540 | 4.683 | .000 |
| | Within Groups | 512702.809 | 10415 | 49.227 | | |
| | Total | 514316.589 | 10422 | | | |
| AC4 * Age | Between Groups | 4811.611 | 7 | 687.373 | 15.626 | .000 |
| | Within Groups | 458146.168 | 10415 | 43.989 | | |
| | Total | 462957.779 | 10422 | | | |
| AE4 * Age | Between Groups | 5438.309 | 7 | 776.901 | 22.430 | .000 |
| | Within Groups | 360749.073 | 10415 | 34.637 | | |
| | Total | 366187.382 | 10422 | | | |
| ACCE4 * Age | Between Groups | 6904.336 | 7 | 986.334 | 8.396 | .000 |
| | Within Groups | 1223570.304 | 10415 | 117.482 | | |
| | Total | 1230474.641 | 10422 | | | |
| AERO4 * Age | Between Groups | 3640.074 | 7 | 520.011 | 4.367 | .000 |
| | Within Groups | 1240057.054 | 10415 | 119.065 | | |
| | Total | 1243697.128 | 10422 | | | |

## APPENDIX 3. Learning Style and Gender

**KLSI 4.0 SCALE SCORES**

| Gender | | CE4 | RO4 | AC4 | AE4 | ACCE4 | AERO4 |
|---|---|---|---|---|---|---|---|
| F | Mean | 20.5441 | 26.3570 | 27.5652 | 32.1763 | 7.0211 | 5.8193 |
| | N | 5361 | 5361 | 5361 | 5361 | 5361 | 5361 |
| | Std. Deviation | 6.63567 | 7.21230 | 6.42519 | 5.90472 | 10.75635 | 11.07936 |
| M | Mean | 19.0114 | 26.0705 | 30.5741 | 31.5219 | 11.5627 | 5.4514 |
| | N | 4809 | 4809 | 4809 | 4809 | 4809 | 4809 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Std. Deviation | 6.15493 | 6.83601 | 6.56067 | 5.92739 | 10.47187 | 10.78587 |
| Total | Mean | 19.8380 | 26.2234 | 28.9954 | 31.8452 | 9.1574 | 5.6218 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| | Std. Deviation | 6.46673 | 7.02489 | 6.66492 | 5.92756 | 10.86578 | 10.92400 |

**ANOVA Table**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| CE4 * Gender | Between Groups | 6214.497 | 4 | 1553.624 | 37.674 | .000 |
| | Within Groups | 429618.808 | 10418 | 41.238 | | |
| | Total | 435833.305 | 10422 | | | |
| RO4 * Gender | Between Groups | 274.365 | 4 | 68.591 | 1.390 | .235 |
| | Within Groups | 514042.224 | 10418 | 49.342 | | |
| | Total | 514316.589 | 10422 | | | |
| AC4 * Gender | Between Groups | 22984.303 | 4 | 5746.076 | 136.060 | .000 |
| | Within Groups | 439973.476 | 10418 | 42.232 | | |
| | Total | 462957.779 | 10422 | | | |
| AE4 * Gender | Between Groups | 1311.870 | 4 | 327.968 | 9.364 | .000 |
| | Within Groups | 364875.512 | 10418 | 35.024 | | |
| | Total | 366187.382 | 10422 | | | |
| ACCE4 * Gender | Between Groups | 52408.458 | 4 | 13102.115 | 115.866 | .000 |
| | Within Groups | 1178066.182 | 10418 | 113.080 | | |
| | Total | 1230474.641 | 10422 | | | |
| AERO4 * Gender | Between Groups | 619.546 | 4 | 154.886 | 1.298 | .268 |
| | Within Groups | 1243077.582 | 10418 | 119.320 | | |
| | Total | 1243697.128 | 10422 | | | |

## APPENDIX 4. Learning Style and Educational Level

**KLSI 4.0 SCALE SCORES**

| Highest Degree Completed | | CE4 | RO4 | AC4 | AE4 | AERO4 | ACCE4 |
|---|---|---|---|---|---|---|---|
| Doctoral Degree | Mean | 19.5295 | 25.3618 | 30.2352 | 31.8257 | 6.4639 | 10.7057 |
| | N | 1067 | 1067 | 1067 | 1067 | 1067 | 1067 |
| | Std. Deviation | 6.54812 | 7.17971 | 6.66189 | 6.41904 | 11.47488 | 10.65666 |
| Master's Degree | Mean | 19.8306 | 25.4564 | 30.2128 | 30.9153 | 5.4588 | 10.3822 |
| | N | 2101 | 2101 | 2101 | 2101 | 2101 | 2101 |
| | Std. Deviation | 6.80713 | 6.98895 | 6.62901 | 6.04574 | 10.94810 | 11.14951 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Primary school | Mean | 20.3983 | 27.2754 | 25.8856 | 33.6144 | 6.3390 | 5.4873 |
| | N | 236 | 236 | 236 | 236 | 236 | 236 |
| | Std. Deviation | 6.14594 | 6.78079 | 5.76708 | 5.21777 | 10.25025 | 9.89196 |
| Secondary school | Mean | 20.8345 | 26.7888 | 27.0268 | 32.7414 | 5.9526 | 6.1924 |
| | N | 1752 | 1752 | 1752 | 1752 | 1752 | 1752 |
| | Std. Deviation | 6.42960 | 7.03284 | 6.39762 | 5.58276 | 10.72801 | 10.60797 |
| University Degree | Mean | 19.5319 | 26.4502 | 29.0597 | 31.8753 | 5.4251 | 9.5278 |
| | N | 5142 | 5142 | 5142 | 5142 | 5142 | 5142 |
| | Std. Deviation | 6.28513 | 6.98601 | 6.61341 | 5.85411 | 10.90564 | 10.69631 |
| Total | Mean | 19.8380 | 26.2234 | 28.9954 | 31.8452 | 5.6218 | 9.1574 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| | Std. Deviation | 6.46673 | 7.02489 | 6.66492 | 5.92756 | 10.92400 | 10.86578 |

**ANOVA Table**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| CE4 * Highest Degree Completed | Between Groups | 2410.180 | 5 | 482.036 | 11.585 | .000 |
| | Within Groups | 433423.125 | 10417 | 41.607 | | |
| | Total | 435833.305 | 10422 | | | |
| RO4 * Highest Degree Completed | Between Groups | 3240.979 | 5 | 648.196 | 13.212 | .000 |
| | Within Groups | 511075.610 | 10417 | 49.062 | | |
| | Total | 514316.589 | 10422 | | | |
| AC4 * Highest Degree Completed | Between Groups | 13853.333 | 5 | 2770.667 | 64.266 | .000 |
| | Within Groups | 449104.446 | 10417 | 43.113 | | |
| | Total | 462957.779 | 10422 | | | |
| AE4 * Highest Degree Completed | Between Groups | 4192.762 | 5 | 838.552 | 24.131 | .000 |
| | Within Groups | 361994.620 | 10417 | 34.750 | | |
| | Total | 366187.382 | 10422 | | | |
| ACCE4 * Highest Degree Completed | Between Groups | 25034.497 | 5 | 5006.899 | 43.268 | .000 |
| | Within Groups | 1205440.144 | 10417 | 115.719 | | |
| | Total | 1230474.641 | 10422 | | | |
| AERO4 * Highest Degree Completed | Between Groups | 2014.703 | 5 | 402.941 | 3.380 | .005 |
| | Within Groups | 1241682.424 | 10417 | 119.198 | | |
| | Total | 1243697.128 | 10422 | | | |

# APPENDIX 5. LEARNING STYLE AND EDUCATIONAL SPECIALIZATION

| | | KLSI 4.0 SCALE SCORES | | | | | |
|---|---|---|---|---|---|---|---|
| Educational Specialization | | CE4 | RO4 | AC4 | AE4 | ACCE4 | AERO4 |
| Accounting | Mean | 18.2197 | 25.9377 | 30.8393 | 31.8131 | 12.6197 | 5.8754 |
| | N | 305 | 305 | 305 | 305 | 305 | 305 |
| | Std. Deviation | 5.55424 | 6.55087 | 5.76432 | 5.75210 | 9.10066 | 10.44775 |
| Agriculture | Mean | 19.9333 | 28.2000 | 27.1333 | 31.8000 | 7.2000 | 3.6000 |
| | N | 30 | 30 | 30 | 30 | 30 | 30 |
| | Std. Deviation | 5.59515 | 6.56742 | 5.72191 | 5.70783 | 9.74998 | 10.63047 |
| Architecture | Mean | 21.2500 | 25.9375 | 31.1250 | 30.2500 | 9.8750 | 4.3125 |
| | N | 32 | 32 | 32 | 32 | 32 | 32 |
| | Std. Deviation | 6.60889 | 7.08446 | 6.42952 | 4.64897 | 10.51190 | 9.56620 |
| Business | Mean | 20.0299 | 25.6335 | 29.0141 | 31.7594 | 8.9842 | 6.1259 |
| | N | 1708 | 1708 | 1708 | 1708 | 1708 | 1708 |
| | Std. Deviation | 6.22134 | 6.77397 | 6.42462 | 6.00303 | 10.47055 | 10.97085 |
| Communications | Mean | 22.3243 | 25.6802 | 27.1036 | 31.5631 | 4.7793 | 5.8829 |
| | N | 222 | 222 | 222 | 222 | 222 | 222 |
| | Std. Deviation | 6.74441 | 7.49368 | 6.50743 | 5.89294 | 10.95573 | 11.23564 |
| Computer Science and Information Science | Mean | 17.2414 | 27.7586 | 30.8276 | 31.7586 | 13.5862 | 4.0000 |
| | N | 58 | 58 | 58 | 58 | 58 | 58 |
| | Std. Deviation | 5.82587 | 6.25289 | 7.07637 | 6.36137 | 10.95611 | 10.88376 |
| Education | Mean | 22.0237 | 25.6303 | 27.3720 | 31.9739 | 5.3483 | 6.3436 |
| | N | 422 | 422 | 422 | 422 | 422 | 422 |
| | Std. Deviation | 7.13923 | 7.26138 | 6.91938 | 6.21215 | 11.71756 | 11.18928 |
| Engineering | Mean | 17.7769 | 25.2870 | 31.3195 | 32.2055 | 13.5426 | 6.9185 |
| | N | 798 | 798 | 798 | 798 | 798 | 798 |
| | Std. Deviation | 5.55257 | 6.58706 | 6.26831 | 5.58928 | 9.42540 | 10.09526 |
| Fine and Applied Arts | Mean | 22.2786 | 27.2000 | 26.6643 | 31.5643 | 4.3857 | 4.3643 |
| | N | 140 | 140 | 140 | 140 | 140 | 140 |
| | Std. Deviation | 7.35930 | 7.69864 | 7.57277 | 5.75421 | 12.78634 | 11.30557 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Health | Mean | 19.2761 | 26.8993 | 27.8134 | 32.6045 | 8.5373 | 5.7052 |
| | N | 268 | 268 | 268 | 268 | 268 | 268 |
| | Std. Deviation | 5.97422 | 7.72085 | 5.96076 | 5.88596 | 9.52124 | 11.58032 |
| Humanities | Mean | 21.3696 | 25.5598 | 29.2500 | 30.7826 | 7.8804 | 5.2228 |
| | N | 184 | 184 | 184 | 184 | 184 | 184 |
| | Std. Deviation | 7.20992 | 7.54054 | 7.66601 | 6.17562 | 13.01604 | 11.69369 |
| Languages | Mean | 21.2449 | 28.0714 | 28.3469 | 30.8673 | 7.1020 | 2.7959 |
| | N | 98 | 98 | 98 | 98 | 98 | 98 |
| | Std. Deviation | 6.90295 | 7.41168 | 6.81130 | 6.42585 | 10.71706 | 11.78673 |
| Law | Mean | 19.6405 | 26.6240 | 29.8182 | 30.8843 | 10.1777 | 4.2603 |
| | N | 242 | 242 | 242 | 242 | 242 | 242 |
| | Std. Deviation | 6.33888 | 6.58830 | 6.65261 | 6.15928 | 10.42805 | 10.22214 |
| Literature | Mean | 22.1687 | 25.8193 | 29.4940 | 29.3133 | 7.3253 | 3.4940 |
| | N | 83 | 83 | 83 | 83 | 83 | 83 |
| | Std. Deviation | 7.42576 | 7.12971 | 6.80813 | 6.94741 | 11.31490 | 11.67066 |
| Medicine | Mean | 18.9333 | 26.1324 | 29.6247 | 32.2932 | 10.6915 | 6.1608 |
| | N | 914 | 914 | 914 | 914 | 914 | 914 |
| | Std. Deviation | 6.44727 | 7.10421 | 6.66966 | 6.05591 | 10.76255 | 11.18643 |
| Nursing | Mean | 19.6926 | 26.8402 | 27.1557 | 32.3238 | 7.4631 | 5.4836 |
| | N | 244 | 244 | 244 | 244 | 244 | 244 |
| | Std. Deviation | 5.93447 | 7.37886 | 6.27494 | 5.64426 | 10.02110 | 10.72878 |
| | N | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 |
| | Std. Deviation | 6.59044 | 6.96979 | 6.51528 | 5.69686 | 10.91876 | 10.75465 |
| Physical Education | Mean | 20.7105 | 27.6579 | 26.1053 | 33.3947 | 5.3947 | 5.7368 |
| | N | 38 | 38 | 38 | 38 | 38 | 38 |
| | Std. Deviation | 6.24243 | 6.92538 | 5.44153 | 4.47540 | 9.51965 | 9.93406 |
| Psychology | Mean | 20.9723 | 26.9782 | 28.5406 | 30.5921 | 7.5683 | 3.6139 |
| | N | 505 | 505 | 505 | 505 | 505 | 505 |
| | Std. Deviation | 7.19314 | 7.47333 | 6.78809 | 6.74683 | 11.33210 | 12.16762 |
| Science and Mathematics | Mean | 17.8937 | 26.0537 | 31.3463 | 32.1788 | 13.4525 | 6.1250 |
| | N | 800 | 800 | 800 | 800 | 800 | 800 |
| | Std. Deviation | 5.27088 | 6.81296 | 6.52530 | 5.67645 | 9.53790 | 10.57836 |
| Social Sciences | Mean | 20.4701 | 26.0124 | 29.2910 | 30.7139 | 8.8209 | 4.7015 |
| | N | 402 | 402 | 402 | 402 | 402 | 402 |
| | Std. Deviation | 6.74290 | 7.06559 | 6.92801 | 5.93861 | 11.41018 | 10.81564 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Social Work | Mean | 21.8273 | 27.8489 | 26.1151 | 31.0504 | 4.2878 | 3.2014 |
| | N | 139 | 139 | 139 | 139 | 139 | 139 |
| | Std. Deviation | 6.68865 | 7.28599 | 6.19733 | 6.26391 | 10.34845 | 11.60034 |
| Total | Mean | 19.8380 | 26.2234 | 28.9954 | 31.8452 | 9.1574 | 5.6218 |
| | N | 10423 | 10423 | 10423 | 10423 | 10423 | 10423 |
| | Std. Deviation | 6.46673 | 7.02489 | 6.66492 | 5.92756 | 10.86578 | 10.92400 |

**ANOVA Table**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| CE4 *Ed. Spec. | Between Groups | 15842.101 | 22 | 720.095 | 17.831 | .000 |
| | Within Groups | 419991.205 | 10400 | 40.384 | | |
| | Total | 435833.305 | 10422 | | | |
| RO4 * Ed. Spec. | Between Groups | 4351.499 | 22 | 197.795 | 4.034 | .000 |
| | Within Groups | 509965.090 | 10400 | 49.035 | | |
| | Total | 514316.589 | 10422 | | | |
| AC4 * Ed. Spec. | Between Groups | 21214.945 | 22 | 964.316 | 22.703 | .000 |
| | Within Groups | 441742.833 | 10400 | 42.475 | | |
| | Total | 462957.779 | 10422 | | | |
| AE4 *Ed. Spec. | Between Groups | 3925.383 | 22 | 178.426 | 5.122 | .000 |
| | Within Groups | 362261.999 | 10400 | 34.833 | | |
| | Total | 366187.382 | 10422 | | | |
| ACCE4 *Ed. Spec. | Between Groups | 67187.265 | 22 | 3053.967 | 27.303 | .000 |
| | Within Groups | 1163287.376 | 10400 | 111.855 | | |
| | Total | 1230474.641 | 10422 | | | |
| AERO4 *Ed. Spec. | Between Groups | 7919.681 | 22 | 359.986 | 3.030 | .000 |
| | Within Groups | 1235777.446 | 10400 | 118.825 | | |
| | Total | 1243697.128 | 10422 | | | |

## APPENDIX 6. LEARNING STYLE TYPE AND EDUCATIONAL SPECIALIZATION

| | KLSI 4.0 LEARNING STYLE TYPE | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | INIT | EXP | IMAG | REF | ANAL | THINK | DECID | ACT | BAL | |
| Accounting | 24 | 23 | 16 | 36 | 46 | 47 | 45 | 33 | 35 | 305 |
| | 7.9% | 7.5% | 5.2% | 11.8% | 15.1% | 15.4% | 14.8% | 10.8% | 11.5% | 100.0% |
| Agriculture | 4 | 4 | 4 | 5 | 3 | 3 | 0 | 4 | 3 | 30 |
| | 13.3% | 13.3% | 13.3% | 16.7% | 10.0% | 10.0% | 0.0% | 13.3% | 10.0% | 100.0% |
| Architecture | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 2 | 6 | 32 |
| | 9.4% | 12.5% | 9.4% | 12.5% | 9.4% | 12.5% | 9.4% | 6.2% | 18.8% | 100.0% |
| Business | 260 | 190 | 183 | 179 | 194 | 206 | 149 | 188 | 159 | 1708 |
| | 15.2% | 11.1% | 10.7% | 10.5% | 11.4% | 12.1% | 8.7% | 11.0% | 9.3% | 100.0% |
| Communications | 45 | 44 | 40 | 15 | 18 | 16 | 15 | 16 | 13 | 222 |
| | 20.3% | 19.8% | 18.0% | 6.8% | 8.1% | 7.2% | 6.8% | 7.2% | 5.9% | 100.0% |
| Computer Science/IS | 5 | 6 | 4 | 5 | 10 | 11 | 7 | 3 | 7 | 58 |
| | 8.6% | 10.3% | 6.9% | 8.6% | 17.2% | 19.0% | 12.1% | 5.2% | 12.1% | 100.0% |
| Education | 77 | 68 | 65 | 39 | 38 | 32 | 24 | 41 | 38 | 422 |
| | 18.2% | 16.1% | 15.4% | 9.2% | 9.0% | 7.6% | 5.7% | 9.7% | 9.0% | 100.0% |
| Engineering | 80 | 42 | 36 | 58 | 127 | 153 | 136 | 77 | 89 | 798 |
| | 10.0% | 5.3% | 4.5% | 7.3% | 15.9% | 19.2% | 17.0% | 9.6% | 11.2% | 100.0% |
| Fine and Applied Arts | 28 | 19 | 32 | 11 | 12 | 13 | 12 | 8 | 5 | 140 |
| | 20.0% | 13.6% | 22.9% | 7.9% | 8.6% | 9.3% | 8.6% | 5.7% | 3.6% | 100.0% |
| Health | 39 | 30 | 30 | 35 | 34 | 25 | 24 | 31 | 20 | 268 |
| | 14.6% | 11.2% | 11.2% | 13.1% | 12.7% | 9.3% | 9.0% | 11.6% | 7.5% | 100.0% |
| Humanities | 24 | 23 | 28 | 14 | 27 | 22 | 10 | 24 | 12 | 184 |
| | 13.0% | 12.5% | 15.2% | 7.6% | 14.7% | 12.0% | 5.4% | 13.0% | 6.5% | 100.0% |
| Languages | 9 | 14 | 19 | 15 | 9 | 6 | 9 | 7 | 10 | 98 |
| | 9.2% | 14.3% | 19.4% | 15.3% | 9.2% | 6.1% | 9.2% | 7.1% | 10.2% | 100.0% |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Law | 28 | 33 | 22 | 33 | 37 | 31 | 21 | 20 | 17 | 242 |
| | 11.6% | 13.6% | 9.1% | 13.6% | 15.3% | 12.8% | 8.7% | 8.3% | 7.0% | 100.0% |
| Literature | 11 | 8 | 17 | 7 | 11 | 8 | 3 | 9 | 9 | 83 |
| | 13.3% | 9.6% | 20.5% | 8.4% | 13.3% | 9.6% | 3.6% | 10.8% | 10.8% | 100.0% |
| Medicine | 117 | 74 | 94 | 76 | 128 | 135 | 103 | 106 | 81 | 914 |
| | 12.8% | 8.1% | 10.3% | 8.3% | 14.0% | 14.8% | 11.3% | 11.6% | 8.9% | 100.0% |
| Nursing | 36 | 34 | 36 | 27 | 21 | 23 | 19 | 25 | 23 | 244 |
| | 14.8% | 13.9% | 14.8% | 11.1% | 8.6% | 9.4% | 7.8% | 10.2% | 9.4% | 100.0% |
| Physical Education | 5 | 9 | 4 | 5 | 2 | 3 | 0 | 3 | 7 | 38 |
| | 13.2% | 23.7% | 10.5% | 13.2% | 5.3% | 7.9% | 0.0% | 7.9% | 18.4% | 100.0% |
| Psychology | 72 | 64 | 74 | 67 | 71 | 41 | 35 | 42 | 39 | 505 |
| | 14.3% | 12.7% | 14.7% | 13.3% | 14.1% | 8.1% | 6.9% | 8.3% | 7.7% | 100.0% |
| Science and Mathematics | 65 | 54 | 49 | 76 | 147 | 134 | 111 | 90 | 74 | 800 |
| | 8.1% | 6.8% | 6.1% | 9.5% | 18.4% | 16.8% | 13.9% | 11.2% | 9.2% | 100.0% |
| Social Sciences | 50 | 52 | 47 | 46 | 60 | 37 | 39 | 33 | 38 | 402 |
| | 12.4% | 12.9% | 11.7% | 11.4% | 14.9% | 9.2% | 9.7% | 8.2% | 9.5% | 100.0% |
| Social Work | 22 | 27 | 31 | 19 | 13 | 3 | 6 | 11 | 7 | 139 |
| | 15.8% | 19.4% | 22.3% | 13.7% | 9.4% | 2.2% | 4.3% | 7.9% | 5.0% | 100.0% |
| Total | 1410 | 1188 | 1206 | 1043 | 1355 | 1219 | 972 | 1057 | 973 | 10423 |
| | 13.5% | 11.4% | 11.6% | 10.0% | 13.0% | 11.7% | 9.3% | 10.1% | 9.3% | 100.0% |

# APPENDIX 7. LEARNING FLEXIBILITY INDEX PERCENTILES

| Frequency | | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| .07 | 1 | .0 | .0 | .0 |
| .09 | 1 | .0 | .0 | .0 |
| .09 | 1 | .0 | .0 | .0 |
| .10 | 1 | .0 | .0 | .0 |
| .12 | 1 | .0 | .0 | .0 |
| .13 | 1 | .0 | .0 | .1 |
| .14 | 1 | .0 | .0 | .1 |
| .16 | 3 | .0 | .0 | .1 |
| .17 | 5 | .0 | .0 | .1 |
| .18 | 2 | .0 | .0 | .2 |
| .18 | 2 | .0 | .0 | .2 |
| .19 | 5 | .0 | .0 | .2 |
| .19 | 4 | .0 | .0 | .3 |
| .20 | 1 | .0 | .0 | .3 |
| .21 | 9 | .1 | .1 | .4 |
| .22 | 5 | .0 | .0 | .4 |
| .22 | 1 | .0 | .0 | .4 |
| .23 | 7 | .1 | .1 | .5 |
| .24 | 11 | .1 | .1 | .6 |
| .26 | 5 | .0 | .0 | .6 |
| .26 | 6 | .1 | .1 | .7 |
| .27 | 17 | .2 | .2 | .9 |
| .28 | 5 | .0 | .0 | .9 |
| .28 | 18 | .2 | .2 | 1.1 |
| .29 | 2 | .0 | .0 | 1.1 |
| .29 | 7 | .1 | .1 | 1.2 |
| .30 | 8 | .1 | .1 | 1.2 |
| .31 | 27 | .3 | .3 | 1.5 |
| .32 | 11 | .1 | .1 | 1.6 |
| .32 | 22 | .2 | .2 | 1.8 |
| .33 | 22 | .2 | .2 | 2.0 |
| .34 | 19 | .2 | .2 | 2.2 |
| .34 | 16 | .2 | .2 | 2.4 |
| .35 | 13 | .1 | .1 | 2.5 |
| .36 | 56 | .5 | .5 | 3.0 |

| .36 | 15 | .1 | .1 | 3.2 |
|---|---|---|---|---|
| .37 | 17 | .2 | .2 | 3.3 |
| .38 | 18 | .2 | .2 | 3.5 |
| .38 | 42 | .4 | .4 | 3.9 |
| .39 | 11 | .1 | .1 | 4.0 |
| .39 | 68 | .7 | .7 | 4.7 |
| .40 | 1 | .0 | .0 | 4.7 |
| .41 | 17 | .2 | .2 | 4.8 |
| .42 | 62 | .6 | .6 | 5.4 |
| .43 | 28 | .3 | .3 | 5.7 |
| .43 | 68 | .7 | .7 | 6.4 |
| .44 | 24 | .2 | .2 | 6.6 |
| .44 | 60 | .6 | .6 | 7.2 |
| .45 | 18 | .2 | .2 | 7.3 |
| .46 | 81 | .8 | .8 | 8.1 |
| .46 | 7 | .1 | .1 | 8.2 |
| .47 | 82 | .8 | .8 | 9.0 |
| .48 | 26 | .2 | .2 | 9.2 |
| .48 | 69 | .7 | .7 | 9.9 |
| .49 | 69 | .7 | .7 | 10.5 |
| .49 | 69 | .7 | .7 | 11.2 |
| .50 | 12 | .1 | .1 | 11.3 |
| .51 | 77 | .7 | .7 | 12.1 |
| .52 | 80 | .8 | .8 | 12.8 |
| .53 | 59 | .6 | .6 | 13.4 |
| .53 | 106 | 1.0 | 1.0 | 14.4 |
| .54 | 19 | .2 | .2 | 14.6 |
| .54 | 184 | 1.8 | 1.8 | 16.4 |
| .55 | 31 | .3 | .3 | 16.7 |
| .56 | 44 | .4 | .4 | 17.1 |
| .56 | 50 | .5 | .5 | 17.6 |
| .57 | 114 | 1.1 | 1.1 | 18.7 |
| .58 | 56 | .5 | .5 | 19.2 |
| .58 | 186 | 1.8 | 1.8 | 21.0 |
| .59 | 62 | .6 | .6 | 21.6 |
| .59 | 53 | .5 | .5 | 22.1 |
| .60 | 15 | .1 | .1 | 22.2 |
| .61 | 199 | 1.9 | 1.9 | 24.1 |
| .62 | 170 | 1.6 | 1.6 | 25.8 |
| .63 | 66 | .6 | .6 | 26.4 |

| .63 | 99 | .9 | .9 | 27.3 |
|---|---|---|---|---|
| .64 | 98 | .9 | .9 | 28.3 |
| .64 | 173 | 1.7 | 1.7 | 29.9 |
| .66 | 245 | 2.4 | 2.4 | 32.3 |
| .66 | 41 | .4 | .4 | 32.7 |
| .67 | 142 | 1.4 | 1.4 | 34.0 |
| .68 | 143 | 1.4 | 1.4 | 35.4 |
| .68 | 79 | .8 | .8 | 36.2 |
| .69 | 59 | .6 | .6 | 36.7 |
| .69 | 207 | 2.0 | 2.0 | 38.7 |
| .70 | 69 | .7 | .7 | 39.4 |
| .71 | 207 | 2.0 | 2.0 | 41.4 |
| .72 | 269 | 2.6 | 2.6 | 44.0 |
| .73 | 54 | .5 | .5 | 44.5 |
| .73 | 293 | 2.8 | 2.8 | 47.3 |
| .74 | 107 | 1.0 | 1.0 | 48.3 |
| .74 | 118 | 1.1 | 1.1 | 49.4 |
| .75 | 53 | .5 | .5 | 50.0 |
| .76 | 120 | 1.2 | 1.2 | 51.1 |
| .76 | 68 | .7 | .7 | 51.8 |
| .77 | 302 | 2.9 | 2.9 | 54.7 |
| .78 | 111 | 1.1 | 1.1 | 55.7 |
| .78 | 138 | 1.3 | 1.3 | 57.0 |
| .79 | 125 | 1.2 | 1.2 | 58.2 |
| .79 | 266 | 2.6 | 2.6 | 60.8 |
| .80 | 15 | .1 | .1 | 60.9 |
| .81 | 301 | 2.9 | 2.9 | 63.8 |
| .82 | 82 | .8 | .8 | 64.6 |
| .83 | 151 | 1.4 | 1.4 | 66.1 |
| .83 | 335 | 3.2 | 3.2 | 69.3 |
| .84 | 83 | .8 | .8 | 70.1 |
| .84 | 285 | 2.7 | 2.7 | 72.8 |
| .85 | 23 | .2 | .2 | 73.0 |
| .86 | 156 | 1.5 | 1.5 | 74.5 |
| .86 | 95 | .9 | .9 | 75.4 |
| .87 | 180 | 1.7 | 1.7 | 77.2 |
| .88 | 99 | .9 | .9 | 78.1 |
| .88 | 258 | 2.5 | 2.5 | 80.6 |
| .89 | 105 | 1.0 | 1.0 | 81.6 |
| .89 | 191 | 1.8 | 1.8 | 83.4 |

| | | | | |
|---|---|---|---|---|
| **.90** | **54** | **.5** | **.5** | **83.9** |
| **.91** | **216** | **2.1** | **2.1** | **86.0** |
| **.92** | **296** | **2.8** | **2.8** | **88.9** |
| **.93** | **100** | **1.0** | **1.0** | **89.8** |
| **.93** | **104** | **1.0** | **1.0** | **90.8** |
| **.94** | **111** | **1.1** | **1.1** | **91.9** |
| **.94** | **149** | **1.4** | **1.4** | **93.3** |
| **.95** | **33** | **.3** | **.3** | **93.6** |
| **.96** | **235** | **2.3** | **2.3** | **95.9** |
| **.96** | **45** | **.4** | **.4** | **96.3** |
| **.97** | **121** | **1.2** | **1.2** | **97.5** |
| **.98** | **55** | **.5** | **.5** | **98.0** |
| **.98** | **111** | **1.1** | **1.1** | **99.1** |
| **.99** | **28** | **.3** | **.3** | **99.3** |
| **.99** | **65** | **.6** | **.6** | **100.0** |
| **1.00** | **4** | **.0** | **.0** | **100.0** |
| **Total** | **10423** | **100.0** | **100.0** | |

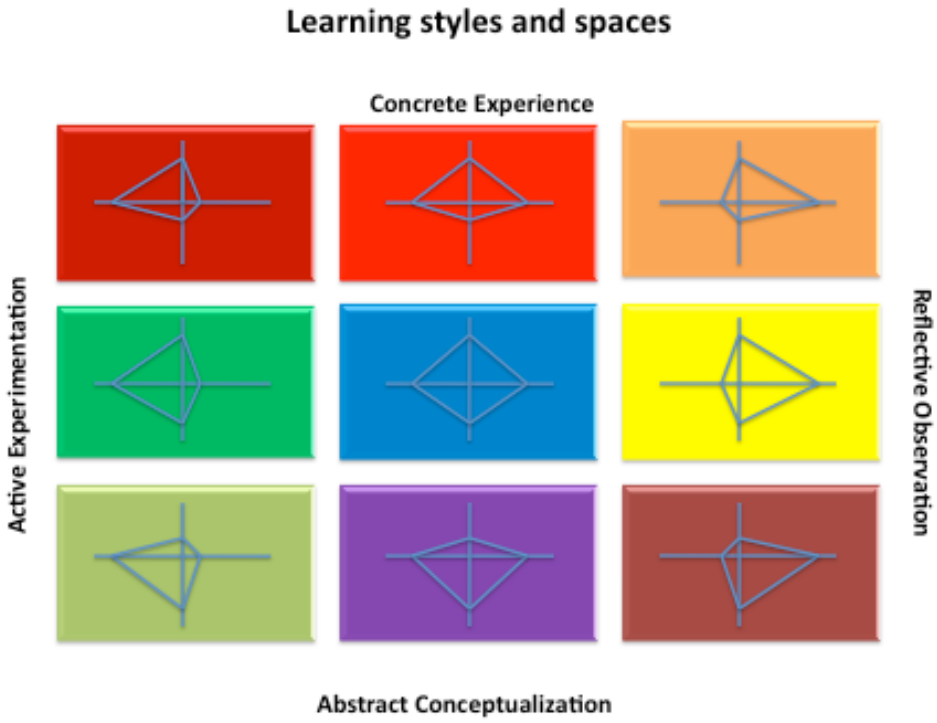
## APPENDIX 8. LFI ITEM SCORES FOR REGIONS OF THE LEARNING SPACE

| LEARNING REGION | CE | RO | AC | AE | ACCE | AERO |
|---|---|---|---|---|---|---|
| EXPERIENCING | 4 | 3 | 1 | 2 | -3 | -1 |
| EXPERIENCING | 4 | 2 | 1 | 3 | -3 | 1 |
| IMAGINING | 4 | 3 | 2 | 1 | -2 | -2 |
| IMAGINING | 3 | 4 | 1 | 2 | -2 | -2 |
| REFLECTING | 3 | 4 | 2 | 1 | -1 | -3 |
| REFLECTING | 2 | 4 | 3 | 1 | 1 | -3 |
| ANALYZING | 1 | 4 | 3 | 2 | 2 | -2 |
| ANALYZING | 2 | 3 | 4 | 1 | 2 | -2 |
| THINKING | 1 | 2 | 4 | 3 | 3 | 1 |
| THINKING | 1 | 3 | 4 | 2 | 3 | -1 |
| DECIDING | 2 | 1 | 4 | 3 | 2 | 2 |
| DECIDING | 1 | 2 | 3 | 4 | 2 | 2 |
| ACTING | 2 | 1 | 3 | 4 | 1 | 3 |
| ACTING | 3 | 1 | 2 | 4 | -1 | 3 |
| INITIATING | 4 | 1 | 2 | 3 | -2 | 2 |
| INITIATING | 3 | 2 | 1 | 4 | -2 | 2 |
| ACCE BALANCE | 4 | 2 | 3 | 1 | -1 | -1 |
| ACCE BALANCE | 4 | 1 | 3 | 2 | -1 | 1 |
| ACCE BALANCE | 3 | 2 | 4 | 1 | 1 | -1 |
| ACCE BALANCE | 3 | 1 | 4 | 2 | 1 | 1 |
| AERO BALANCE | 1 | 4 | 2 | 3 | 1 | -1 |
| AERO BALANCE | 1 | 3 | 2 | 4 | 1 | 1 |
| AERO BALANCE | 2 | 4 | 1 | 3 | -1 | -1 |
| AERO BALANCE | 2 | 3 | 1 | 4 | -1 | 1 |

**APPENDIX 9.**

# The KLSI 4 Nine Style Typology Descriptions and Case Studies

On the Cycle of Learning target scores form a “kite” shape defined by the combination of preferences for the four modes of the learning cycle. Because each person's learning style is unique; everyone's kite shape is a little different. Years of research on the learning styles of many thousands of individuals have led to the identification of nine distinct kite types or clusters of learning styles in the KLSI 4.0. These learning style types can be systematically arranged on a two dimensional learning space defined by Abstract Conceptualization – Concrete Experience and Active Experimentation – Reflective Observation.




Previous versions of the KLSI divided this learning space into four regions defining four learning style types—accommodating, diverging, assimilating, and converging. Research and feedback from individual users indicated that the division of the space into four regions was problematic for some and categorized their learning style in a way that was misleading. Individuals who scored near the middle of the space reported that their style description was inaccurate while those who scored near the line between two styles were not comfortable with being typed into just one of the two styles. Further investigation revealed that these borderline cases were actually distinct styles in themselves resulting in the creation of the following nine style typology.

- The **Initiating** style is distinguished by the ability to initiate action to deal with experiences and situations.

- The **Experiencing** style is distinguished by the ability to find meaning from deep involvement in experience.

- The **Creating** style is distinguished by the ability to create meaning by observing and reflecting on experiences.

- The **Reflecting** style is distinguished by the ability to connect experience and ideas through sustained reflection.

- The **Analyzing** style is distinguished by the ability to integrate and systematize ideas through reflection.

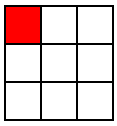
- The **Thinking** style is distinguished by the capacity for disciplined involvement in abstract reasoning, mathematics and logic.

- The **Deciding** style is distinguished by the ability to use theories and models to decide on problem solutions and courses of action.

- The **Acting** style is distinguished by a strong motivation for goal directed action that integrates people and tasks.

- The **Balancing** style is distinguished by the ability to flexibly adapt by weighing the pros and cons of acting vs. reflecting and experiencing vs. thinking.

These nine style types are described in detail below. Each description shows the characteristics of the style type and its learning space region based on previous research and clinical observation. Learning strengths and challenges for individuals with the style type are summarized. Finally, individuals with the style type describe themselves in their own words.



## The Initiating Learning Style

Emphasizes the learning modes of **Active Experimentation (AE)** and **Concrete Experience (CE).** The Initiating style is distinguished by the ability to initiate action in order to deal with experiences and situations.

If your learning style is **Initiating,** you prefer to learn from "hands-on" experience and real life situations. You are willing to jump in and try out new and challenging experiences and will volunteer for leadership on tasks. You are able to act quickly and decisively in a changing environment without being caught in excessive deliberations. Because of your style you are comfortable thinkng on your feet. Because you are willing to take risks, you are able to identify new opportunities and generate possibilities for success at work and in life in general. You have the ability to take initiative to start new projects, put ideas into practice, and identify a course of action.

You learn best by tuning into the present circumstances and less from reflections about past events or planning for future actions. Your tendency may be to act on "gut" feelings rather than on logical analysis. In solving problems, you may rely more heavily on people for information than on your own technical analysis.

Others may see you as spontaneous, energetic, persuasive, and courageous.

### Preferred Learning Space

You thrive in dynamic learning spaces where you can work with others to get assignments done, to set goals and to try out different approaches to completing a project. You prefer teachers who take the role of coach or mentor in helping you learn from your life experiences.

**Learning Strengths**

Committing yourself to objectives

Seeking new opportunities

Influencing and leading others

**Learning Challenges**

Controlling the impulse to act

Listening to others views

Impatience

**Initiating—In their own Words**

**Jodie— College student**

I can see why my learning style is "Initiating" because I do have strong preference for action over reflection. For example, I enjoy lab courses but do not like lectures. I love my calculus course because we do problems as we go through class, enabling me to be actively involved with the material I am learning. On the other hand, my lecture chemistry course is less pleasant because there are a million people in a room and the professor is just saying things. Such circumstances do not allow many opportunities for the hands-on style of learning that I prefer.

**Rosalyn— Human resources manager**

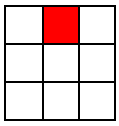
In one simple word…yes, I agree with the label "Initiator" for my learning style. My peers, leaders, family members and friends would all be able to quickly identify me as action oriented. I tend to be impatient with waiting for decisions and more than likely will jump in with a plan to take action. In my work as a human resources manager this bias for action has served me extremely well. The retail business is constantly changing. Amidst that change some people can be caught spinning with indecisiveness and an inability to act based on the excessive speed in which the business is moving. I, on the other hand, make decisions quickly. A day without action is extremely rare. The ability to identify needs, and act on those needs quickly is essential to my success in the corporate environment. My manager has mentioned how I have an amazing ability to seek out new information and apply it. I think this relates to my curiosity and willingness to take risks.

**Ginny— College student**

I am most effective in learning by having the opportunity to "learn by doing". Whether learning a new sport, a new activity, or new information, in order to retain what I have learned, it is important that I apply new learning quickly to real life situations. For example, when learning how to tie knots for sailing or climbing, I must have the opportunity to repeat the action while watching the instructor do it. Without the immediate application of the action, my retention is painfully low.
In classroom situations, it is challenging for me to learn just from lectures or books. Connecting with my classmates to discuss and debate about a reading or a lecture helps my retention.

**Julie— School administrator**

I really enjoy and get a lot out of hands-on experiences. Sharing in an experience, working in a team and setting goals together with my colleagues are concrete ways I prefer to learn. Feedback from colleagues and friends would echo these statements. They find me a strong and engaged team member that has good instincts and is a "doer."
I love my job, but also realize that it has helped create an imbalance in my learning style. I realize that I am not a very reflective person. While I always conduct event and program evaluations on *what* I do, I rarely take the time to think about *why* I do what I do. This can also said of my personal life. I react quickly rather than thinking things through. I prefer people to ideas and will be more influenced by an inspirational speech then by a logical theory.



## The Experiencing Learning Style

Emphasizes **Concrete Experience (CE)** while balancing **Active Experimentation (AE)** and **Reflective Observation (RO).** The Experiencing style is distinguished by the ability to find meaning from deep involvement in experience.

If your learning style is **Experiencing**, you learn from your deep involvement in your life experiences and contexts. You rely on your feelings and reactions to people and situations to learn. You are sensitive to other people's feelings and are particularly adept in building meaningful relationships. You are open minded and accepting which can lead to difficulty in making independent judgments.

You can be innovative and unconventional in your approach to problem solving. You approach a problem intuitively rather than logically and later seek validation through reflection and action.

Others may see you as sensitive, empathetic, helpful, and intuitive.

### Preferred Learning Space

You prefer learning spaces rich in interactions and ongoing communications with your friends and co-workers. While you may enjoy working in groups, you also need time to work alone to get things done. It is important that you receive constructive feedback on your progress at work and in your personal life. It is important for you to have a personal relationship with your teacher.

**Learning Strengths**

Building deep personal relationships

Strong intuition focused by reflection and action

Open to new experiences

**Learning Challenges**

Understanding theory

Systematic planning

Evaluation

**Experiencing--In their own words:**

**Susan—Human resources director**

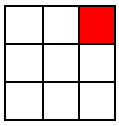
Over the years I have often questioned why I so much enjoyed beginning new relationships and felt exhilaration when brainstorming, planning, and implementing projects. Rarely have I found pleasure in working alone and felt stifled in situations when I must do so. Engaging in conversation, learning about and from others is exciting and sometimes I am surprised when people with whom I've had little involvement expose their soul. I have been told I ask questions of people and engage others in such a way as to generate rich discussion and debate in a non-threatening, thoughtful manner, this may be why they open up so easily.

**Camille— College student**

Unlike many of my classmates who are more abstract learners, I tend to act and then reflect, instead of the reciprocal, reflecting and then acting. I enjoy working with other students inside and outside of a class setting in order to set goals, to engage in lots of activities and to experiment with different approaches to complete a project. I think I am sensitive and considerate to others, but I also like to influence people and change situations. My career goal is to become an adolescent psychologist because I am good at relating to adolescents with an open-minded approach. I really crave interacting with children; that is why I am working at Children' Museum where I have plenty of opportunity to interact with children.

**Marianne— Consultant**

I learn through experiencing and this is an accurate description of the way I learn best. I typically reflect on real experiences and think of analogies as I hear about new ideas and theories. I ask others for input versus doing detailed research. Then, I quickly want to actively experiment with a new approach or implementing new solution. The cycle continues, creating many concrete experiences from which I learn.



## The Creating Learning Style

Combines the learning steps of **Concrete Experience (CE)** and **Reflective Observation (RO).** The **Creating** style is distinguished by the ability to create meaning by observing and reflecting on experiences.

If your learning style is **Creating**, you learn by stepping back from experiences to observe and reflect on your feelings about what is going on. You have the ability to see things from different perspectives and from many different points of view. Because of your sensitivity to people's feelings you are able to consider diverse opinions and views and bridge the differences. You are comfortable with ambiguity and tend not to see situations in black and white. Your approach to situations is to observe rather than take action.

You are able to recognize patterns in events, relationships and group interactions and make sense of what they mean. You probably have broad cultural interests and like to gather information. You are good at imagining the implication of a particular course of action and creating alternative paths and approaches.

Others may see you as caring, accepting, creative, sensitive, and open-minded.

### Preferred Learning Space

You like working in groups where there is open and free flowing conversation where you can gather information, listen with an open mind, and receiving personalized feedback. You may enjoy situations that call for generating a wide range of ideas, such as brainstorming sessions. You like teachers who take a facilitating role and are sensitive and creative.

**Learning Strengths**

Awareness of people's feelings and values

Listening with an open mind

Imagining the implications of ambiguous situations

**Learning Challenges**

Decision making

Taking leadership

Timely action

**Creating—In their own words:**

**Annie—Consultant**

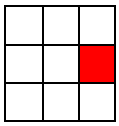
As luck may have it, my Learning Style Inventory (LSI) indicates a strong reliance upon Creating. Having no prior knowledge of learning styles when I took the assessment, I did so with an open mind and no preconceived notion of what type of learning style I favored (which turns out to be a strength of a Imagining learner, by the way). In groups I like to sit back and see how the people fit together before taking action, which reflects both observing and understanding people. I am very sensitive to people's feelings and often can tell you more about the tone of a conversation than what was actually discussed. I like brainstorming and use it whenever possible, whether trying to decide on what to eat for dinner with my family or in a meeting at work. I think outside the box (creative) and I like to get to the root of the issue (problem recognition). Every characteristic rings true with how I see myself.

**Lorain—Non- profit organization manager**

As a creating learner, I have the ability to take a multiple perspective "helicopter view," allowing me to see "surfacing" of patterns of emotional energy between individuals, and among and within groups, systems, and events. My ability to see the large picture allows me to notice and anticipate the likelihood of what may happen if a particular decision or action is taken. As a result, I am often able to redirect individual, group, system, or event energy in new directions. The downside of my style is that, because of my extreme imaginative tendency, I tend to be distracted by all the possibilities and views that I see. I often received feedback from people around me that I am a " big picture planner," or " have ability to see things globally".

**Robin—Consultant/ Trainer**

I can understand why I am a creating learner. In group situations such as project teams to which I have been assigned, and classes for religious study at my church, I have received feedback that I am someone who watches and listens first, then participates; that when I do participate, people listen and value my input because they know I have thought through the topic or question; that I can represent multiple views of the same situation or topic; and that I have a bias for action and getting things done. As an example, we attended a private golf lesson together and recognized that my husband's approach to improving his golf swing is to analyze the components of an ideal golf swing, to break it down in his mind and then to tape himself to see if his swing is on the same plane as the model swing. I improve my swing by getting the feel of a good swing, learning to tell the difference between the feel of a good swing or a poor swing, and then repeating it over and over until the feel of a good swing is ingrained in my mind and body.



## The Reflecting Learning Style

Emphasizes **Reflective Observation (RO)** while balancing **Concrete Experience (CE)** and **Abstract Conceptualization (AC)**. The **Reflecting** style is distinguished by the ability to connect experience and ideas through sustained reflection.

If your learning style is **Reflecting**, you use observation and reflection as the primary basis for learning. You have the capacity for deep reflection while balancing the ability to engage both in feeling and thinking. You enjoy situations that call for generating different alternatives and perspectives and identifying problems. Because of your keen sense of observation, you are able to make sense of and recognize the deeper meaning that underlies events, facts and people's interactions. You value process and talking about your reflections with others to debrief events.

When you organize information or analyze data, you do it in a manner that is meaningful and orderly. When working with teams and organizations, you excel in ability to create processes that produce healthy communication and effective outcomes. You are good in coming up with creative ideas and solution to problems but prefer to leave the implementation to others. You are sensitive to people's feelings, thoughts and needs and are able to find common ground by bringing together different ideas and perspectives.

People may see you as quiet, insightful, thorough, sensitive, and deep.

**Learning Strengths**

Understanding others' point of view

Seeing "What's going on" in situations

Converting intuitions into explicit explanations

Gathering information

**Learning Challenges**

Initiating action

Rumination

Speaking up in groups

### Preferred Learning Space

You thrive in learning spaces rich in dialogue and discussions, but you are also comfortable learning from lectures, independent projects, and from readings. Because of your preference for deep reflection, you may also need time to reflect and make sense of your experience on your own. You value teachers who provide opportunities for individual and group reflection and who are open to exploring ideas.

### Reflecting—In their own words:

**Jerry—Human resources manager**

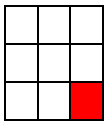
The Reflecting learning style has been particularly well suited to the traditional teaching methods I've experienced in my educational career. I have enjoyed classroom lectures and work well independently. I am able to process a wide variety of information, find patterns and themes, and easily understand the underlying theories. As a result, my academic performance has been strong. I am an avid note-taker. My textbooks and professional reading include numerous margin notes about ideas sparked by the reading. These represent the reflecting, brainstorming, and conceptualizing that accompany my learning. This opportunity to reflect and organize information is critical to my ability to retain what I have learned. To move in to Active Experimentation, I am most successful when I can partner with a colleague who demonstrates that strength. Using observation, I am able to learn from role models whose strengths are different from my own.
I have always had many interests, often more intellectual in nature. As I have grown older, my interests have often related to concepts and theories. My health and fitness goals are more motivated by a commitment to the concept of good health, than by any external or social factor.

**Kirk— Organizational development consultant**

I can relate very well to the Reflecting style of learning. I see myself as someone that learns best when I can take time to think and reflect on information that I am taking in. I have been told that I "over-process" situations and events in my life. My husband often takes a deep breath when I say "I would really like to talk more about…". Once I process the information and how I feel about the information or situation, then I can take action with greater ease. When considering a situation in my personal life or my professional life, my first response is usually to get as many different ideas and perspectives from as many people as possible before coming to my own conclusions. In my professional life, I have frequently been asked to lead brainstorming sessions as its something that feels very natural to me. I am sensitive to feelings of others and I think this is something I was born with.

**Bill—Director of operations**

As I reflect on my learning style results, it makes sense that I am a reflective learner. I often received feedback from people around me that I had excellent interpersonal skills. In my job role of Director of Operations, analytical problem-solving skills are valuable in supporting the development of systems, processes, and structures, often involving information management and technology, and strategy, for example. As I reflect, I know that I am excellent at organizing information. For example, some of the most significant contributions I have made include a computer system that serves as a tool for capturing, organizing, tracking and sharing resident information among counselors.
Here are few examples of feedback I have gotten from various people around me and I think they describe well my learning style:
"You're sensitive to feelings and people." –Friend-
"You balance well the intuitive, sensitive, emotional side of things along with the more abstract and analytical; On the other hand, you could do some things faster and less thoroughly." -Co-worker-
"You do first apply logic to ideas, but you are willing to allow persons to pursue them even if the logic cannot be articulated. You know that there are other ways of knowing. " –Wife-



## The Analyzing Learning Style

Combines learning modes of **Reflective Observation (RO)** and **Abstract Conceptualization (AC).** The **Analyzing** style is distinguished by the ability to integrate and systematize ideas through reflection.

If **Analyzing** is your learning style, you are best at taking in a wide range of information and putting it into concise, logical form. You probably are less focused on people and more interested in abstract ideas and concepts. Generally, people with this learning style find it more important that a theory has logical soundness than practical value. You like to carefully analyze and assess each step and weigh its relative consequence before taking action. Because you like to plan ahead, you are able to minimize mistakes and anticipate potential problems and pitfalls.

When dealing with people or events, your approach is to rely on your logical and objective understanding of the situation and avoid your feelings to get in the way of your sound judgments.

Others may see you as logical, organized, reliable, careful, and thoughtful.

### Preferred Learning Space

You thrive in learning spaces where you can use and develop your analytical and conceptual skills. You may prefer lectures, readings, exploring analytical models, and having time to think things through. You would rather work alone than in groups. You prefer teachers who model their thinking and analysis process in their lectures and interactions with you.

**Learning Strengths**

Organizing information

Being logical and rational

Building conceptual models

**Learning Challenges**

Risk taking

Socializing with others

Dealing with lack of structure

**Analyzing—In their own words:**

**Scott—Art student**

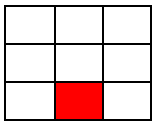
When I came to Art School, I decided to major in graphic design. I was always drawn to the conceptual part of the design process. I can see things in abstract ways and that is the fun part of the graphic design. Now I can see why I am an analytical learner. I like to work on my conceptual skills because it is satisfying to me and I am good at it. One time, our teacher gave us a design assignment. I produced a piece I was pretty proud of and I took it to my teacher for him to critique it. He looked at my work and said: " I like your concept and your drawing skills are excellent. But, I don't feel anything from it. It does not communicate to me what you are experiencing." I was surprised by what he said. But I know now, by looking at my LSI kite, what he meant. I do not use my feeling very much when I learn. I rarely go out in the world to experience things. I like to stay in my studio and work on my projects from my head. If I want to become a good artist, I need to become well rounded by working on my underdeveloped skills.

**Jane—Higher education administrator**

As a strong analytical learner, I excel in "planning systematically". I am touted as an exceptional planner. In fact, I spend a portion of every day planning the day, week, and month ahead. I do this through lists, spreadsheets, calendars, and even post-it notes, napkins, and e-mails to myself that eventually find their way to another master list. In addition, my current career involves extensive planning of meetings and events. My learning style contributes greatly to my success and positive job performance reviews in this position.
I find that my learning style is an asset in my career and long term career goals but can at times be a detriment in my personal relationships. By rigorously and constantly making sense of ideas and concepts, I do not allow for much spontaneity or chaos. I occasionally miss out on experiences because they do not fit my agenda. By loosening up and going with the flow more often, I will open the doors to new experiences and opportunities for growth and learning.

**Michelle—College student**

I understand why I enjoy making sense of things. I am able to gather all kinds of data and information and pull it together to make sense. My classmate pointed out to me that although this may be my strength, this is also where one of my weaknesses becomes evident. She told me, " you oftentimes develop great points in your mind during class, but then you don't openly share them." This is because I am more comfortable discussing an idea with a small group of people or one on one and it becomes harder for me to find that same comfort in a large class. I am a very individual thinker. Reflecting and analyzing an idea comes easily to me, but not right away in a classroom. I am better off working alone outside of a crowded and intimidating atmosphere. Along the same line, I prefer to study alone as opposed to studying in groups because I have always been a strong individual learner. I always enjoyed math, because solving math equations is a purely rational exercise which does not require communication.



## *The Thinking Learning Style*

Emphasizes **Abstract Conceptualization (AC)** while balancing **Active Experimentation (AE)** and **Reflective Observation (RO**. The **Thinking** style is distinguished by the capacity for disciplined involvement in abstract reasoning, mathematics and logic.

If **Thinking** is your learning style you learn primarily by deeply involvement in abstraction. You value thinking things through and like to fit wide range of data and information into concise ideas and models. You may enjoy working with numbers and engage in mental activities in general that require abstract reasoning and analytical skills. You may prefer working with quantitative over qualitative information. You like to work by yourself and prefer to deal with technical tasks rather than personal issues.

You are good at planning and goal-setting, but you like to concentrate on the quality of your plan rather than achieving the actual goals. You strive for consistency and accuracy in your worldviews and ideas. You tend to be controlled in your emotional expression and like to speak precisely and concisely. When you act, your action tends to be the result of much thought. You work hard to avoid mistakes.

Others may see you as thorough, precise, reliable, consistent and introspective.

**Preferred Learning Space** You may learn best in well-structured learning spaces with clear directions and learning agendas. You also thrive in environments in which you can design or conduct experiments or manipulate data. You may prefer to work alone and need time to think things through. A teacher's expertise in their field is of primary importance to you.

**Learning Strengths**

Logical analysis

Rational decision making

Analyzing quantitative data

**Learning Challenges**

Working with people

Keeping an open mind about your ideas

"Lost in thought"

**Thinking—In their own words:**

**Jake—College student**

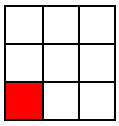
I think my learning style descriptions fit the way I like to learn. I do no like to be lectured and would rather want to be working on a lab doing something with the information instead of just sitting and listening to the professor talk. I think that is why I like math so much because I can think things through and solve problems. I prefer to work on mathematics or physics problems much more than working out problems with a friend or family member.

**Marianne—Financial analyst**

I like to solve problems, make decisions and I have a slight preference towards the technical tasks versus the personal issues. In a learning setting, I need to see the practical application of the topic or a theory. I need time to absorb information and think through it, planning and organizing information. I absolutely want to know exactly what I have to do to meet and exceed the standard. In fact, when I don't have this information or when others in the group move forward without the information, or don't allow me the time I need to assimilate it, I get frustrated. I need to know what success and failure looks like in the eyes of the person who is judging. I need time alone to process information and rejuvenate. I make "to-do" lists for everything from tasks at work, to the grocery store, packing for a trip. Doing this helps me to feel organized and focused. I don't like to be responsible for certain types of decisions for fear that I will make the wrong decision. Decisions, such as, which direction to take when driving, giving advice, or which gift to purchase. Being so centered in thinkingperhaps causes me to struggle between planning and developing options and making the decisions.

**Brian – Editor and newsroom manager**

It does not come as surprise to me that Learning style assessment shows that I am "thinker." I learn more by thinking, although my preference for acting and watching is also strong. Often, when I set out to learn something new, my first inclination is to find a "how-to" book on the subject. This is especially true if the subject is technical; for example having to do with computer systems, organization development, sailing or training a puppy. But it's also true in the case of more creative subjects, such as cooking or learning to play the guitar. I'm inclined to want to know the "big picture" – theory, scales, and so on in the case of the guitar – rather than to just sit down and sound out the music. And while I'm aware of people's feelings and am open to varying opinions on a project or problem, I generally prefer to approach things logically rather than emotionally and tend to short-circuit process and "cut to the chase.



## The Deciding Learning Style

Combines learning modes of **Abstract Conceptualization (AC)** and **Active Experimentation (AE).** The **Deciding** style is distinguished by the ability to use theories and models to decide on problem solutions and courses of action.

If **Deciding** is your learning style, you are best at finding practical uses for ideas and theories. You have the ability to solve problems and make decisions based on rational evaluation of solutions to questions or problems. You are good at identifying flaws and mistakes in concepts and ideas by testing them in the real world. You like to set clear goals, evaluate and then decide on the best path to achieve them. Because you are efficient and focused, you tend not to be distracted by what you consider to be tangential facts or information. This can sometimes lead to missing important information or solving the wrong problem.

Your focus is on technical problem-solving when working with others. When you work with people, you tend to concentrate on helping them to solve their problems efficiently and effectively rather on feelings and interpersonal issues.

People may see you as focused, pragmatic, rational and decisive.

**Learning Strengths**

Problem solving

Evaluating ideas and solutions

Setting goals

Making decisions

**Learning Challenges**

Thinking "out of the box"

Sensitivity to people's feelings

Dealing with ambiguity

### Preferred Learning Space

You may learn best in learning spaces where you can experiment with new ideas, simulations, laboratory assignments, and practical applications. You prefer teachers who set clear standards and goals and evaluate with problems and questions that have right or wrong answers.

### Deciding—In their own words:

### George—Sales manager

My preferred learning style is "deciding" and I believe this to be a good fit in terms of how I see myself. In addition to my regional sales management responsibilities, I also oversee the sales productivity function. My sales productivity team focuses on how to help the organization become

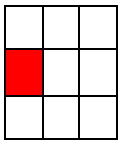
more effective and efficient through the practical application of various tools, technology, and training. Given my preference for a "deciding" learning and working style, I tend to enjoy gathering information, from both internal and external sources to the organization. I like to solve problems and make decisions to help the sales team succeed in creating a competitive advantage. As an example of this, I actively experiment with my sales team, taking the new ideas that are generated by my sales productivity team and finding practical applications related to organization structure, incentive compensation, performance recognition, and enabling tools and technology. But as I am an introvert by nature and therefore prefer to deal with technical tasks and problems versus social and interpersonal issues, I need to understand people better, and being more open-minded. Also, I use little reflection in my work and life in general. In my case I can learn from my wife, who has "imagining" learning style tendencies, and hope to improve our communication knowing now that we approach problems on opposite ends of the spectrum.

**Charles—Management consultant**

As a "deciding" learner, I have a desire to understand things from a conceptual perspective rather than a concrete one. My preference for models and theories validates why I excel at courses that are more conceptual in nature. I have a natural tendency to communicate conceptually instead of concretely. For example, with my wife being more concrete than conceptual, it validates the tendency to "lose her" when I give a conceptual explanation. It also validates my challenge in learning to understand and communicate with my children at a more concrete level. I have a natural desire to apply and act on what I am learning as opposed to reflecting and pondering. I don't feel I fully understand something till I have an opportunity to experiment and test it out. My deciding style explains the tension I feel when I am with those of other learning styles. When I'm with those with an Initiating style, I feel a need to push for a clearer conceptual understanding of the situation before moving to action and solutions. When I'm with those with an Analyzing style, I feel a need to address the question, "Will this model or theory work?" and "When we will we test it out?" When I'm with those with an Imagining style, I feel the need to bring direction and closure after multiple ideas are expressed and generated.

**Amanda—Management consultant**

The Deciding learning style suits me for many different reasons. When I first reflected on this definition the first thing that stood out was that I *usually converge on the correct solution.* This is definitely how most situations play out for me. I tend to go into situations, either alone or with people, and come out with a clear concise analysis with data and facts that results in a plan for the future. Throughout my life, people have said to me that I can clear away the garbage to find the truth with ease and wisdom beyond my years. People in my life tend to gravitate to me when they need a solution or for my honesty and clear-headed nature. I tend to arrive at an answer to tough decisions more quickly than others might, but this should not be mistaken for rash or impulsive decision-making. Rather, I am sure of my answer once I have analyzed and arrived at that answer, lending a very decisive and definitive air to my interactions. This has done wonders for me in career and my personal world.



## The Acting Learning Style

Emphasizes **Active Experimentation (AE)** while balancing **Concrete Experience (CE)** and **Abstract Conceptualization (AC).** The **Acting** style is distinguished by a strong motivation for goal directed action that integrates people and tasks.

If your learning style is **Acting,** you use action as your primary basis for learning. You are goal oriented and focused on getting things done. You are good at implementing plans or testing ideas by combining your experience of the immediate situation with ideas and concepts for dealing with it. You have the ability to find solutions to questions or problems based on technical analysis while paying attention to the needs of people. You may be equally comfortable in functioning in a practical world that can make use of your feelings and actions as well in a technical world that requires your conceptual abilities. As a result, you excel in identifying and integrating task and people needs.

You are good at improving existing operations and systems and producing results. You can excel in leadership position that calls for coordinating complex operations and systems. Because of your strong preference for action over reflection, you may tend to commit to an idea without considering its consequences and alternative options or solutions.

Others may see you as dynamic, strategic, personable, and responsible.

### Preferred Learning Space

You learn best by on the job learning through discussions with colleagues and working in teams. You prefer teachers with practical real world experience that you can emulate.

**Learning Strengths**

Combining technical knowledge and personal relationships

Focused on getting things done

Leading work teams

**Learning Challenges**

Taking time to reflect

Solving the right problem

Gathering and analyzing information

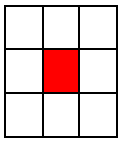
**Acting—In their own words:**

**Elizabeth—Retail store manager**

As an Acting learner, I do find that I move easily to the doing stage, and am more comfortable plunging into get things done. When I have a task ahead, I am eager to get started. Usually I will have a strong gut feeling about the best course of action. My next step will be to look for data to validate my intuition. I do think about what and why my intuition is pointing in a certain direction and like to get my conceptual arms around the topic. I look for a few pieces of information to back up my perception using people and other sources. I don't spend enormous time gathering data although if it is an important decision and I am unsure, I will spend time talking to people I respect. Once ready to act, I do. I am comfortable learning by doing and taking risk. On the positive side, I am able to get lots done, moving from one thing to another, switching gears easily. I don't get overwhelmed that easily by work. On the negative side, sometimes I am surprised by something that I haven't researched thoroughly or that when learning- by-doing the results are not as perfect as I might like.

**Nancy—Independent consultant**

I very much agree that my learning style is Acting. I experience a "need" to act during my learning process. My colleagues, staff, and family all agree that it's my drive for action and the passion in which I move to action, that draws them to me. It's also my Achilles heel, meaning, at times I move to action before I've properly finished gathering all the sources of data, spent time away from the "facts" to consider other options and reflect on other potential ideas. When I'm not careful or when timing is tight and I feel internal pressure to meet deadlines and implement tasks, I will skip over the Reflective Observation component of learning process completely. I hyper-process information, succumbing to deep analysis that is very quick, but gives little time for the data to digest.



## The Balancing Learning Style

Balances **Concrete Experience, Abstract Conceptualization, Active Experimentation and Reflective Observation.** The **Balancing** style is distinguished by the ability to adapt flexibly by weighing the pros and cons of acting vs. reflecting and experiencing vs. thinking.

If your learning style is **Balancing,** your primary approach to learning is to switch approaches from feeling to thinking and from reflecting to acting. Because of your ability to navigate through the learning cycle you can change your approach to learning based on the situation. You are open to new experiences and equally adept at identifying and solving problems. You are able to see diverse perspectives on issues and bridge differences between people with different styles. In a team environment you are able to adapt to fill in the missing style needed to get the task done and help the team navigate through the learning cycle.

Because of your balanced worldview, you may find it difficult to make decisions about issues or choose between different alternatives. Your tendency to pursue a variety of interests may lead you to change jobs and careers many times over the course of your life.

People may see you as curious, open, flexible, multi-talented and resourceful.

### Preferred Learning Space

You tend to be more satisfied in learning environments where you can use all four learning modes: learning from lectures, discussions groups, brainstorming sessions, labs and on-the-job learning. Because you are able to adapt to the different learning environments, you can learn from teachers with different teaching approaches.

**Learning Strengths**

Flexibility in moving around the learning cycle

Ability to work with diverse groups of people

Creative insights

**Learning Challenges**

Indecisiveness

"Jack of all trades, master of none."

Sustained commitment

**Balancing—In their own words:**

**Cloe—College freshman**

It makes a lot of sense why I am a balancing learner. I thought I was different from other people but never understood why and in what ways. For example, when I took the test, it was difficult from me to choose one item over others. They all made sense to me and I said to myself, " Well, I do all these things when I am learning!" When I looked at my classmates LSI styles they all had strong preferences one way or the other. I was like, "here I go again. I don't fit anywhere." I can see what I have to do in each different situation. For example, we had a group activity in class the other day. We had to come up with a solution to a case study that the instructor had assigned to us. I can see that some of my classmates like to brainstorm a lot, and others like just to stand back and think. It came to a point where I knew we need to make a decision about what to do and that was the role I took up on myself. Many times I feel like it sucks to be able to see what is going on when nobody else seem to be able to. Now I have a different perspective and appreciation for who I am. I am a balanced learner and I have a lot of strengths as a result of my learning style.

**Mary Lou—Art college student**

I am not surprised about how I came out in my learning style test. I am a balanced learner for sure. I took a lot of different kind of personality tests in the past and I managed to come out right in the middle in all of them. When people ask me if I am a pro-life or pro-choice, or if I am a liberal or conservative; it is hard for me to take a position because I can see the strengths and weaknesses in both sides of the arguments.

**Karen—CEO's chief of staff**

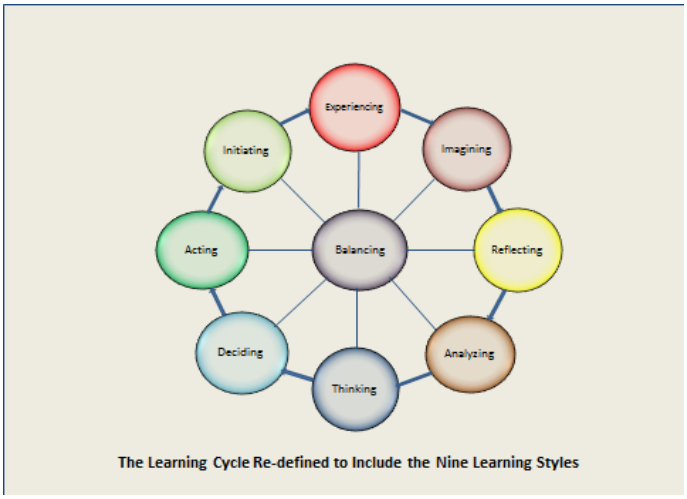
"Jack of all trades and master of none". This timeworn phrase is often used to describe journalists, and certainly applied to my two decades in the profession. I covered police, politics, education and child welfare, to name just a few. My friends from college pursued medicine or graduate school; I just kept learning a little bit about a lot.

**Jina—Consultant**

Because I am comfortable learning in a variety of ways, I am adaptable to different situations and contexts, which makes me a versatile team member. I am generally able to do whatever is needed to get the job done. In addition, I tend to pick up new skills or concepts quickly, which I would attribute to my ability to learn in a variety of ways.

# Appendix 10
# Experiential Learning
# Session Designs

The experiential learning session designs described below can be used in classes and training programs to explain aspects of ELT and learning styles. The experiences are designed to "teach around the learning cycle" so participants of all styles can sometimes find their home space and practice using other learning styles (See Chapter 1). The experiential learning cycle includes all nine styles of the KJLSI 4.0 as shown in the adjoining figure. Each design activity is coded with the learning styles the activity is designed to activate for participants.



The Learning Cycle Re-defined to Include the Nine Learning Styles

## Session Design 1: Using the KLSI 4.0 to Understand Individual Learning Styles & Learning Flexibility

### Objectives

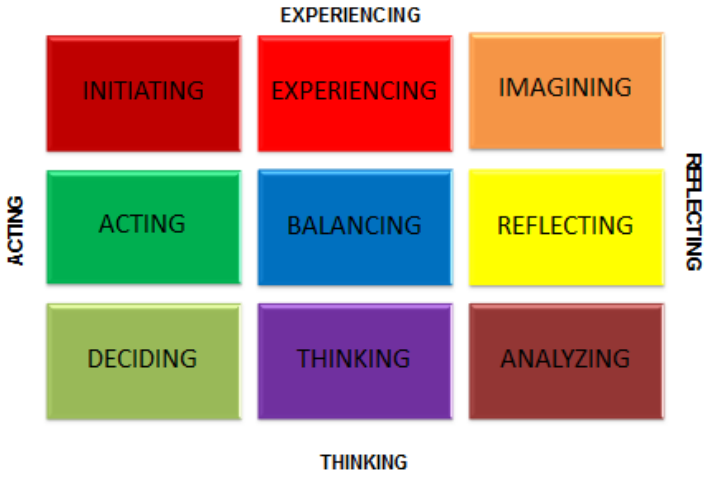
- To help participants increase their understanding of the way they learn.
- To heighten participants' awareness of their own, and others' learning styles.
- To enable participants to assess their learning strengths and weaknesses, and learning flexibility.
- To set learning goals that promote self-development and growth.

### Materials Required

- Participants should be instructed to take the KLSI 4.0 online, print out the interpretative booklet with their scores and bring it to the session.

- The exercise requires a large, open area to afford sufficient room for participants to position themselves on the experiential learning space; a classroom with movable furniture or another large open area is preferable.

- Materials to reproduce the 9 style experiential learning space shown below in an open area large enough to accommodate the participants (eg. masking tape to produce the 9 style grid and paper and markers for labels).




- Blank flipcharts: 2–3 sheets for each small group of 4–6 members
- Flipchart markers: one per small group

## Presentation Issues

To prepare for the session, facilitators should take the instrument themselves and read Chapter 1, Appendix 9 and the KLSI 4.0 Interpretative Report. For answers to questions most likely to be asked about ELT and the KLSI go to FAQ at www.learningfromexperience.com .

In administering the LSI, we have noticed that some participants accept it with almost blind faith, treating it as an ultimate measure of their personality traits. We feel the LSI is used best as an instrument for self-inquiry, and that LSI scores should be open to cross-validation through other sources of data, checked against how the participants see themselves and how others see them.

To reinforce this, this session includes an opportunity for participants to review their scores, in light of what they have learned in the learning styles presentation and their personal experience of their learning strengths and weaknesses.

*Time Frames*

The total session time and the estimates for each activity step may vary with the size of your group and your facilitating style. Use them as a guide.

## Timeline

(Total time: 1:30 to 2 hours)

*Step 1*

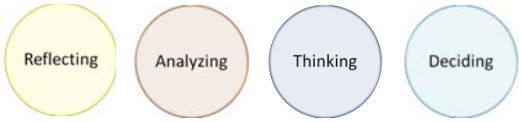
0:00–0:20

Styles to Engage:


**Introduce exercises and objectives to participants. Present an overview of the four stages of the Cycle of Learning, the nine Learning Style Types, and the strengths and weaknesses of each style type. (See Chapter 1 pages 3–9 and pages 4-16 of the KLSI 4.0 Interpretative Report.)**

*Step 2*
0:20–0:25

Styles to Engage:




**Have participants individually review their learning style kite shape and type description on page 8 of the KLSI 4.0 Interpretative Report and review the other 8 styles that follow. They should reflect on whether their learning style type fits for them or if another fits them better. If they wish they can choose another style type for steps 3 & 4.**

*Step 3*
0:25–0:30

Styles to Engage:


**Have participants position themselves according to their learning style type on the Experiential Learning Space. Ask them to observe their position relative to the rest of their group and the overall style emphasis of the group.**

*Step 4*
0:30-0:50

Styles to Engage:


**Form small groups, three to six members each, whose members share a similar style. If a style is represented by only 1 or 2 people have them choose a similar style group to join (e.g. a Deciding style could join with the Thinking group).**

**Have each group select a member who will report the results of their discussion to the large group.**

Post the flipchart with the following discussion questions. In the small groups, have each member in turn respond to the discussion questions. Other group members may ask questions as each person speaks, but encourage groups to budget their time so all members can respond to these questions.

**Guidelines for Small Group Discussion**

**1. Individual Learning Style**

- Do your learning profile scores seem valid to you?
- How do you describe the way you learn?
- What is your greatest strength as a learner?
- What is your greatest weakness as a learner?

**2. Personal Learning Goals**

- What do you want to achieve in this session?
- How do you want to improve your learning skills?
- What changes would you like to make in your learning style?

**3. Preferred Learning Environment**

- What kind of learning situations are best to help you learn?
- What makes it difficult for you to learn?
- What can the facilitator or other participants do to make this the best learning experience for you?

*Step 5*
0:50-1:20

Styles to Engage:

**Reassemble the large group and ask each small group in turn to briefly report the results of its discussion. Allow for questions after each report and summarize conclusions at the end of the reports.**

*Step 6*
1:20-1:35

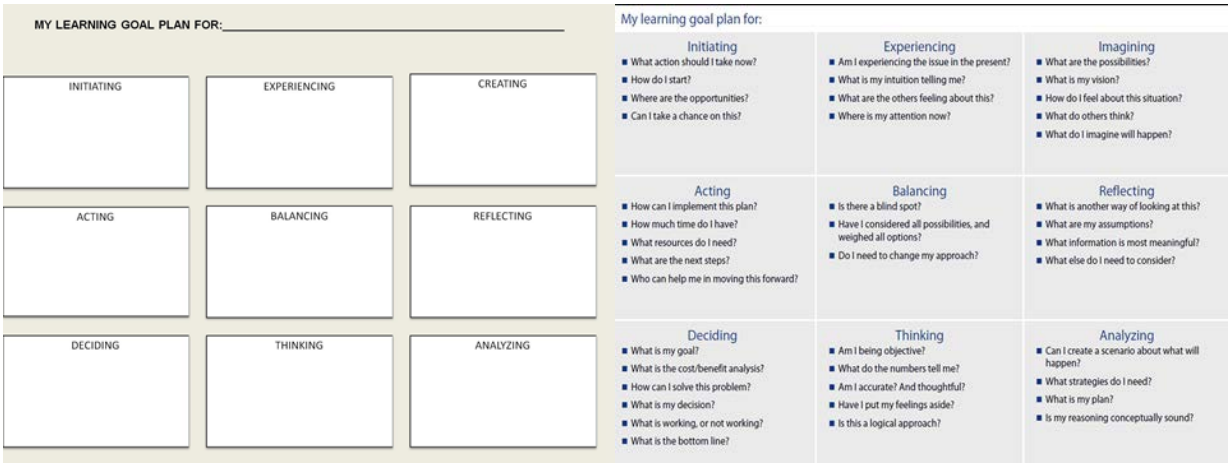
Styles to Engage:


**Learning Flexibility.**

**Introduce the concept of learning flexibility (See Chapter 1, page 23 and Chapter 6, page 71). Direct participants to page 17 of the KLSI 4.0 Interpretative Report and help them understand their learning flexibility index score and profile (Showing and explaining your own scores can sometimes help here).**

*Step 7*
1:35-1:45
Styles to Engage:

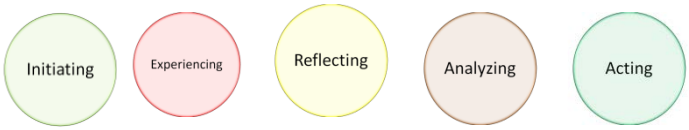

**Working individually participants should complete the Personal learning Goal worksheet following instructions on page 18 of the KLSI 4.0 Interpretative Report.**




Step 7 can be given as a homework assignment or if time permits proceed to step 8 & 9.

*Step 8*
1:45-1:55

Styles to Engage:




**Divide participants into groups of three and instruct them to share their goal plans and give each other their ideas and reactions.**

*Step 9*
1:55-2:05

Styles to Engage:


**Ask the trios to briefly report their conversations and summarize findings.**

# Session Design 2: The Lemon Exercise: Experiencing and Thinking

## Objectives

- To increase understanding of the foundation of the experiential learning cycle–William James dual knowledge concept.
- To heighten participants' awareness of their own experiencing and thinking process.
- To enable participants to assess their learning strengths and weaknesses in both modes, and to set learning goals that promote self-development and growth.

## Materials Required

- Lemons – One lemon for each student
- Large cardboard box (to hold all lemons)
- Blank flipcharts: 3 sheets

## Preparation

The following articles available for download at www.learningfromexperience.com provide useful background information for this session:

> Kolb, A. Y. & Kolb, D. A. (2009). The learning way: Meta-cognitive aspects of experiential learning. *Simulation and Gaming: An Interdisciplinary Journal*. 40(3): 297-327
> Yeganeh, B. & Kolb, D. A. (2009). Mindfulness and experiential learning. *OD Practitioner* 41(3):8-14

### *Time Frames*

The total session time and the estimates for each activity step may vary with the size of your group and your facilitating style. Use them as a guide.

## Timeline

(Total time: 1 hour, 15 Minutes)

*Step 1*

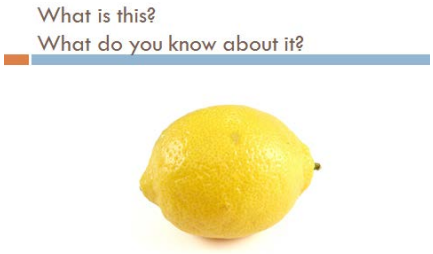
0:00–0:10

Styles Engage: 

to

**Introduce exercises and objectives to participants.**

**Hold up a lemon and ask the group "What is this?" Ask them to describe what they know about lemons. You can provide the first example: lemons are yellow. They may provide more adjectives such as oval, sour, grows on trees, citrus, small, light et cetera. Make a list of all the descriptions on a flipchart, chalkboard, etc.**




*Step 2*

0:10–0:15

Styles to Engage: 


**After the list describing lemons is made, give each participant their own personal lemon. Ask them to get to know their personal lemon carefully for about one minute. Make it clear that they will need to remember details about the lemon. Ask them to think of a story about how the lemon came to look like it does. Tell them that they can give their lemon a name.**

*Step 3*

0:15–0:25

Styles to Engage: 


**After participants have had time to study their lemon, go around the room with the box and collect all the lemons, and mix them up.**

**Place the box in the center of the room and tell the participants to pick their lemon out. There may be a small scuffle at the box. If the group is large pour the lemons on the floor in a large open space to facilitate the process of finding their lemon. It will seem to many that they will not be able to pick out their lemon from a box of 20-30 lemons, but we have had groups of 50 people find their lemon with only one or two exceptions.**

*Step 4*
0:25-0:40

Styles to Engage:


**When everyone has their lemon again, have them return to their seats. Go around the room asking participants how they identified their lemon. They will be eager to explain their personal lemon. Make a list of the characteristics that the students mention, which will vary, but they will be something similar to: Large lumps, a big scratch, and a patch of green, a very skinny lemon, small or large, et cetera.**

*Step 5*
0:40-0:45

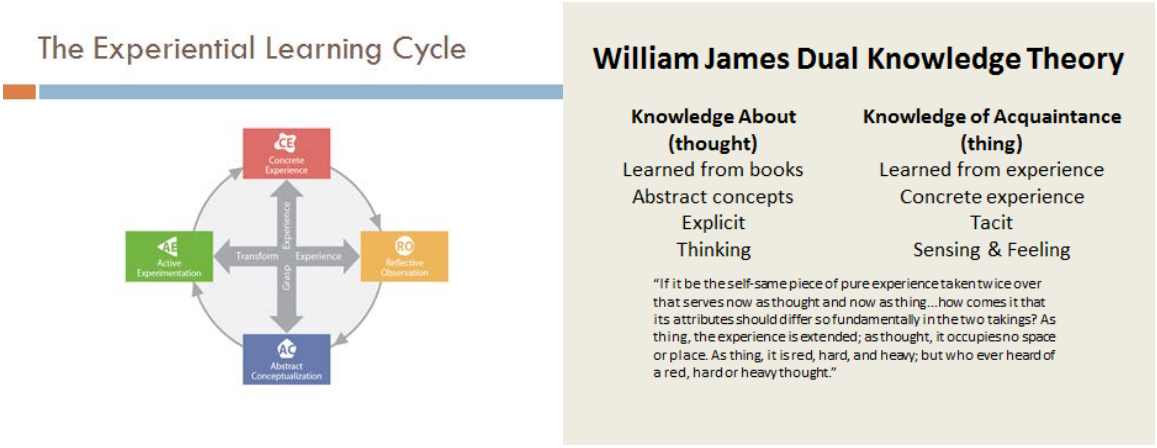
Styles to Engage:


**When the list of characteristics is complete, place it next to the first list of general lemon characteristics and ask participants to compare the two lists. Ask "What is the difference between these two lists?" Responses will be like—the first is general and the second is unique; based on prior knowledge vs. based on present experience; comes from thinking vs. comes from the senses.**

*Step 6*
0:45-1:00

Styles to Engage:


**Introduce William James dual knowledge theory and its place in the experiential learning cycle—knowing through Concrete Experience and Abstract Conceptualization. Emphasize that we all know the world in both ways and that it is by integrating these two ways of knowing though the transformation dimension of action and reflection that we learn and create.**




**Connect the dual knowledge theory to the two lists. The first list is "knowledge about" lemons based on conceptualizing and the second list is "knowledge of acquaintance" based on experiencing.**

Step 7
1:00-1:15

Styles to Engage:


**Group Practice and Discussion. Ask participants to put themselves in the conceptualizing mode for one minute. Have them share their thoughts.**

**Now ask them to put themselves in the experiencing mode for one minute. Have them share their experience. Ask:**

**Which mode was easier for you to get into?**

**What techniques did you use to get into the modes?**

**Are you able to "toggle" between modes in your daily life or do you get stuck in one?**

**What are the pluses and minuses of each mode for learning? For productivity? For creativity? For personal relationships?**

**What action steps can you take to integrate both modes in your daily life?**

## Appendix 11
## Evaluating Experiential Learning—The Personal Application Assignment

The Personal Application Assignment (PAA) was developed as a way for participants to consolidate insights gleaned from experiential learning, and for facilitators to assess participants' learning. It is a holistic evaluation method that gives equal weight to all four modes of the learning cycle. The PAA is a journal or essay assignment in which participants:

1. Select an experience, occurring either in or out of the training session, and chronicle the actual events of the experience

2. Review their thoughts and feelings about the experience, making observations about it from a fresh perspective

3. Develop concepts or theories that make sense of the experience

4. Create future action plans based on what they have learned from the experience

Since each step of the PAA process corresponds to a step in the Cycle of Learning, the PAA guides the learner through all four phases, from actual experience to future planning. The PAA is a useful tool for consolidating learning, for developing new insights about one's experience, and for learning how to learn. It can be used to evaluate participant learning achieved through experiential methods and to help participants consolidate learning derived both from courses, training sessions and from first-hand experience. The PAA also can be used as a journal assignment, as an adjunct to training session discussion, or as a follow-up to training games or simulations. Use of the PAA solely as a journal assignment (which may or may not be reviewed and evaluated by the facilitator) is most appropriate when participants have been asked to select outside experiences of deep personal significance. The accent on personal growth and practice with each of the learning modes makes journal use a natural choice.

The PAA can be used as an adjunct to training discussion helps participants to generalize and gain new insights from classroom experiential learning. For young participants or those with overspecialized learning styles, such a guided pass through the learning modes can be a growth-promoting process. In addition, observation, reflection, and conceptualization about experience by participants is critical if the facilitator is to avoid providing merely pleasant or exciting exercises with limited transferable usefulness. Finally, the PAA has been used successfully as a follow-up to day-long simulations and to more limited training sessions. Its flexibility in encouraging expression of subjective feelings and reactions as well as objective concepts and theories seems particularly well-suited to the dynamic atmosphere of the training game or simulation.

Using the PAA

The PAA is most effective when the Concrete Experience (actual experience) chosen has some personal significance for the participant. For this reason, students sometimes choose a personal experience from outside the training environment. If the emphasis is solely on personal growth and practice with the learning modes, this is an acceptable

choice; however, if the focus is on direct experience that generates theories and insights about a theoretical concept (for example, intergroup dynamics), then a more controlled training exercise might be a better choice. This prevents exploration of experiences that, while personally significant to the participant, might have little relevance to the topic.

We have only experienced problems with the PAA as a classroom tool when participants have not clearly understood its purpose or the guidelines for grading. Since the assignment is probably unlike papers the participants have written in the past, all expectations should be made clear at the outset. The Elements of the PAA section summarizes the suggested grading criteria for each section of the PAA. We suggest that this, the Sample PAA and the grading criteria summary at the end of this appendix be used as handouts to explain the essay requirements.

**Guidelines on Grading, Topic Selection, and Confidentiality**

There are five elements to the paper and each normally is weighted equally. A 20-point grading system simplifies understanding how each component of the paper is graded and weighted. These include the four elements in the learning style model and a fifth element that takes into account the introduction, integration, synthesis and general quality of writing in the PAA. The score given in each element depends upon how effectively the student has met all the criteria listed for that section of the paper. For the instructor's part, we believe that instructors need to provide specific feedback as quickly as possible to students on why they were awarded points in each area and, more importantly, what they need to do to improve. To achieve these objectives the same summary sheet that guides the grading is provided to the student as feedback. This sheet is attached at the end of this handout.

The above paragraph referred to the weighting as “normally” being equal for all parts of the paper. In cases where the quality of the student writing is clearly below acceptable standards for college- level courses, this component or the entire paper may be given a significantly lower grade. (Preparing a good quality initial draft to be reviewed by a peer will help eliminate this potential problem. An initial draft is not the same as a first draft or rough draft. It should be a version the student has already revised one or more times. Students should be responsible for seeking out help with their writing skills if necessary.

Choosing a good topic is essential. Select an experience that relates to the assigned course topics. It should be an experience that you would like to understand better, (e.g., there was something about it that you do not totally understand, that intrigues you, that made you realize that you lacked certain managerial skills, or that was problematical or significant for you.) When students are excited about learning more about the incident, their papers are lively and interesting. The topic must be meaty enough to take it through the entire learning cycle. The incident does not have to be work related; an incident in any setting (sports, school, family, church, etc.) that relates to the course topics is acceptable.

You should select a recent experience (not something that happened back in high school). The more recent the experience, the more likely it is that you could take actions that could improve your current interactions with a supervisor, group member, roommate, or other person with whom

you have an ongoing relationship. You also may select an experience which is not ongoing if this is more salient to you.

Two additional issues should be considered in choosing your topic. The first is confidentiality. Students sometime wish to write on a topic that is of a personal nature. They may be willing for the instructor to read their paper but not want this to be read by other students in the class. This is a reasonable request and confidentiality will be honored. Students who want their paper to be confidential should inform the instructor ahead of time and should write "confidential" at the top of the paper.

There is one exception to the confidentiality rule. If a student describes conduct related to a University where significant University rules or State/Federal laws have been violated by other students or University staff, the instructor reserves the right to bring this issue to the attention of the appropriate administrator to ensure that the situation is remedied.

**Elements of the PAA**

**1. Concrete Experience**

In this part of the paper, students briefly describe what happens in the experience. A simple description of the events which occurred is not sufficient. The feelings experienced by the student as well as his or her thoughts and perceptions during the experience are relevant to this discussion.

Another way of looking at the concrete experience would be to recognize that it possesses an objective and a subjective component. The objective part presents the facts of the experience, like a newspaper account, without an attempt to analyze the content. The subjective part is the "here-and-now" personal experience of the event. This experience is composed of feelings, perceptions and thoughts.

Helpful hints: (1) It often helps students to replay the experience in their mind. After reviewing the experience, students should write a report of what they saw, heard, felt, thought, and heard and saw others doing. (2) Students should avoid presenting the detailed mechanics of the experience unless these are critical to the remainder of the paper. This section of the paper should be no longer than 1.5 pages long. (3) Students should avoid reporting the feelings and thoughts experienced after the experience being described. This retrospection is more appropriate in the reflective observation section.

Example:

> We all sat at the table together. Not a sound came from any of us. Finally, after what felt like an hour to me, I simply had to say something. "Why are all of you taking this course?" I asked. One person, a small foreign looking man said, "I needed this course to complete my MBA." Others laughed. Another person, a nicely dressed woman, said, "I'd like to get an easy 'A.'" I thought to myself: What a bummer! I didn't want to be in a group with people who didn't take the subject matter seriously. When the meeting ended, my perceptions of the group had somehow changed. Maybe this was a good group to be in after all. Some of the members had similar

interests to mine, and most of them were nice people that I could see getting along with. I felt somehow hopeful that this semester wouldn't be so bad after all.

**2. Reflective Observation**

The student should ask him/herself: What did I observe in the experience and what possible meanings could these observations have? The key task here is to gather as many observations as possible by observing the experience from different points of view. The main skill to work on is perspective taking or what some people call "re-framing." Try to look at this experience and describe it from different perspectives. For example, how did other participants view the situation and what did it mean to them? What would a neutral ("objective") observer have seen and heard? If some time has passed since the experience, do you now see the situation differently? Look beneath the surface and try to explain why the people involved behaved the way they did. Reflect on these observations to discover the personal meaning that the situation had for you.

Helpful hints: (1) If possible, discuss the experience with others who were involved to gain their views and clarify your perceptions. (2) "Unhook" yourself from the experience and meditate about it in a relaxed atmosphere. Mull over your observations until their personal meaning comes clear to you. Try to figure out why people, and you in particular, behaved as they did. What can you learn about yourself, looking back on the experience? If you write about a conflict or interaction, be sure to analyze both sides and put yourself in the shoes of the other people involved.

Examples:

> In thinking back on the meeting, I began to see how the group might have taken my comments. My comments were, after all, somewhat aggressive. Some might even call them belligerent. Had I said these things before this class, or at work, I must confess that I would have surprised even myself.
>
> But it seemed there was more going on here than met my eye at the time. Sarah and Bob at first didn't seem to be the kind of people to combine forces on this job, so why was I arguing against them this time? Then it dawned on me: Their departments were about to be combined into the same division! Why hadn't I remembered that during the meeting?
>
> Many thoughts raced through my head. Was the cause of last night's "high" that we won the game? Was it the first time we had worked together as a group? Maybe the fact that member X wasn't there that night helped! But I still had a nagging hunch that my involvement, downplayed as it was from previous meetings, helped.

**3. Abstract Conceptualization**

By relating assigned readings and lectures to what you experienced, you are demonstrating your ability to understand conceptually abstract material through your experiences. This process will help you refine your model of people and organizations. While some assigned readings and lectures will have varying degrees of relevance to your experience, it is important that you make

several references and not limit your conceptualizing to just one source. Use at least two major concepts or theories from the course readings and cite them correctly e.g,, (Osland, Kolb & Rubin, 2001: 31).

By reviewing the assigned reading material, you should be able to identify several specific concepts or theories that relate to your experience. First, briefly define the concept or theory as you would for someone who was not familiar with it. What issue or problem does the theory examine? What variables are used to analyze the problem and how does the theory explain the link between causal variables and outcomes. What suggestions does the theory give as to effective management practices? Second, in a separate paragraph, apply the concept thoroughly to your experience. The tie-in should include the specific details of how the theory relates to and provides insight into your experience. Try to develop diagnostic questions based on the theory that help you to analyze your situation. Does the theory explain what causes certain behaviors or outcomes and were these causes present in your situation? Does the theory distinguish between effective and ineffective practices that help you to understand your situation? Does the experience support or refute parts of the theory? You are encouraged to suggest modifications to a theory to make it fit your particular situation better.

Helpful hints: (1) It is sometimes useful to identify theoretical concepts that interest you first and then search out and elaborate on a personal experience that relates to these concepts. (2) An alternative approach is to select an experience you wish to understand better and then select concepts that apply to your experience.

The example below shows how one concept was defined and applied in a student PAA.

Abstract Conceptualization Example

> There are several organizational behavior concepts that help me understand this experience. One is the Thomas-Kilman theory of conflict (Osland, p. 284-285) which is based upon two axes, either the concern for one's own interests or the concern for the interests of the other party. The five styles reflect a low or high position on these two axes and are labeled competition, compromise, avoidance, accommodation, and collaboration.
>
> In the incident I described, my coach began with a collaborative style, high concern for both his own interests and the interests of the other party. He tried to work out a solution that would satisfy both of us but I neither saw nor heard his point of view. I just wanted to get my own way and practice in the same way I had on my previous team. I see now that the conflict style I used was the competitive style, high concern for my own interests and low concern for the interests of the other party. Looking back, this is the style I have used most often throughout my life; I usually got away with it before because I was such a good athlete. However, my experience with the coach supports the textbook's description (p. 285) of the losses that may result from using this style. I lost everything when I was kicked off the team and I certainly alienated the coach and the other players and discouraged them from wanting to work with me.

**4. Active Experimentation**

This section of the paper should begin by summarizing what you have learned as a result of writing the paper. What new personal insights and practical lessons did you learn about how to more effectively deal with these types of experiences. This should be presented in a separate paragraph and not buried within your discussion of an action step. Here's an examples of the lessons one student learned:

> Effective communication is a difficult skill to master, particularly when communicating with a loved one about an emotional issue. When the situation with Jason happened, I was completely unaware of my communication style and habits. Looking back, I can see that my communication goal was to give and get information by the most efficient means possible. Now that I have taken the time to reflect on the situation from his point of view, the missed opportunities for effective and meaningful conversation are painfully clear. I realize I have to think more carefully about how to communicate and that I need to make come improvements in my communication skills.

Next you should present four action steps that you will take to make you more effective in the future in these situations. (Future actions must be based on the experience reported in the Concrete Experience.) These actions can be stated in the form of guidelines as to how you would act differently or resolutions as to steps you could take to develop or practice particular skills. You should elaborate in detail how you see your action ideas being carried out. A given step might include several related activities to complete it. Sometimes students have a tendency to list an action step and then shift to explaining why they would take the action without sufficiently explaining the actual behavior they would modify. For example, the statement "I would strive to communicate better because people feel I don't listen very well" does not tell a reader very much about what you would do to communicate better. Saying that "I will strive to communicate better by using active listening techniques where I will paraphrase the other's viewpoint before presenting my own opinion" is a better indication of how you will carry out this action step.

There should be a clear link between your action steps and the concepts presented in the abstract conceptualization section. If the theories you selected provide recommendations for improving management practices, you are encouraged to incorporate these ideas in formulating your action steps. Don't just repeat tips from the text. Try to include at least one action resolution that is based upon new knowledge that you have gained about yourself. If you were to re-live your experience, what would you do differently? What would you do to improve the situation?

In past student PAA's it is often difficult to sort out where one action step ends and another begins. Please provide a separate paragraph for each action step and number or otherwise demarcate the separate action steps. For example, "First, I would ..... My second action step would be ..." This will help the reader differentiate between action steps and will ensure that you provide four distinct action steps as part of your plan. Explain why you would take these action steps. Why would the selected behaviors be likely to improve the situation?

Helpful hints: (1) Project a future experience in which you envision the implementation of your ideas and then elaborate on that experience as a way of demonstrating how your actions will be

carried out. (2) Where does this situation exist in your life (home, work, school)? Do you need a support system to make it happen? How will you obtain the cooperation of others to jointly improve the situation? (3) Try to imagine the final results of your experimentation. What will it be like if you accomplish what you want to do?

Example of Action Steps:

How then can I best utilize and improve my achievement motivation? First, I must arrange for some accomplishment feedback. This will be done by designing or perceiving tasks so that I succeed bit-by-bit, gaining a reward each time and thus strengthening my desire to achieve more.

Second, I should look to "models of achievement." If people around me succeed, it will further stimulate me. I will ask them how they go about setting realistic goals for themselves and observe how they get feedback from others regarding their performance.

Third, I should modify my self-image to include my desire for personal challenges and responsibilities and my requirement of continual feedback. (As a first step, I imagine myself as a person who requires or must have success, responsibility, challenge and variety.) I will seek out situations that are more likely to provide these challenges in the future.

Fourth, I must learn to control my reveries. Just beyond the borderline of awareness, many of us are constantly talking to ourselves. While it is fun to fantasize, I will try to make sure my aspirations are realistic given my current skills and time available to accomplish my various goals. I will spend time prioritizing my goals to ensure that I don't try to do too much or too little.

Finally, although I would never admit so, I agree that salary is a potential "dissatisfier" for me. Therefore, I must insist on what I perceive as a "fair return" for my performance. I will discuss my salary expectations with my supervisor to ensure I know what is expected and also to ensure that my boss knows my expectations. Wish me luck!

Here is another example of a good action step, written by a student who wanted to stop being a passive follower and become more of a leader.

*"I am going to take a more active role in team meetings. I will volunteer to be the team facilitator in at least one meeting during this semester. In all other meetings, I am going to make at least two process interventions to help the team function more effectively. To prepare myself, I am going to carefully observe other students who are excellent leaders, and I will read two articles on team leadership. I will also design an evaluation form on my team participation and ask my team to use it to evaluate me after the meeting I facilitate. Based on their feedback, I will continue working on possible weak areas during the rest of this course."*

## 5. Integration and Writing

The well written PAA has a focal issue and a story line with themes that are carried throughout each of the four sections. The idea of synergy applies here: "The whole is greater than

the sum of the parts." If integration is present, then the reader can attend to the content without distraction; if integration is absent, barriers prevent the reader from gaining a full appreciation of the content. Are the major themes that you have identified integrated throughout your paper? Make sure that the reflective observation takes into account the viewpoint of all the key people cited in the concrete experience. Do the concepts cited in abstract conceptualization fit well with these observations? Is there a clear link between the concepts or theories that you cite and the subsequent action steps that you formulate? Citing the theories is not just meant to be an academic exercise - it should help guide the analysis of the situation and the planning of practical steps for improving future situations.

Other barriers that prevent the reader from fully appreciating the paper's content are spelling and grammatical errors, as well as the overall appearance of the final document. Since good writing skills are so important in the business world, there should be no errors in your paper. Use the spell check (and grammar check) on your computer before you hand it in. Sometimes reading a paper aloud will indicate where sections of a paper may need revision to simplify awkward or unclear sentences.

Helpful hints: Troyka's Handbook for Writers is a good refresher on writing skills. Keep in mind the following points:

**(a) Decide what one or two main points you wish to convey in each paragraph. The lead sentence in the paragraph should alert the reader to these points. Start a new paragraph to convey new main points. Paragraphs should be of moderate length. Not a page long!**

(b) Keep sentences short. Avoid complex modifying phrases that distract from the main idea.

(c) Label each section: Concrete Experience, Reflective Observation, etc. Don't place a heading at the bottom of the page with no following text.

(d) Transitions are important (between sentences, paragraphs, and sections) and make the paper flow.

(e) The four sections should be equally well developed and fairly similar in length

(f) **The paper should not exceed 5 pages in length.** Please number the pages.

(g) Use 1" margins and double space. Use a font size of 11 or 12.

## SAMPLE PAA

Concrete Experience

I worked for one year in the marketing group in the Chicago office of a large public accounting firm. The internal service departments were organized into profit centers and operated like little fiefdoms. We worked very closely with the graphics department. We provided the majority of their work but that did not mean the two departments got along well. In fact, we spent more time battling each other than collaborating. A constant bone of contention for both groups was missed deadlines. Most of the time, a marketing person was the contact with the client, usually a partner in the firm. We set up a production schedule, to which the client would agree, and made every effort to stick to it. But 99 times out of 100, something would happen on the partner's end that would cause a delay. However, the original deadline was never modified to take these setbacks into account because we were not allowed to tell the partners their requests were unreasonable. This put terrific pressure on both departments, but graphics personnel continually accused us of purposely holding onto information or dragging our feet in order to make their jobs more difficult.

It was very frustrating for me to get my projects completed. From the very beginning, I felt they thought I was an incompetent jerk who was just trying to make their job more difficult. It wasn't long before I adopted the perception of the rest of my department - graphics was a bunch of uncooperative whiners. I never expected to get good service from them and I didn't. I dreaded going into their office with changes and kept my communications with them to a minimum. Occasionally, I'd have a confrontation with an artist, which would escalate into an argument with two or three other graphics people. Then I was angry for the rest of the day. I had no idea how to remedy the situation and I was under such pressure to get my work done that I had no time to repair the relationships, even if I had known how to do it.

Reflective Observation

Looking back, I think that if I had not been so caught up in the intergroup fighting, I would have recognized that the graphics personnel were under as much pressure as I was. At the time it always seemed like "once again graphics was being uncooperative." But I never stopped to ask myself why they were being so hostile to me and I never put myself in their shoes. One of the things this taught me was that I can be somewhat self-centered and ignore the problems of others when they are a barrier to getting my work done. When graphics stereotyped me, I let myself be influenced by my co-workers rather than making the effort to develop a positive relationship with graphics and get beyond the stereotypes. I felt like one of the gang when we all shared our horror stories about the latest thing graphics had done.

For their part, graphics was probably struggling to keep up with their work and deadlines. Just when they thought they had things under control, we would appear with new changes and requests. Perhaps a lot of their resentment stemmed from feeling that, because of us, they could not control their own workflow. We didn't want to lose the partners' business by asking for extended deadlines since they could have hired an outside firm, but graphics had no investment in our service to the partners. Instead, they were worried about satisfying their own clients. And our last-minute changes got in the way of serving their other clients.

There was another person in a different department who was very positive about the graphics department. At the time I remember thinking, "Oh, he must not deal with them on a regular basis like I do or they wouldn't be so cooperative with him." It never occurred to me that this person was doing something different than I was and, as a result, had a better relationship with the graphics personnel. And it certainly never occurred to me to ask him what he did to have such a great rapport with the group.

Since other people and groups managed to have good relations with graphics, we could hardly be justified in thinking that they were totally in the wrong. But both groups had stereotyped the other and were unwilling to change their opinions. Even though both our managers knew about the problem, they did not intervene, perhaps because the work always got done somehow. These managers were more focused upon tasks than people so they never worried about the personal cost of the conflict, and probably did not know how to resolve the problem.

Abstract Conceptualization

Conflict, defined as "a form of interaction among parties that differ in interests, perceptions, and preferences" (reader, p. 305) is the concept that best helps me understand my experience. Our two departments had different interests in serving our customers and different perceptions about each other and our work demands.

The situation between marketing and graphics was an example of when too much conflict occurs. The following passage could have been written about us. "The combination of negative stereotypes, distrust, internal militance, and aggressive action creates a vicious cycle: 'defensive' aggression by one group validates suspicion and 'defensive' counter aggression by the other, and the conflict escalates (Deutsch, 1973) unless it is counteracted by external factors" (reader, p. 307). Graphics never believed that we weren't holding back information or dragging our feet on purpose. And we never trusted them to do our work well without giving us a hard time. We both complained bitterly about each other and never lost an opportunity to slander the "enemy" to others in the organization, which is a form of aggression. Brown (reader, p. 306) states that managers must intervene when conflict reaches a dysfunctional level but our managers never did. They probably did not want to "rock the boat" as long as things were getting done. But it makes me wonder how much more effective we could have been, had we been able to work through our differences. Someone should have helped the two groups diagnose the conflict and its underlying causes (competing for the scarce resource of time, struggling with uncontrollable last minute demands and iron deadlines, and allegiance to our department rather than the company as a whole).

Another concept that applies to this incident is perception, the process by which we read meaning into stimuli (textbook, p. 204). Marketing and graphics personnel constructed barriers to communication between each group by using the techniques of selective exposure, selective attention, distrusted source and erroneous translation. We saw, heard and paid attention to what we wanted to, not necessarily the behaviors that may have been actually occurring. Our stereotypes were consistently reinforced by the perceptions we chose to respond to.

Active Experimentation

The positive thing about negative experiences is that hopefully I learn from them. I do not have control over other people but if I act appropriately, I will have a much better chance of getting the cooperation I desire. This experience taught me the dangers of going along with the group. My negative actions only made the job and the situation worse. Next time I will behave differently.

If I were in situation like this again, I would first try to do a better job of managing myself. I would remember that it takes two sides to make a conflict. I need to be as objective as possible and not simply go along with the group in criticizing "them" so that I feel more a part of the group. I learned that I could have “sat out” this conflict and simply chosen not to get involved. I should have devoted my energy to work or resolving the conflict rather than fighting. In the future, I will take a step back and analyze whether my emotions rather than my intellect is guiding my behavior..

Second, had I made the effort, I might have been able to establish at least one positive relationship with someone in graphics. I should have asked my positive colleague how he managed to develop such a good relationship with them. I suspect his advice would have been to spend more time with them, treat them with greater respect, refrain from blaming them when things go wrong, and be more empathetic.

Third, I will try harder to see all sides of an issue rather than just my own perspective. I should have made an effort to understand the graphics department’s point of view and refrained from stereotyping them. I am going to keep an open mind about others and try to be less judgmental.

Finally, I would talk to my manager about the problem and suggest possible solutions. By making my feelings known and telling her that I wanted to do my part in conflict management maybe she would be more willing to take action. If not, at least I would know that I had tried to be proactive rather than reactive.

## PERSONAL APPLICATION ASSIGNMENT GRADING CRITERIA SUMMARY

**CONCRETE EXPERIENCE - 4 points**

_____ Does the paper contain a clear, objective description of facts in your personal experience? (up to 2 points)

_____ Does it contain a subjective description of FEELINGS, perceptions and thoughts that occurred during (not after) the experience? (up to 2 points)

_____ Does this section provide enough information so the reader will understand the rest of the paper but not too much irrelevant detail? Remember that **this section should not be longer than 1 - 1.5 pages.** (Delete 1 point)

**REFLECTIVE OBSERVATION - 4 points**

_____ Did you look at the experience from the different points of view of all the major actors? (up to 2 points)

_____ Did you make an attempt to figure out why the people involved, and you in particular, behaved as they did? (up to 1 point)

_____ Did the different perspectives and behavioral analyses add significant meaning to the situation? (up to 1 point)

**ABSTRACT CONCEPTUALIZATION – 4 points**

_____ Did you briefly define and explain at least two different concepts or theories from the assigned readings that relate to your experience and did you reference them properly? (up to 2 points)

_____ Did you thoroughly apply the concepts/theories to your experience? (up to 2 points)

**ACTIVE EXPERIMENTATION – 4 points**

_____ Did you summarize the practical lessons you derived from writing this paper on your experience? (up to 1 point)

_____ Did you describe thoroughly at least four action steps you will take in the future so you can be more effective? (up to 2 points) Remember to come up with lessons and/or action steps that respond to all the major themes found in the paper?

_____ Did you identify and include at least one action step that is based upon what you learned about yourself as a result of writing the paper? (up to 1 point)

_____ Did you merely copy action steps from the workbook or reader without adding any of your original thinking? (delete 1 point)

**INTEGRATION, SYNTHESIS AND WRITING – 4 points**

_____ Does the PAA have major themes that are carried throughout each section of the paper and are the sections well-integrated and fairly equally developed? Is the material for each section where it should be? (up to 1 point)

_____ Is the paper clear and well-written? (up to 1 point)

_____ Is the paper free of spelling and grammar errors? (up to 2 points)