Learning Orientation Questionnaire--Interpretation Manual

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LEARNING ORIENTATION QUESTIONNAIRE

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1. Introduction

Recent advances in the neurosciences in the last ten years have revealed the extraordinary complexities and fundamental impact of emotions on brain plasticity, learning, and memory. These theories highlight more than the cognitive element, they explore the DOMINANT power of emotions and intentions on learning. The Learning Orientation research integrates the biology of learning with the more traditional psychological and educational aspects. It discusses the theoretical foundations for understanding sources for individual differences in learning. It specifically explores the importance of tapping into emotions, values, intentions, and social factors to measure and improve learning and memory skills. In contrast to most traditional approaches that focus primarily on cognitive or behavioral aspects, the Learning Orientation research proposes a higher-order theoretical foundation that considers emotions from a biological perspective.

Why don't we consider emotions as an important issue in Education? In the eighties, Snow and Cronbach suggested "an understanding of cognitive abilities considered alone would not be sufficient" to explain learning, individual learning differences and aptitude treatment interactions." Yet twenty-five year later the cognitive hegemony continues. We still subjugate or overlook emotions and intentions as a key learning factor and then we wonder why our learning solutions are inadequate or why learners are resistant or unmotivated to learn, especially online. To make today's learning really work, we need new learning and assessment models to stimulate and support emotions. Tapping into emotions will help individuals make the connections that translate into movement, testing, action, progress, and achievement—fostering the transition from passive to more active learning. For some (e.g., those who rely heavily on instructors), this is more difficult than others.

Successful learners distinguish themselves as strategic managers of a self-directed, well-planned effort to learn. Influenced by *emotions and intentions, autonomy,* and *committed strategic planning and learning effort,* these individuals deliberately use learning to empower themselves and improve or transform their environments. The learning orientation research examines how (to varying degree) learners understand and know how to focus emotions and intentions, commit strategic effort to set and accomplish short or long-term goals, and capably self-manage learning, progress, problems, and accomplishments. Traditionally, instructors in the classroom have learned how to supplement instruction and interact with learners to develop supportive human-to-learning relationships. Experienced educators who especially know how to tap into deep-seated emotions have a terrific advantage in helping learners succeed.

2. Learning Orientation Questionnaire

The Learning Orientation Questionnaire (LOQ) is a multidimensional measure of learning

orientation designed to have broad applicability across different learning goals, styles, skills, roles, and situations. Available in paper or electronic form, the instrument takes fifteen to twenty minutes to complete. It has been through several studies and field tested with 15,000+ subjects at several universities and corporations. The foundation of the Learning Orientation Questionnaire is the learning orientation research and a theoretical, three-factor representation called the *Learning Orientation Construct*. Refined through a series of analyes, the LOQ isolates and measures three complex factors that influence successful learning: (1) *Conative and Affective Learning Focus*, (2) *Learning Independence or Autonomy,* and (3) *Committed Strategic Planning and Learning Effort*.

This 25-item self-report questionnaire provides scores to identify learning orientation and offer explanations about individual learning differences. Learning orientations are generalizable to most learning situations and are not domain or environment specific. Although researchers accept that learner reactions and processes vary depending on the learning task and situation, the LOQ avoids a too-specific level or situational perspective. This means that items are not relevant to specific topics, instructors, or courses. Resulting scores describe a general disposition to learn and generally assess how individuals may enjoy or want to learn.

A series of studies has been conducted since 1999. In this sample (n=1277), the LOQ demonstrates an acceptable internal-consistency reliability coefficient of .823. Additional studies appear in the Appendix. Descriptive statistics are shown next.

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.592	2.619	6.060	3.442	2.314	.982	25
Item Variances	2.119	1.064	3.832	2.768	3.601	.429	25

3. Descriptions for the Three Learning Orientation Construct Factors

Factor 1

Conative and Affective Learning Focus describes the individual's will, commitment, intent, drive, or passion for improving, transforming, setting and achieving goals, and meeting challenges. This subscale refers to the individual's *general* conative and affective orientation to the process of learning, regardless of content, environments, or delivery. Naturally, learners will be more intentional and enjoy or apply greater effort in specific courses, topics, or situations that interest or appeal to them. This subscale estimates the learner's general feelings, attitudes, and willingness to learn.

This subscale has an eigenvalue of 6.37 and accounts up to 26% of the variance. Descriptive statistics and factor loadings are shown below (n=1277). This sample (n=1277) demonstrates an acceptable internal-consistency reliability coefficient of .891.

Item Statistics

	Mean	Std. Deviation	Factor Load
Q1	4.9413	1.31801	.66
Q2	5.9808	1.03155	.66
Q4	4.5826	1.44668	.58
Q6	6.0603	1.12061	.70
Q10	5.6022	1.23364	,66
Q11	5.4722	1.37666	.57
Q12	4.3453	1.59070	.58
Q13	5.5137	1.26287	.76
Q15	5.7987	1.19668	.69
Q16	5.4374	1.26131	.72
Q17	4.4675	1.45569	.70
Q19	5.5767	1.19051	.69
Q21	4.9280	1.40123	.67
Q24	5.3493	1.40594	.44

This subscale is greatly influenced by how much the learner believes that setting and accomplishing personal learning goals will improve personal growth, needs, and learning performance. Causal beliefs and affective and conative factors help successful learners expand knowledge, self-assess values and principles, and set challenging learning goals. These factors describe how successful learners self-manage internal and external resources, persist with planned, assertive learning efforts, and obtain satisfaction from accomplishment. Successful learners place great importance on intentions and follow beliefs, passions, and sources for satisfaction to achieve challenging personal goals. Scoring high on this factor describes individuals who approach learning with strong emotions and intentions, high learning efficacy, strong beliefs, and intrinsic motivation.

Factor 2

Learning Independence or Autonomy refers to the individual's desire and ability to take responsibility, make choices, and control, self-assess, self-motivate, and manage, or improve their own learning (i.e., make choices independent of the instructor) in the attainment of learning and personal goals. As individuals have different experiences and mature as learners, they gradually (to some varying degree) (1) gain awareness of their learning capabilities and processes, (2) develop desires for learning control or autonomy, (3) assimilate and develop a unique, personal set of learner-difference variables, (4) commit and self-manage effort to attain personal learning goals, and (5) review and monitor experiences to improve subsequent learning.

This subscale has an eigenvalue of 3.178 and accounts up to 13% of the variance. Descriptive statistics and factor loadings are shown below. This sample (n=1277) demonstrates an acceptable internal-consistency reliability coefficient of .788.

Item Statistics

	Mean	Std. Deviation	Load
Q3	4.1519	1.43962	.70
Q5	4.6586	1.62734	.55
Q8	3.8724	1.47980	.62
Q20	3.9052	1.50171	.75
Q22	4.2020	1.45730	.75
Q23	3.9514	1.46243	.74

Factor 3

Committed Strategic Planning and Learning Effort refers to the degree that learners strategically commit deliberate and persistent effort to accomplish learning. Successful learners place great importance on the act of striving or commitment to applying focused, strategic, hard-working principles and skills to learn. They have high standards and use extraordinary abstract thinking and planning skills and effort to meet learning challenges, expand personal knowledge, and initiate improvements and change. They do this against a background of desires, emotions, perceived capabilities, anticipated situational requirements and results, intrinsic and extrinsic resources, and perceived ability to accomplish the intended learning and performance. Less successful learners prefer to extend lesser effort generally, unless it is a specific area of high interest. Some lack insight that effort, not luck, is a contributing factor for achievement.

This subscale has an eigenvalue of 2.248 and accounts up to 9% of the variance. Descriptive statistics and factor loadings are shown next. This sample (n=1277) demonstrates an acceptable internal-consistency reliability coefficient of .791.

Item Statistics

	Mean	Std. Deviation	Load
Q7	2.6186	1.95748	.82
Q14	3.0478	1.75365	.76
Q18	3.4667	1.57514	.62
Q25	2.7917	1.84904	.84

4. Learning Orientations Model (ILO)

The learning orientation model uses the three-factor construct to describe **four** specific learning orientations—categorizing an individual's general orientation or disposition to learn (shown in Table 1). Learning orientations are how individuals, with varying beliefs and levels of ability, will intentionally and emotionally approach, commit and expend effort to some extent, and then experience learning to progress and attain goals. In other words, learning orientations describe how an individual typically wants and chooses to manage their brain during the learning

process.

Table 1
Four Learning Orientations Model

Transforming Learners	Performing Learners	Conforming Learners	Resistant Learners

The differing orientations represent the variability in learning from an individual-learning perspective. Learning orientation is the degree that learners, following beliefs, desires, emotions, and intentions to learn, generally commit effort and self-manage the learning process to learn. They describe how learners intend to set and attain goals, have feelings about learning progress, and use reflections to improve future learning. Learning orientations describe the individual's proclivity to take control, expend strategic effort, manage resources, and take risks to learn.

5. The Four Learning Orientations

Learners situationally fall along the continuum of learning orientations. Change to a new learning orientation requires psychological change, greater effort and learner control, and stronger intentions, feelings, and beliefs about learning.

Transforming Learners are highly goal-oriented, holistic thinkers who value learning ability, committed, persistent, and assertive effort, abstract theories, creative strategies, and positive expectations to self-manage and accomplish personal goals successfully. These learners seldom rely heavily on schedules, deadlines, expected compliance, or others for support. These learners, who may find routine activities boring, enjoy taking responsibility and control of their learning and willingly become actively involved in managing the learning process (high internal locus of control). Transforming learners typically tap into stimulating, intrinsic influences, such as passions, personal principles, beliefs, and desires to self-direct intentional achievement of challenging, long-term goals. These learners learn best in open, discovery, or challenging learning environments that encourage innovation, expertise building; risk-taking; mentoring relationships; complex, problem-solving situations; high learning standards, and personal accomplishments and change. This group of learners can improve by not overlooking important details and increasing focus on implementation and task completion.

Performing Learners are task-oriented, more often extrinsically motivated, and prefers avoiding risks and mistakes. They are less comfortable with abstract theories, more often focus on details, processes, principles, grades, rewards, and normative achievement standards. They often are ready to rely on instructors, external resources, and social interaction to accomplish tasks. They may selectively use self-regulated learning skills and commit effort to learn topics and skills that they find particularly interesting and beneficial. Often, these learners will clearly acknowledge that they want to limit or constrain effort (for example, they do not have enough time or interest) by only meeting stated objectives, getting an expected grade, or avoiding

exploratory steps beyond requirements. They value and learn best in semi-structured learning environments that add peer affiliation, teamwork, collaboration, competition, fun, and coaching to foster motivation (i.e., both intrinsically and extrinsically). These learners can improve by practicing more holistic, abstract, problem solving, and critical thinking skills.

Conforming Learners value security, structure, and routine. They are deeply influenced by an awareness of the social aspects of learning and external resources that motivate them. They more passively accept knowledge, store it, and reproduce it to conform and complete assigned tasks. These learners are less complex learners, and struggle using initiative, abstract thinking, critical thinking, making mistakes, and meeting challenging goals. In comfortable, uncomplicated learning communities, conforming learners will, with scaffolded support and feedback, social collaboration, and explicit guidance, successfully work to achieve progressively difficult goals. This group of learners can improve, over time with targeted support, social intervention, and by learning how to take increasingly greater risks in learning.

Resistant Learners may deal with either short-term (temporary) or long-term (permanent) resistance. They may doubt that: (1) they can learn or enjoy achieving any goals set by others (2) compulsory academic learning and achievement can help them achieve personal goals or initiate desired changes, and (3) their personal values, interests, and goals can benefit from academic objectives. Too often Resistant Learners will suffer repeated, long-term frustration from conflicting values, expectations, and goals, misunderstandings, perceived academic or social inadequacy, disappointment, or instruction that confuses or lacks value.

Learning Orientation Profiles

ORIENTATION	CONATIVE/AFFECTIVE ASPECTS	COMMITTED LEARNING AND STRATEGIC EFFORT	LEARNING AUTONOMY
TRANSFORMING LEARNER (Transformance)	Focus strong passions and intentions on learning. Be an assertive, expert, highly self-motivated learner. Use learning to transform to high, personal standards.	Set and accomplish personal short- and long-term challenging goals that may not align with goals set by others; maximize effort to reach personal goals. Commit great effort to discover, elaborate, and build new knowledge and meaning. Succeed in loosely structured, mentoring environments that promote challenging goals, discovery, and self-managed learning.	Assume learning responsibility and self-manage goals, learning, progress, and outcomes. Experience frustration if restricted or given little learning autonomy.
PERFORMING LEARNER (Performance)	Focus emotions/ intentions on learning selectively or situationally. Be a self-motivated learner when the content appeals. Use learning to perform to above-average group standards.	Set and achieve short-term, task-oriented goals that align and meet average-to-high standards assigned by others; situationally minimize efforts and standards to reach assigned or negotiated standards. Selectively commit measured effort to assimilate and use relevant knowledge and meaning. Succeed in semi-complex, semi-structured, coaching environments that stimulate personal value, and provide interaction, and external benefits.	Will situationally assume learning responsibility in areas of interest but willingly give up control in areas of less interest. Prefer continual coaching and interaction for achieving goals.

ORIENTATION	CONATIVE/AFFECTIVE ASPECTS	COMMITTED LEARNING AND STRATEGIC EFFORT	LEARNING AUTONOMY
CONFORMING LEARNER (Conformance)	Focus intentions and emotions cautiously and routinely as directed. Be a modestly effective, extrinsically motivated learner. Use learning to conform to easily achieved group standards.	Follow and try to accomplish simple task-oriented goals assigned by others. Try to please and conform; maximize efforts in supportive environments with safe standards. Commit careful, measured effort to accept and reproduce knowledge to meet external requirements. Succeed in safe, structured environments that help learners achieve easy learning goals, in a step-by-step fashion and provide external benefits.	Assume little responsibility, manage learning as little as possible, be compliant, want continual guidance, and expect reinforcement for achieving short-term goals.
RESISTANT LEARNER (Resistance) ➤	Focus on not cooperating. Be an actively or passively resistant learner. Avoid using learning to achieve academic goals assigned by others.	Consider lower standards, fewer academic goals, conflicting personal goals, or no goals; maximize or minimize efforts to resist assigned or expected goals either assertively or passively. Chronically avoid learning (apathetic, unskilled, frustrated, discouraged, or aggressively disobedient). Avoid formal learning environments with assigned or expected goals that conflict with expectations, personal goals and values.	Assume responsibility for not meeting goals set by others, and set personal goals that avoid meeting formal learning requirements or expectations.
▲ *Situational Resistance* ➤	Learners may situationally improve, perform, or resist in reaction to positive or negative learning conditions or situations		

6. Scoring and Interpretation of the Results

The LOQ uses a seven-point Likert scale ranging from 1 (*Uncharacteristic of Me*) to 7 (*Very Characteristic of Me*). Subjects enter a score that shows their agreement with each item--the higher the agreement with the item, the greater the possession of the hypothesized subscale. Approximately one third of the items are reflectively worded and scored in reverse. The LOQ measures where the learner may fall (1) across the individual construct factors and (2) along the learning orientation continuum. After taking the LOQ, subjects receive four scores, one score for each of the three construct factors and one learning orientation score. The electronic version on the Web will automatically calculate and show scores on the Internet. The LOQ paper version is manually scored and delivered via email. To help interpret the LOQ scores, read the *Descriptions for the Three Learning Orientation Construct Factors* in Section 3. These descriptions provide explanations for each of the individual factors that contribute to the individual's overall learning orientation score. Interpretations for the learning orientation score appear in the *Learning Orientations Model* in Section 4 and *The Four Learning Orientations* in Section 5.

7. Brain Plasticity

The development of the LOQ is an ongoing process and validation evidence collection is an ongoing process. This is because the LOQ constructs are theoretical abstractions embedded in theoretical frameworks that are greatly influenced by continuing developments in the neurosciences. Of particular importance is the area of brain plasticity, which refers to how the

brain changes to learn, organize, and act in response to influences and experiences. It is the brain's ability to "be shaped and modified by growth of new and more complex connections among cells. Some neurons develop up to 50,000 connections, a mind-boggling number when one considers there are billions of neurons in the brain" (Eslinger, 2000). As an adult, when we change our behavior due to new sensory input influencing learning and memory, new synaptic connections develop and adjust to the stimulus in the brain cells. According to a long-standing theory, learning takes place and memories form when the same message travels repeatedly between specific cells in the brain. Communication between these cells grows stronger with repetition and multiple processing. The more we practice a skill, the more the automatic the skill becomes. Eventually the cells no longer need to be stimulated by an outside source such as a teacher or input from the senses. (Cromie, 2002).

"We are now at the dawn of an era when we can use these technologies to see pathways in the brain that underlie emotions" (National Institute of Mental Health, 2001). Scientists have learned to use neuroimaging technology to see the living, thinking, feeling human brain live at work. Neuroimaging tools include functional magnetic resonance imaging (fMRI), which uses magnetic fields and radio waves to elicit signals from the brain, and positron emission tomography (PET), which uses low doses of a radioactive tracer to obtain signals from the brain" (National Institute of Mental Health, 2001). "As the sciences of developmental psychology, cognitive psychology, and neuroscience, to name but three, have contributed vast numbers of research studies, details about learning and development have converged to form a more complete picture of how intellectual development occurs" (Bransford, Brown and Cocking, 1999).

The evolution of the brain's limbic system (the brain's emotional center) suggests that what gets our attention (and stimulates negative or positive emotional response) influences how we create memories and how the brain engages in strengthening synaptic connections in the cerebral cortex (Brown University, 2000). The "most popular candidate site for memory storage is the synapse, where nerve cells communicate with each other. A change in the transmission efficacy at the synapse (called "synaptic plasticity") has been considered to be the cause of memory and a particular pattern of synaptic usage or stimulation (conditioning or priming stimulation) is believed to induce synaptic plasticity--stimulating new neuronal connections and communication. Many questions remain to be answered, such as how synaptic plasticity is induced and how synaptic plasticity is involved in creating in learning and memory—hence, the search for Lashley's engram (1950). Lashley suggested that learning was a distributed process and alteration that could not be isolated within any specific part of the brain.

At Duke University, researchers are seeking to identify parts of the brain that are associated with multiple processing of input and emotional responses. Researchers at Rutgers have identified cypin, a protein in the brain that regulates and increases dendrite growth when a person learns. Cypin acts as a mortar to the dendrite structure. "An increase in the number of branches provides additional sites where a neuron can receive information that it can pass along, enhancing communication" (Rutgers, 2004). Researchers at the University of Wisconsin-Madison's Child Emotion Research Laboratory explored how individuals differentially perceived and categorized emotions. These researchers are suggesting that the neural brain processes used to perceive and categorize emotions are both innate and influenced by different environments and

experiences. At University of Illinois (Beckman Institute for Advanced Science and Technology), researchers are using electron microscopes to count synaptic connections between brain cells (neurons) in healthy people. Results are showing that individuals in more sophisticated professions have more synaptic connections developed through education and professional commitment.

8. Research-Based Learning and Assessment Models

Understanding the mechanisms and processes of brain plasticity is essential to understanding learning and improving educational learning and assessment models. Today's research contributes greatly to supporting how individuals like to learn, especially how individuals like to learn and perform differently. One powerful, consistent finding to emerge from recent advances in neuroscience is the realization that how individuals want and intend to learn differently is a powerful force in how well they manage information, plan, set, and meet goals, learn and perform tasks, and succeed as learners—some more successfully than others. What is becoming clear is that recognizing and supporting emotional differences in learning to motivate and prepare lifelong learners for a fast-moving economy has escalated to a national priority, especially as information resources increase geometrically.

Rapid scientific and technology changes demand that enough learners are prepared in our educational system to learn smart, fast, and well enough to manage today's fast-paced changes and leadership challenges--successfully and productively. What are the characteristics and solutions involved for more successful learning, despite the differences in learning ability? Developing a "best practice" research-based framework (for design, teaching and learning strategies) that supports differences in learning and improved performance is critical.

"Studies from around the world show that early stimulation is important to brain development. An enriched environment can boost the number of neural connections that children form. Even animal studies have shown a significant relationship. For example, William Greenough of the University of Illinois exposed one group of rats to a stimulating environment. A second group was housed in standard drab cages. The animals housed in the enriched environments had 25% more connections among their brain cells" (Rauscher, 1997). If one considers research in other fields, such as marketing or advertisement, tapping into emotions to personalize experiences is a common practice. For example, advertisers or marketers may use a personalization strategy to ensure that customers can tell them who they are, what they value, what they want and how they want it, thus achieving "emotional lock-in" and brand recognition and loyalty. Emotional lock-in is also a foundational concept for learning. Successful instructors identify those key attributes that nurture or drive a similar "emotional lock in" for their audiences and integrate them, along with other key learning attributes, into a more personalized learning model. New learning and assessment models should enable instructors and designers to leverage the power of personalization analytics (e.g., audience analysis, measurement, tracking, data collection, and reporting), while still maintaining control and flexibility via the objectives, strategies, context, sequencing, and delivery elements that have long been conventionally integrated into learning solutions.

What is included in the instructional frameworks that can provide learner-centered [and biology-centered] psychological principles and contribute to educational reform and school redesign efforts (Board of Educational Affairs, American Psychological Association, 1997)? What are the challenging measures and goals that can help researchers isolate key learning variables and audience attributes that can influence more "emotionally" successful learning?

New learning and assessment and assessment models should help learners understand and know how to (1) feel comfortable and enjoy learning, (2) explore reasons for learning and committing effort and attention to continuous, persistent learning, (3) determine and manage what they already know, determine what they do not know, and acquire what they need or want to know to create new ideas, (4) set and extend challenging goals by building towards accomplishment and improvement, (5) self-motivate, plan, commit resources and mix and match strategies and skills to accomplish short- and long-goals, sometimes beyond those expected by others, (6) improve sophisticated learning ability skills (e.g., problem-solving, holistic thinking, critical thinking, and task-sequencing) with practice, (7) gain confidence, satisfaction, and expertise over time, and (8) self-assess, monitor progress, schedule, and reflect to enhance learning and empowerment.

9. Brain Structure Influences the Learning Cycle

Multiple areas of neuroscience research are providing specific information to develop individual differences in learning constructs that consider more than the primarily cognitive aptitude perspective. The hegemony of the cognitive perspective is receding due to advances in neuroscience research. "Considering the curiosity that the brain has inspired in scientists for a very long time, it is perhaps surprising that a model of learning based on neural function has taken so long to influence pedagogy." (Leamnson, 2002, p. 75). Recent advances in the neurosciences warrant a new look at interpreting how the brain learns.

As Zull (2001) suggests, "without biology, the learning cycle is theoretical." Needed are measurable psychological constructs based on proven or evolving biology-centered models that help researchers (a) isolate brain activity (input, processes, and responses) as primary sources for learning differences, (b) measure related underlying psychological factors and interactions, and (c) explain the impact of specific factors (e.g., conative, affective, cognitive, and social factors) on more successful learning and performance. In working towards a more comprehensive human learning theory, educators need to identify strategies that can help learners take the difficult steps in the learning cycle that lead to creating new ideas and taking risks. "Acquisition of complex knowledge and skills requires extended learner effort and guided practice. "Without learners' motivation to learn, the willingness to exert this effort is unlikely without coercion" (Board of Educational Affairs, American Psychological Association, 1997).

Scientists often discuss the four areas of the brain's cerebral cortex shown in Figure 1 when they discuss learning and memory.

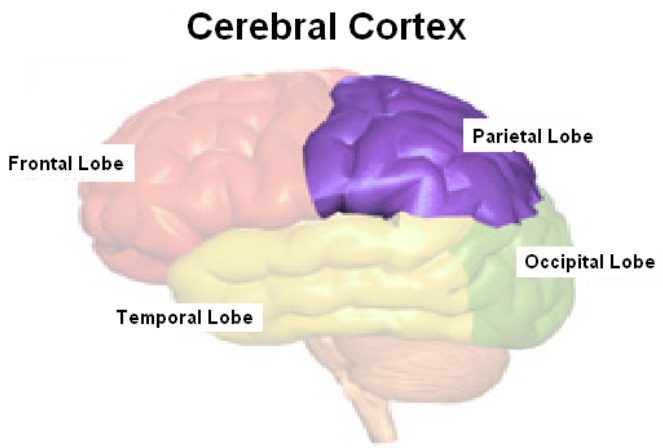

Figure 1. Brain Structure of the Cerebral Cortex

- The parietal lobe is typically described as responsible for the brain's ability to sense stimuli (e.g., through taste, vision, feeling, or hearing).

- The occipital lobe is typically described as responsible for the brain's ability to recognize stimulus and connect to what we already know (e.g., in long-term memory) to establish meaning.

- The temporal lobe is typically described as responsible for the brain's ability to interpret, process, and plan to create new meaning.

- The frontal lobe is typically described as responsible for the brain's ability to reason, create new meaning, problem solve and commit to action.

Educators for years have often used a learning cycle model as a tool for planning instruction. Kolb (1984) described four steps, including concrete experience, observation and reflection, the formation of abstract concepts, and testing in new situations. Kolb (1984) used these four steps to describe a framework for a continuous or repetitious learning process that supports practice and feedback towards more experiential learning. Similarly, McCarthy (2000) provided a 4-step teaching model for curriculum development using experiencing, reflecting, abstracting, and acting. Zull (2002) suggests that educators can begin using recent advances in the neurosciences to find evidence that empirically recognizes a natural learning cycle.

Zull (2002) overlays Kolb's 4-step learning cycle (similar to those shown in Figure 2) to roughly estimate and match what we know about the 4-part brain structure to demonstrate how the entire brain engages in learning and memory.

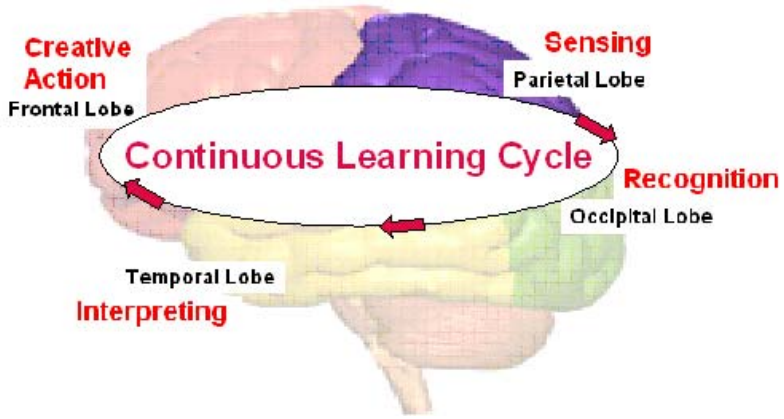

Figure 2. Connecting the Brain to Kolb's 4-Step Learning Cycle

Zull (2002) describes the learning process by discussing the brain connections that change data into knowledge. They represent the brain's ability to (1) receive signals via the senses, (2) recognize, connect, and reflect, (3) abstract the information, and (4) generate a plan for action as the occasion requires. Thousands of signals are received simultaneously each competing for the individual's attention and response. Also in Figure 2, the learning appears in two sections: (1) Sensing and recognition in the "back cortex" area to illustrate the reception and transformation of signals into meaning connecting to long-term memory and (2) interpretation and creation in the "front cortex" area to illustrate the planning, abstracting, and creation of new ideas and action. Zull suggests that it is emotions that drive the learning cycle and cements memories to change brain structure (brain plasticity).

Zull (2002) suggests that we can imagine a *Transformation Line* (shown in Figure 3) between the "back" and "front" cortex areas that once bridged creates a change in the learner from a receiver to a producer or from a passive to a more active learner. It is the ability of the learner to move past this imagined transformation line that influences the individual's more successful learning ability.

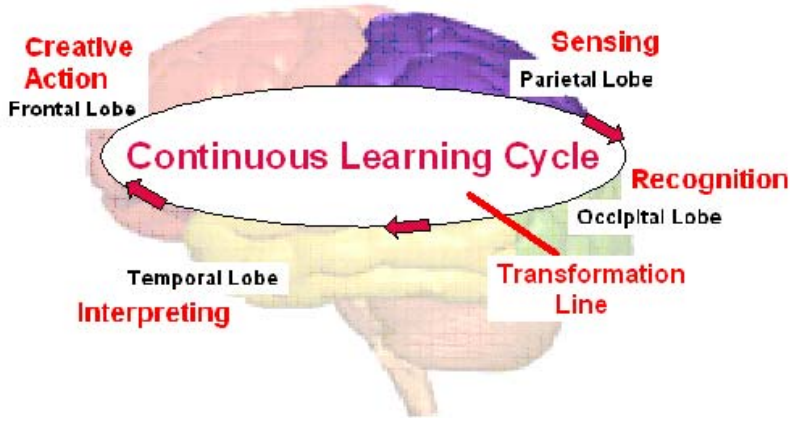

Figure 3. Transformation Line

Research also proposes that any progress in learning and thinking engages the "emotional center" and acts as the mortar to the brain's structure (Damasio, 1999; Ledoux, 1996, 2002; Zull, 2002) and a source for driving the learning cycle. As educators, we can use this newer understanding of brain structure and natural learning cycles to help learners bridge or manage the transformation line that presents challenges to many learners. With more efficient measures and targeted interventions recognizing individual differences in learning, we can begin to implement targeted strategies for more productive, active, or successful learning.

To address the challenges discussed, this paper considers how to apply the multidisciplinary body of research to implement practical solutions that help learners tap into emotions and intentions to develop, manage, and apply more effective learning cycles (i.e., improve creativity, higher-order cognitive processing ability, executive control, and motivation). Tomorrow's research-based learning and assessment models and tools will need to consider the deep psychological sources (identified by the neurosciences) that influence successful learning or impede academic success.

10. Learning Strategies

Everyone thinks of changing the world, but no one thinks of changing himself," wrote Leo Tolstoy. Have you ever thought about how learning changes your brain? Recent developments in the neurosciences and education research are beginning to have a significant impact on our understanding about empowering individuals to learn more successfully. Here are strategies that offer common sense ways to help students improve their learning ability. Zull (2002) is used a source for many of the following recommendations.

1. Always engage emotions. The best learning comes from concrete experiences stimulated by great emotions.
2. Tap into all the human senses; use those that are very relevant to the learning experience.
3. Try to detect what is understood and use concrete experiences to build on what exists.
4. The best images in our brain arise from direct emotional experience, make connections with these images and reinforce them continuously to improve learning.
5. Ensure practice and feedback opportunities; the best learning comes from experience. Repeat! Repeat! Repeat!
6. Humans are good at copying. Use techniques to help students copy and practice expertise.
7. If you are teaching something important, don't assume they know it and can immediately make connections to create new meaning.
8. Don't focus on mistakes; misunderstandings are incomplete, minimize negative emotions and try to build on what is known and correct.
9. Use metaphors, parables, similes, analogies, and stories to enhance connections with meaning; help your students build their own to create new ideas, images, and patterns.
10. Use reflection to search for connections, consider meaning, and build new knowledge. When you are supporting reflective experiences for students, minimize sensory experience.

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12. Additional Learning Orientation Research Sites

Transforming Learning Orientation: http://www.trainingplace.com/loq/pop_trans1.htm
Performing Learning Orientation: http://www.trainingplace.com/loq/pop_perf1.htm
Conforming Learning Orientation: http://www.trainingplace.com/loq/pop_conf1.htm
Resistant Learning Orientation: http://www.trainingplace.com/loq/pop_resist1.htm
Learning Orientation Research Site: http://www.trainingplace.com/source/research/index.html
Intentional Learning Newsletter: http://training.trainingplace.com/newsletter/index.htm
Learning Orientation Publications: http://www.trainingplace.com/source/research/papers.htm
Learning Orientation Questionnaire: http://www.trainingplace.com/loq/loqinfo.htm
Brain Studies: http://www.trainingplace.com/newsletter/brainsarticles.htm

Other LOQ Studies:

Factors for Success: Characteristics of Graduates in an Online Program
Effectiveness of Web-based Learning Opportunities in a Competency-based Program
The Development of Computerized Mathematical Learning Dispositions Scale for Elementary School Children

More studies appear at: http://www.trainingplace.com/source/research/relatedstudies.htm
http://www.trainingplace.com/source/research/LOQPKG-Manual2005.pdf
http://www.trainingplace.com/source/research/LOQCaseStudies2005.pdf

Appendix

Few diagnostic inventories measuring individual differences consider the whole-person perspective, including affective, conative, cognitive, and social factors. In response to the theoretical importance of the impact of emotions that guides neural activity and the increase in brain plasticity research, the purpose of this series of studies is to collect reliability and validation evidence to demonstrate that the Learning Orientation Questionnaire LOQ behaves in a manner that is consistent with its theoretical framework and makes it useful for practical, valid interpretations. The Training Place has participated in and sponsored several studies concerned with
the construct validity of the Learning Orientation Questionnaire designed to measure learning orientation.

Summary of 10 Case Studies

	N	Tran Mean	Perf Mean	Conf Mean	Res Mean	Alpha	Re Test	Factors	Var	Aff/Con	Effort	Autonomy
Case1	1277	5.83	4.96	4.16	3.13	0.80		3	51%	768(**)	.822(**)	.802(**)
Case2	6178	5.90	5.08	4.21	3.15	0.86		3	49%	.807(**)	.866(**)	.697(**)
Case3	43	5.87	5.00	4.19	3.26	0.86	0.85					
Case4	1167	5.83	4.97	4.17	3.12	0.80		3	47%	.803(**)	.822(**)	.693(**)
Case5	205	5.79	4.97	4.29	3.48	0.80				.715(**)	.838(**)	.779(**)
Case6	2035	5.84	5.09	4.24	3.48	0.88				.826(**)	.811(**)	.829(**)
Case7	1959	6.03	5.12	4.25	2.96	0.88						
Case8	869	5.85	5.09	4.23	3.48	0.83				.751(**)	.852(**)	.714(**)
Case9	162	5.80	5.03	4.23	2.56	0.80				.751(**)	.751(**)	.714(**)
Case10	13		5.09	4.60			0.83					
Total	13,908											

Case Study 1 – Investigating the Psychometric Properties of the LOQ (n=1277)

Purpose - To investigate the psychometric properties of the Learning Orientation Questionnaire (LOQ) that measures learning orientation.

Research Questions
Q1 What are the internal consistency estimates for the LOQ score and three LOQ constructs?
Q2 Which factors are related to individual differences in learning and which items load on which factor?
Q3 What is the relationship between the overall LOQ score and the three LOQ construct scales?
Q4 What is the sample proportion by learning orientation for a population comprised of high school and university students?

Participants - A total of 1277 high school and undergraduate students enrolled in universities located across the United States participated in this study by taking the hard-copy version of the LOQ. The majority of the participants were White and came from middle-class backgrounds.

Procedure - Professors at various universities administered the hard-copy version of LOQ to their students.

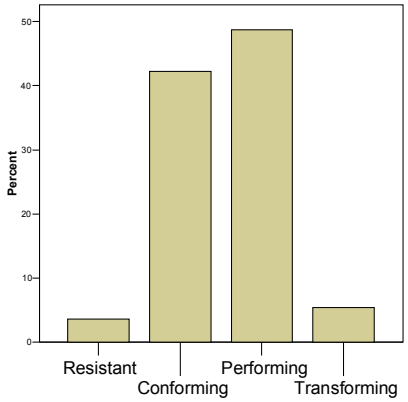
Statistical Analysis and Results
Investigators used the SPSS statistical package for a series of statistical analyses to accomplish the research goals.

Descriptive statistics were computed, including the minimum, maximum, mean score, standard deviation, and variance for the construct factor and LOQ scores (shown next).

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Con/Aff	1277	5.22	1.78	7.00	4.7773	.02001	.71503	.511
Comm	1277	5.29	1.71	7.00	4.6264	.02175	.77733	.604
Indep	1277	5.33	1.56	6.89	4.3822	.02177	.77802	.605
LOQ	1277	5.00	1.84	6.84	4.5928	.01682	.60111	.361
Valid N (listwise)	1277							

The sample was examined regarding the proportions of learning orientations. The sample was typical of a university student populace with LOQ score distributions dispersed as a bell curve, (e.g., large population of performing and few resistant learning orientations). However, the addition of the high school students to the sample increased the proportion of the conforming learning orientation. The sample included Transforming (n=68, 5%, mean=5.83), Performing (n=540, 42%, mean=4.96), Conforming (n=623, 49%, mean=4.16), and Resistant (n=46, 4%, mean=3.13).



Cronbach's alpha reliability analysis was computed for the items, the LOQ score, and the construct scales.
For the 25 items, Cronbach's Alpha and Cronbach's alpha based on standardized items was used to measure the internal consistency of the scales used in this study. The high Alpha values (α=.80) produced by the Cronbach's Alpha and the almost identical high Alpha values (α=.82) produced by the Cronbach's Alpha based on standardized items indicate a high degree of internal consistency of the items in the survey. Similar results for the LOQ score and construct scales show α=.86 and α=.87, respectively. An estimated lambda reliability of .86 produced by Guttman's scale is equally high. These results demonstrate good internal consistency reliability and reflect the homogeneity of items intended to measure the same quantity, that is, the extent to which responses to the items are correlated.

Principal factor analysis of all the items was computed to determine the latent structure or dimensions of a set of variables. The factor analysis used a Promax rotation to show how many factors (construct scales) account for unique variance in the data (number of factors to extract) and how the original variables load or correlate with the extracted factor constructs. Based on Kaiser's criterion (eigenvalues larger than unity) four factors were postulated. Three factors accounted for 51% of the variance. The eigenvalues from the factor analyses yielded more factors than hypothesized. This is probably due to the presence of differentially skewed items. However the difference between the eigenvalues of the first three factors and the rest suggested that there are actually only three significant uncorrelated factors (shown in the table next) that accounted for 47% of the total sample variance. The same factors were similar to those proposed in previous studies. Fourteen items loaded highly on the first factor (Affective/Conative Aspects) at .50 or higher. Six items loaded highly on the second factor (Learning Autonomy) at .55 or higher, and four items loaded highly on the third factor (Committed Strategic Planning and Learning Effort) at .62 or higher. The results (below) show that 92% of the items (Q1-Q25) loading on each factor have high coefficients (i.e., over .50), are highly interrelated, and appear independent of the other factors (univocal).

Structure Matrix

	Component		
	1	2	3
Q1	.662	.144	-.278
Q2	.665	.143	-.229
Q3	.150	.696	-.038
Q4	.576	.105	-.187
Q5	.170	.546	-.446
Q6	.696	.166	-.218
Q7	-.154	.053	.816
Q8	.061	.623	.156
Q9	.226	-.078	.107
Q10	.659	.192	-.237
Q11	.572	-.031	-.048
Q12	.578	.082	-.073
Q13	.762	.105	-.125
Q14	-.138	.135	.762
Q15	.693	.152	-.082
Q16	.720	.053	-.109
Q17	.700	.112	-.151
Q18	-.174	.193	.622
Q19	.687	.088	-.160
Q20	.069	.758	.139
Q21	.671	.185	-.170
Q22	.186	.794	.057
Q23	.096	.750	.159
Q24	.440	.180	-.120
Q25	-.189	.023	.843

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

A component correlation matrix (shown next) lends further support to the conclusion of scale independence with all the off-diagonal elements being low. Results are demonstrating construct validity as each scale represents different aspects of the theoretical construct or trait that it purports to measure.

Component Correlation Matrix

Component	1	2	3
1	1.000	.170	-.228
2	.170	1.000	.026
3	-.228	.026	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

K-Means Cluster analysis was used to identify the groups which inherently existed in the data to support the three-factor theory. Results showed that the sample reflected the same clusters hypothesized in the learning orientation construct model.

Number of Cases in each Cluster	Number of Items Loading on Each Construct

Cluster	1	423	33%	6	25%
	2	654	51%	14	58%
	3	200	16%	4	17%
Valid		1277		24	
Missing		0			

Bivariate correlation coefficients were explored to measure the relationship between the overall LOQ score and the three LOQ construct scales. All relationships appear significant ($p < .01$) with some stronger than others. The scores provide evidence that our theory that all three scales are related to the LO construct is supported. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. The magnitude of these correlations offer further construct validity evidence.

Correlations

		LOQ	Con/Aff	Comm	Indep
LOQ	Pearson Correlation	1	.768(**)	.822(**)	.802(**)
	Sig. (2-tailed)	.	.000	.000	.000
	N	1277	1277	1277	1277
Con/Aff	Pearson Correlation	.768(**)	1	.502(**)	.340(**)
	Sig. (2-tailed)	.000	.	.000	.000
	N	1277	1277	1277	1277
Effort	Pearson Correlation	.822(**)	.502(**)	1	.525(**)
	Sig. (2-tailed)	.000	.000	.	.000
	N	1277	1277	1277	1277
Autonomy	Pearson Correlation	.802(**)	.340(**)	.525(**)	1
	Sig. (2-tailed)	.000	.000	.000	.
	N	1277	1277	1277	1277

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

The LOQ items were analyzed using the Rasch model to examine such properties such as item difficulty and other model-fitting statistics. This will enable the establishment of large calibrated item banks for developing multiple versions of the LOQ. Such item banks can be useful for equating item difficulty.

```
TABLE 13.1 LOQData 2005 Rasch Analysis            ttp2005.out Apr 27 17:36 2005
INPUT: 1277 PERSONS, 25 LOQ Item IDs  MEASURED: 1277 PERSONS, 25 LOQ Item IDs, 7 CATS
-------------------------------------------------------------------------------
PERSON: REAL SEP.: 1.84  REL.: .77 ... LOQ Item ID: REAL SEP.: 23.39  REL.: 1.00
        LOQ Item ID STATISTICS:  MEASURE ORDER
+-------------------------------------------------------------------------------+
|ENTRY    RAW                   MODEL|   INFIT  |  OUTFIT  |PTMEA|            |
|NUMBER  SCORE  COUNT  MEASURE  S.E. |MNSQ  ZSTD|MNSQ  ZSTD|CORR.| LOQ Item ID|
|------------------------------------+----------+----------+-----+------------|
|     7   3344   1277    1.04     .02|2.12   9.9|2.25   9.9|  .22| 7= LOQ7    |
|    25   3565   1277     .94     .02|1.83   9.9|1.88   9.9|  .20| 25=LOQ25   |
|    14   3885   1276     .80     .02|1.49   9.9|1.55   9.9|  .25| 14=LOQ14   |
|    18   4420   1276     .60     .02|1.23   6.4|1.26   7.1|  .20| 18=LOQ18   |
|     8   4945   1277     .40     .02| .89  -3.5| .90  -3.1|  .39| 8= LOQ8    |
|    20   4980   1276     .39     .02| .86  -4.4| .87  -3.9|  .44| 20=LOQ20   |
|    23   5046   1277     .37     .02| .80  -6.4| .81  -5.8|  .46| 23=LOQ23   |
|     9   5203   1277     .31     .02|1.18   5.1|1.22   5.9|  .26| 9= LOQ9    |
|     3   5302   1277     .27     .02| .82  -5.7| .85  -4.5|  .42| 3= LOQ3    |
|    22   5366   1277     .25     .02| .75  -7.8| .76  -7.5|  .51| 22=LOQ22   |
|    12   5549   1277     .18     .02| .93  -2.0| .97   -.9|  .48| 12=LOQ12   |
|    17   5705   1277     .12     .02| .72  -8.9| .73  -8.1|  .55| 17=LOQ17   |
|     4   5852   1277     .06     .02| .83  -5.1| .86  -4.1|  .46| 4= LOQ4    |
```

5	5942	1276	.02	.02	1.28	7.2	1.42	9.9	.26	5= LOQ5
21	6293	1277	-.13	.02	.76	-7.0	.78	-6.3	.54	21=LOQ21
1	6310	1277	-.13	.02	.70	-8.7	.73	-7.6	.50	1= LOQ1
24	6824	1276	-.38	.02	1.08	1.9	1.06	1.4	.41	24=LOQ24
16	6944	1277	-.44	.02	.77	-6.0	.77	-6.0	.54	16=LOQ16
11	6988	1277	-.47	.02	1.06	1.3	1.05	1.2	.44	11=LOQ11
13	7034	1276	-.50	.02	.77	-5.9	.76	-6.2	.58	13=LOQ13
19	7122	1277	-.54	.02	.77	-5.9	.79	-5.1	.50	19=LOQ19
10	7154	1277	-.56	.02	.85	-3.7	.84	-3.7	.50	10=LOQ10
15	7398	1276	-.72	.03	.89	-2.6	.85	-3.4	.54	15=LOQ15
2	7638	1277	-.89	.03	.80	-4.5	.75	-5.7	.49	2= LOQ2
6	7725	1275	-.97	.03	1.02	.5	.93	-1.4	.51	6= LOQ6
MEAN	5861.	1277.	.00	.02	1.01	-1.4	1.03	-1.1		
S.D.	1239.	0.	.54	.00	.35	6.0	.38	6.1		

Discussion
This study adds to the growing literature about individual differences in learning and contributes to a deeper understanding of patterns and divergence in adult learners. Clearly, distinct groups do exist with learners who have particular preferences and patterns in managing their learning efforts and accomplishing goals. The results were consistent with the theories that underlies the hypothesized construct and do not compromise the validity of the instrument for its intended purpose.

Case Study 2 – Investigating the Psychometric Properties of the LOQ (n=6178)

Purpose - To investigate the psychometric properties of the Learning Orientation Questionnaire (LOQ) that measures learning orientation.

Research Questions
Q1 What are the internal consistency estimates for the LOQ score and three LOQ constructs?
Q2 What is the relationship between the overall LOQ score and the three LOQ construct scales?
Q3 What is the sample proportion by learning orientation for a population comprised of high school and university students?
Q4 Is there a significant relationship between learning orientation and gender, education and the perception of expertise, and holistic thinking and problem solving ability.

Participants - A total of 6178 computer users comprised of high school and university students and adults in the U.S. came to a vendor web site and voluntarily participated in this study by taking the online version of the LOQ. The participants were all nationalities and spoke multiple languages. The sample included 2172 females and 4006 males.

Statistical Analysis and Results
Investigators used the SPSS statistical package for a series of statistical analyses to accomplish the research goals.

Descriptive statistics were computed, including the range, minimum, maximum, mean score, standard statistic, and variance for LOQ scores and construct factor scores (shown next). The next tables show descriptive statistics by the total sample and by gender.

Descriptive Statistics - Total Sample

	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Holistc_thinking	6178	1	7	5.38	.013	.994	.988
problem_solving	6178	1	7	5.59	.012	.938	.881
LOQ	6178	1.76	7.00	5.1642	.00822	.64593	.417
Con/Aff	6178	1.56	7.00	5.9488	.01012	.79532	.633
Effort	6178	1.13	7.00	4.8850	.01075	.84518	.714
Autonomy	6178	1.75	7.00	4.5607	.01030	.80951	.655
gender	6178	1	2	1.65	.006	.477	.228
Valid N (listwise)	6178						

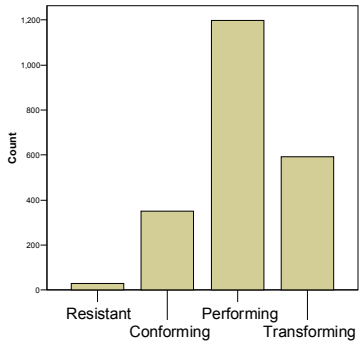
Descriptive Statistics - Male

	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Holistc_thinking	4006	1	7	5.33	.016	.997	.995
problem_solving	4006	1	7	5.47	.015	.950	.902
LOQ	4006	1.76	7.00	5.1819	.01009	.63881	.408
Con/Aff	4006	1.78	7.00	5.9932	.01232	.77984	.608
Effort	4006	1.13	7.00	4.9019	.01335	.84499	.714
Autonomy	4006	1.88	7.00	4.5493	.01257	.79530	.633
gender	4006	2	2	2.00	.000	.000	.000
Valid N (listwise)	4006						

Descriptive Statistics - Female

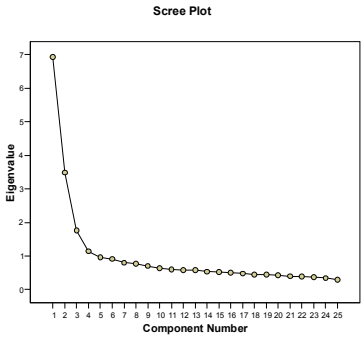
	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Holistc_thinking	2172	1	7	5.48	.021	.981	.962
problem_solving	2172	1	7	5.81	.019	.877	.769
LOQ	2172	2.36	7.00	5.1315	.01411	.65777	.433
Con/Aff	2172	1.56	7.00	5.8669	.01753	.81699	.667
Effort	2172	1.75	7.00	4.8538	.01813	.84485	.714
Autonomy	2172	1.75	7.00	4.5818	.01791	.83485	.697
gender	2172	1	1	1.00	.000	.000	.000
Valid N (listwise)	2172						

The sample was examined regarding the proportions of learning orientations. The sample was typical of a university student populace with LOQ score distributions dispersed as a bell curve, (e.g., large population of performing and few resistant learning orientations). However, the addition of the high school students to the sample increased the proportion of the conforming learning orientation. The sample included Transforming (n=1758, 29%, mean=5.90), Performing (n=3448, 56%, mean=5.08), Conforming (n=894, 15%, mean=4.21), and Resistant (n=78, 1%, mean=3.15).



Cronbach's alpha reliability analysis was computed for the items, the LOQ score, and the construct scales.
For the 25 items, Cronbach's Alpha and Cronbach's alpha based on standardized items was used to measure the internal consistency of the scales used in this study. The high Alpha values (α=.86) produced by the Cronbach's Alpha and the almost identical high Alpha values (α=.87) produced by the Cronbach's Alpha based on standardized items indicate a high degree of internal consistency of the items in the survey. Similar results for the LOQ score and construct scales show α=.85 and α=.86, respectively. An estimated lambda reliability of .86 produced by Guttman's scale is equally high. These results demonstrate good internal consistency reliability and reflect the homogeneity of items intended to measure the same quantity, that is, the extent to which responses to the items are correlated.

Principal factor analysis of all the items was computed using Promax rotation to show how many factors (construct scales) account for unique variance in the data (number of factors to extract) and how the original variables load or correlate with the extracted factor constructs. The factor analysis of the LOQ revealed three uncorrelated factors that accounted for 49% of the total sample variance. The same factors were similar to those proposed in previous studies. Fourteen items loaded highly on the first factor (Affective/Conative Aspects) at .52 or higher. Six items loaded highly on the second factor (Learning Autonomy) at .60 or higher, and thirteen items loaded highly on the third factor (Committed Strategic Planning and Learning Effort) at .62 or higher. The large international sample might contribute to showing less independent factors (less univocal).



To further substantiate the three factor hypothesis, the scree plot, which graphically groups factors to separate the retainable constructs from those that are not useful, becomes quite flat after the third factor. The large eigenvalues (1- 6.9, 2 - 3.5, and 3 - 1.77) also facilitates identification of the three common factors that are most meaningful and eligible for retention.

The results are useful because they satisfy three key determinants for retaining factors, that is. the position of the factors in the scree plot, the proportion of variance accounted for by each factor, and overall interpretability of the three retained factors.

A component correlation matrix (shown next) lends further support to the conclusion of scale independence with all the off-diagonal elements being low. Results are demonstrating construct validity as each scale represents different aspects of the theoretical construct or trait that it purports to measure.

Component Correlation Matrix

Component	1	2	3
1	1.000	.544	.034
2	.544	1.000	-.031
3	.034	-.031	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Bivariate correlation coefficients were explored to measure the relationship between the overall LOQ score and the three LOQ construct scales. All relationships appear significant ($p < .01$) with some stronger than others. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. The magnitude of these correlations offer further construct validity evidence.

Correlations

		LOQ	Con/Aff	Effort	Autonomy
LOQ	Pearson Correlation	1	.807(**)	.866(**)	.697(**)
	Sig. (2-tailed)	.	.000	.000	.000
	N	6178	6178	6178	6178
Con/Aff	Pearson Correlation	.807(**)	1	.619(**)	.260(**)
	Sig. (2-tailed)	.000	.	.000	.000
	N	6178	6178	6178	6178
Effort	Pearson Correlation	.866(**)	.619(**)	1	.433(**)
	Sig. (2-tailed)	.000	.000	.	.000
	N	6178	6178	6178	6178
Autonomy	Pearson Correlation	.697(**)	.260(**)	.433(**)	1
	Sig. (2-tailed)	.000	.000	.000	.
	N	6178	6178	6178	6178

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

Bivariate correlation coefficients were also explored to measure the relationship between the overall LOQ score and the other study variables. As shown next, several relationships appear significant ($p < .01$) with some stronger than others. Holistic Thinking at .344**, Problem-Solving at .325**, Avid Book Reading at .174**, Self-Improvement at .133**, Science/New Technology at .135**, Professional at .097**, Executive at .085**, Keirsey Temperament at -.136**, Classical Music at .164**, and Age at -.105**.

Bivariate correlation coefficients were also explored to measure the relationship between the overall LOQ score, construct score, and the gender variable. Research suggests that gender learning differences occur in the area of intrinsic motivation, while there appears to be no significant differences in extrinsic motivation between male and females (Fraser, Lytle, & Stolle, 1978; Tyson, 1989; Sizoo etal., 2003). Tyson found that females scored "significantly higher on 'work needs' (the desire to perform a task well), slightly lower on 'mastery needs' the desire for new and challenging tasks), and significantly lower on 'interpersonal competitiveness' (the desire to outperform others). Research indicates that academic performance is positively correlated with high work and mastery needs and negatively correlated with high interpersonal competitiveness (Williams, 1991)."As shown next, the relationship between LOQ and Gender (.037**)

and LOQ Scale 1 (.076**) appear significant ($p < .01$). These results suggest the need to explore this relationship further.

Comparison of Means were computed. Each participant was asked to estimate (self-report) their holistic thinking ability from 1-7 (highest). To further examine the relationship between LOQ score and holistic thinking, a comparison of means between the LOQ score and holistic thinking was reviewed. As expected, the results show that the higher the holistic thinking rating, the higher the LOQ score.

LOQ_Score * Holistc Thinking

Holistic Thinking	Mean	N	Std. Deviation
1	4.5284	19	.99094
2	4.7371	21	.74775
3	4.6600	112	.68869
4	4.8732	1008	.67901
5	5.0528	1964	.59824
6	5.2888	2389	.57715
7	5.6031	665	.57370
Total	5.1642	6178	.64593

Similarly, each participant was asked to estimate (self-report) their problem solving ability from 1-7 (highest). To further examine the relationship between LOQ score and problem solving, a comparison of means between the LOQ score and holistic thinking was reviewed. As expected, the results show that the higher the problem solving rating, the higher the LOQ score.

LOQ Score * Problem Solving

Problem Solving	Mean	N	Std. Deviation
1	4.5022	9	1.33703
2	4.5692	13	.78386
3	4.7132	94	.72494
4	4.8459	649	.67789
5	5.0019	1736	.62732
6	5.2399	2804	.57804
7	5.5448	873	.59419
Total	5.1642	6178	.64593

Discussion

This study adds to the growing literature about individual differences in learning and contributes to a deeper understanding of patterns and divergence in adult learners. Clearly, distinct groups do exist with learners who have particular preferences and patterns in managing their learning efforts and accomplishing goals. The results were consistent with the theories that underlies the hypothesized construct and do not compromise the validity of the instrument for its intended purpose.

Study 3 - Test-Retest Reliability Evidence (n=43)

Purpose - Gather more evidence about the psychometric properties of the Learning Orientation Questionnaire (LOQ) by investigating the LOQ's test-retest reliability.

Research Questions

Q1 What are the test-retest reliability estimates of the learning orientation score?

Q2 What are the internal consistency estimates for the LOQ score and three LOQ constructs?

Participants - A total of 43 undergraduate students enrolled in an Eastern U.S. university took the online version of the LOQ to participate in this study. The same students took the same LOQ version for a second time 10 weeks later. The majority of the participants were White and came from middle-class backgrounds.

Statistical Analysis and Results
Investigators used the SPSS statistical package for a series of statistical analyses to accomplish the research goals.

Descriptive statistics were computed, including the minimum, maximum, mean score, and standard deviation for age, LOQ scores, and construct factor scores (shown next).

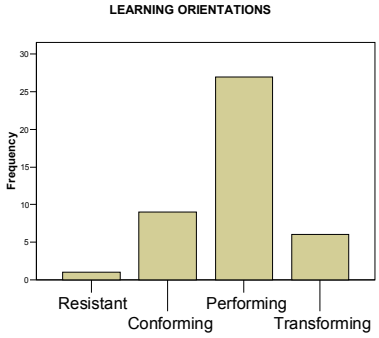
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	43	19.00	51.00	32.0465	10.25149
LOQ	43	3.12	6.52	4.9656	.62790
CONSTRUCT1	43	3.89	7.00	6.0493	.79359
CONSTRUCT2	43	3.13	6.75	4.8226	.85334
CONSTRUCT3	43	3.13	5.88	4.1602	.65021
Valid N (listwise)	43				

The sample was examined regarding the proportions of learning orientations. The sample was typical of a university student populace with LOQ score distributions dispersed as a bell curve, (e.g., large population of performing and few resistant learning orientations). However, the addition of the high school students to the sample increased the proportion of the conforming learning orientation. The sample included Transforming (n=14, 14%, mean=5.87), Performing (n=27, 63%, mean=5.00), Conforming (n=9, 21%, mean=4.19), and Resistant (n=1, 2%, mean=3.26).

Learning Orientations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Resistant	1	2.3	2.3	2.3
	Conforming	9	20.9	20.9	23.3
	Performing	27	62.8	62.8	86.0
	Transforming	6	14.0	14.0	100.0
	Total	43	100.0	100.0	



Cronbach's alpha reliability analysis was computed for the LOQ score and the three construct scales.
The high Alpha values (α=.86) produced by Cronbach's Alpha and the almost identical high Alpha values (α=.89) produced by Cronbach's Alpha based on standardized items indicate a high degree of internal consistency of the items in the survey. These results demonstrate good internal consistency reliability and reflect the homogeneity of items intended to measure the same quantity, that is, the extent to which responses to the items are correlated.

Test-retest reliability analysis was computed to give a sense of how stable or variable an individual's normative score is likely to be over time. The high Alpha values (α=.85) indicate a high degree of stability and reliability.

Discussion
Test-retest reliability is a measure of the correlation between the scores of the same people on the same test given on two different occasions. The level of the alpha coefficients in this study indicate that the scales were reliable over time to roughly the same extent as the instrument is reliable at a single point in time.

Case Study 4 – Investigating the Psychometric Properties of the LOQ – Computer Users (n=1167)

Purpose - To investigate the psychometric properties of the Learning Orientation Questionnaire (LOQ) that measures learning orientation.

Research Questions
Q1 What are the internal consistency estimates for the LOQ score and three LOQ constructs?
Q2 Which factors are related to individual differences in learning and which items load on which factor?
Q3 What is the relationship between the overall LOQ score and the three LOQ construct scales?
Q4 What is the sample proportion by learning orientation for a population comprised of high school and university students?
Q5 How do the different learning orientations respond to each item?

Participants - A total of 1167 undergraduate students enrolled in universities and community colleges located across the United States participated in this study by taking the hard-copy version of the LOQ. The majority of the participants were White and came from middle-class backgrounds.

Statistical Analysis and Results
Investigators used the SPSS statistical package for a series of statistical analyses to accomplish the research goals.

Descriptive statistics were computed, including the minimum, maximum, mean score, standard deviation, and variance for LOQ scores and construct factor scores (shown next).

Descriptive Statistics

Descriptive Statistics

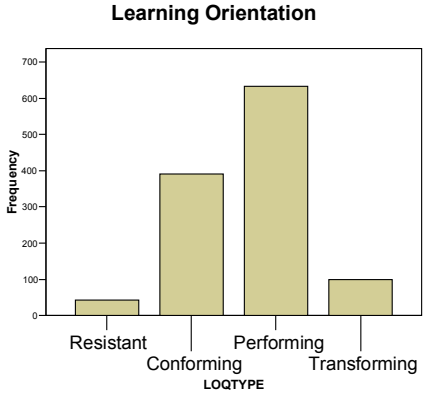
	N	Minimum	Maximum	Mean		Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
LOQ	1167	1.84	6.84	4.7056	.01860	.404
Con/Aff	1167	1.78	7.00	5.0333	.02523	.743
Effort	1167	1.88	7.00	4.6763	.02310	.623
Autonomy	1167	1.63	6.88	4.3664	.02346	.642
Valid N (listwise)	1167					

The sample was examined regarding the proportions of learning orientations. The sample was typical of a university student populace with LOQ score distributions dispersed as a bell curve, (e.g., large population of performing and few resistant learning orientations). However, the addition of the high school students to the sample increased the proportion of the conforming learning orientation. The sample included Transforming (n=100, 9%, mean=5.83), Performing

(n=633, 54%, mean=4.97), Conforming (n=391, 34%, mean=4.17), and Resistant (n=43, 4%, mean=3.123).

Learning Orientation Frequencies

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Resistant	42	3.7	3.7	3.7
	Conforming	391	33.5	33.5	37.2
	Performing	633	54.2	54.2	91.4
	Transforming	100	8.6	8.6	100.0
	Total	1167	100.0	100.0	



Cronbach's alpha reliability analysis was computed for the items, the LOQ score, and the construct scales. For the 25 items, Cronbach's Alpha and Cronbach's alpha based on standardized items was used to measure the internal consistency of the scales used in this study. The high Alpha values (α=.80) produced by the Cronbach's Alpha and the almost identical high Alpha values (α=.83) produced by the Cronbach's Alpha based on standardized items indicate a high degree of internal consistency of the items in the survey. An estimated lambda reliability of .87 produced by Guttman's scale is equally high. Similar results for the LOQ score and construct scales show α=.83 and α=.85, respectively. These results demonstrate good internal consistency reliability and reflect the homogeneity of items intended to measure the same quantity, that is, the extent to which responses to the items are correlated.

Principal factor analysis of all the items was computed to determine the latent structure or dimensions of a set of variables. The factor analysis used a Promax rotation to show how many factors (construct scales) account for unique variance in the data (number of factors to extract) and how the original variables load or correlate with the extracted factor constructs. Three significant uncorrelated factors (shown in the table next) accounted for 47% of the total sample variance. The same factors were similar to those proposed in previous studies. A fourth factor was explored but only 5% more of the variance was reported. Thirteen items loaded highly on the first factor (Affective/Conative Aspects) at .50 or higher. Four items loaded highly on the second factor (Committed Strategic Planning and Learning Effort) at .50 or higher and six items loaded highly on the third factor (Learning Autonomy) at .55 or higher. The results (below) show that 92% of the items (Q1-Q25) loading on each factor have high coefficients (i.e., over .50) and are highly interrelated. Except for Item 5, all the items also appear independent of the other factors (univocal).

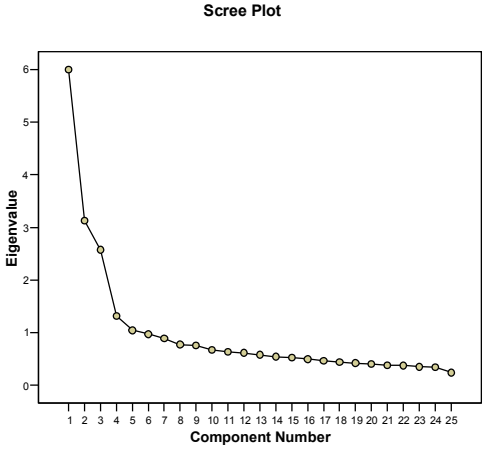
Structure Matrix

	Component		
	1	2	3
Q1	.630	-.120	.103
Q2	.661	-.059	.150

Q3	.098	-.044	.653
Q4	.552	-.076	.076
Q5	.043	-.490	.525
Q6	.684	-.107	.129
Q7	.039	.877	.046
Q8	.093	.311	.572
Q9	.235	.146	-.015
Q10	.665	-.036	.183
Q11	.556	.031	-.049
Q12	.569	.027	-.028
Q13	.741	.047	.133
Q14	.039	.809	.110
Q15	.700	.079	.177
Q16	.702	.047	.055
Q17	.693	-.021	.102
Q18	-.087	.629	.176
Q19	.685	-.010	.108
Q20	.100	.205	.719
Q21	.668	-.013	.118
Q22	.142	-.043	.792
Q23	.109	.138	.769
Q24	.438	-.064	.122
Q25	-.077	.822	.050

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

From the scree plot below you can see that the first three factors account for most of the variance and the remaining factors all have small eigenvalues. This evidence further supports the simple structure for a three-factor construct. The scree test confirm a three factor solution. According to Cattell's scree test, all factors can be omittted after the one starting the elbow in the downward curve of the eigenvalues.



A component correlation matrix (shown next) lends further support to the conclusion of scale independence with all the off-diagonal elements being low. Results are demonstrating construct validity as each scale represents different aspects of the theoretical construct or trait that it purports to measure.

Component Correlation Matrix

Component	1	2	3
1	1.000	-.018	.148
2	-.018	1.000	.042
3	.148	.042	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Bivariate correlation coefficients were explored to measure the relationship between the overall LOQ score and the three LOQ construct scales. All relationships appear significant ($p < .01$) with some stronger than others. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. The magnitude of these correlations offer further construct validity evidence.

Correlations

		LOQ	Con/Aff	Comm	Indep
LOQ	Pearson Correlation	1	.768(**)	.822(**)	.802(**)
	Sig. (2-tailed)	.	.000	.000	.000
	N	1277	1277	1277	1277
Con/Aff	Pearson Correlation	.768(**)	1	.502(**)	.340(**)
	Sig. (2-tailed)	.000	.	.000	.000
	N	1277	1277	1277	1277
Comm	Pearson Correlation	.822(**)	.502(**)	1	.525(**)
	Sig. (2-tailed)	.000	.000	.	.000
	N	1277	1277	1277	1277
Indep	Pearson Correlation	.802(**)	.340(**)	.525(**)	1
	Sig. (2-tailed)	.000	.000	.000	.
	N	1277	1277	1277	1277

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

The following table provides descriptive statistics for the sample, including the minimum, maximum, mean score, standard error, and variance for each LOQ item stratified by learning orientation.

Descriptive Statistics

		N	Minimum	Maximum	Mean	Std.	Variance
		Statistic	Statistic	Statistic	Statistic	Error	Statistic
Transforming	Q1	100	2.00	7.00	6.09	0.10	1.01
Performing	Q1	633	1.00	7.00	5.26	0.05	1.29
Conforming	Q1	391	1.00	7.00	4.54	0.06	1.41
Resistant	Q1	42	1.00	6.00	2.95	0.20	1.70
Transforming	Q2	100	4.00	7.00	6.74	0.05	0.28
Performing	Q2	634	2.00	7.00	6.24	0.03	0.60
Conforming	Q2	391	2.00	7.00	5.64	0.05	1.16
Resistant	Q2	42	1.00	7.00	4.36	0.27	3.16
Transforming	Q3	100	2.00	7.00	5.14	0.14	1.86
Performing	Q3	634	0.00	7.00	4.28	0.06	2.08

Conforming	Q3	391	1.00	7.00	3.77	0.07	1.77
Resistant	Q3	42	1.00	6.00	2.76	0.22	2.09
Transforming	Q4	100	2.00	7.00	5.87	0.11	1.18
Performing	Q4	634	1.00	7.00	4.86	0.05	1.86
Conforming	Q4	391	1.00	7.00	4.07	0.07	1.65
Resistant	Q4	42	1.00	6.00	3.02	0.22	2.07
Transforming	Q5	100	1.00	8.00	4.66	0.21	4.55
Performing	Q5	634	1.00	7.00	4.24	0.07	3.41
Conforming	Q5	391	1.00	7.00	4.37	0.08	2.32
Resistant	Q5	42	1.00	7.00	2.98	0.21	1.88
Transforming	Q6	100	5.00	8.00	6.80	0.05	0.24
Performing	Q6	633	2.00	7.00	6.30	0.03	0.70
Conforming	Q6	390	1.00	7.00	5.71	0.06	1.25
Resistant	Q6	42	1.00	7.00	4.12	0.29	3.42
Transforming	Q7	100	1.00	7.00	5.37	0.25	6.17
Performing	Q7	634	1.00	7.00	4.02	0.10	6.18
Conforming	Q7	391	1.00	7.00	2.21	0.07	1.96
Resistant	Q7	42	1.00	7.00	3.07	0.31	4.17
Transforming	Q8	100	1.00	7.00	5.56	0.14	1.84
Performing	Q8	634	0.00	7.00	4.29	0.06	2.30
Conforming	Q8	391	1.00	7.00	3.52	0.07	2.00
Resistant	Q8	42	1.00	6.00	2.64	0.20	1.75
Transforming	Q9	100	1.00	7.00	5.21	0.16	2.69
Performing	Q9	634	1.00	7.00	4.21	0.06	2.52
Conforming	Q9	391	1.00	7.00	3.76	0.07	2.20
Resistant	Q9	42	1.00	7.00	3.00	0.24	2.39
Transforming	Q10	100	4.00	7.00	6.44	0.07	0.55
Performing	Q10	633	2.00	7.00	6.00	0.04	0.89
Conforming	Q10	391	1.00	7.00	5.13	0.06	1.59
Resistant	Q10	42	1.00	7.00	3.76	0.23	2.23
Transforming	Q11	100	4.00	7.00	6.46	0.09	0.74
Performing	Q11	634	2.00	7.00	5.76	0.04	1.26
Conforming	Q11	391	1.00	7.00	5.14	0.07	1.85
Resistant	Q11	42	1.00	6.00	3.55	0.25	2.69
Transforming	Q12	100	1.00	7.00	5.66	0.14	2.07
Performing	Q12	633	1.00	7.00	4.72	0.06	2.17
Conforming	Q12	391	1.00	7.00	3.69	0.08	2.22
Resistant	Q12	42	1.00	6.00	2.86	0.20	1.74
Transforming	Q13	100	4.00	8.00	6.59	0.08	0.61
Performing	Q13	634	1.00	7.00	5.94	0.04	0.89
Conforming	Q13	391	1.00	7.00	4.94	0.06	1.53
Resistant	Q13	42	1.00	6.00	3.31	0.22	2.02
Transforming	Q14	100	1.00	9.00	5.44	0.20	4.11
Performing	Q14	634	1.00	7.00	4.12	0.08	4.21
Conforming	Q14	391	1.00	7.00	2.81	0.07	1.99
Resistant	Q14	42	1.00	7.00	3.10	0.28	3.21
Transforming	Q15	100	3.00	7.00	6.74	0.06	0.38
Performing	Q15	632	2.00	7.00	6.21	0.03	0.76
Conforming	Q15	391	1.00	7.00	5.25	0.06	1.35
Resistant	Q15	42	1.00	7.00	3.83	0.23	2.24

Transforming	Q16	100	3.00	7.00	6.34	0.10	0.93
Performing	Q16	634	3.00	7.00	5.89	0.04	0.89
Conforming	Q16	391	1.00	7.00	4.89	0.06	1.44
Resistant	Q16	42	1.00	6.00	3.31	0.22	1.98
Transforming	Q17	100	3.00	7.00	5.91	0.10	0.91
Performing	Q17	634	1.00	7.00	4.92	0.05	1.45
Conforming	Q17	391	1.00	7.00	3.79	0.06	1.58
Resistant	Q17	42	1.00	6.00	2.62	0.17	1.27
Transforming	Q18	100	1.00	8.00	5.01	0.19	3.44
Performing	Q18	634	1.00	7.00	3.80	0.07	2.93
Conforming	Q18	391	1.00	7.00	3.40	0.07	1.90
Resistant	Q18	42	1.00	7.00	3.14	0.20	1.74
Transforming	Q19	100	1.00	7.00	6.42	0.09	0.81
Performing	Q19	633	1.00	7.00	5.96	0.04	0.89
Conforming	Q19	391	2.00	7.00	5.15	0.06	1.23
Resistant	Q19	42	1.00	7.00	3.55	0.23	2.20
Transforming	Q20	100	1.00	8.00	5.41	0.13	1.66
Performing	Q20	634	0.00	7.00	4.23	0.05	1.90
Conforming	Q20	391	1.00	7.00	3.51	0.07	1.81
Resistant	Q20	42	1.00	6.00	2.57	0.18	1.42
Transforming	Q21	100	2.00	7.00	5.99	0.11	1.18
Performing	Q21	634	1.00	7.00	5.38	0.04	1.27
Conforming	Q21	390	1.00	7.00	4.31	0.06	1.63
Resistant	Q21	42	1.00	6.00	2.62	0.19	1.46
Transforming	Q22	100	1.00	7.00	5.22	0.15	2.36
Performing	Q22	634	0.00	7.00	4.39	0.06	2.07
Conforming	Q22	391	1.00	7.00	3.75	0.06	1.65
Resistant	Q22	42	1.00	5.00	2.43	0.17	1.18
Transforming	Q23	100	1.00	7.00	5.34	0.14	2.07
Performing	Q23	634	1.00	7.00	4.16	0.05	1.91
Conforming	Q23	391	1.00	7.00	3.42	0.06	1.54
Resistant	Q23	42	1.00	5.00	2.48	0.18	1.38
Transforming	Q24	100	3.00	8.00	6.24	0.10	1.09
Performing	Q24	633	1.00	7.00	5.57	0.05	1.51
Conforming	Q24	391	1.00	7.00	4.95	0.07	2.16
Resistant	Q24	42	1.00	7.00	3.55	0.27	3.08
Transforming	Q25	100	1.00	7.00	5.20	0.24	5.74
Performing	Q25	634	1.00	7.00	3.43	0.09	5.16
Conforming	Q25	391	1.00	7.00	2.62	0.08	2.30
Resistant	Q25	42	1.00	7.00	2.81	0.23	2.26

Discussion

This study adds to the growing literature about individual differences in learning and contributes to a deeper understanding of patterns and divergence in adult learners. This is the second factor analysis with similar results. Clearly, distinct groups do exist with learners who have particular preferences and patterns in managing their learning efforts and accomplishing goals. The results were consistent with the theories that underlies the hypothesized construct and do not compromise the validity of the instrument for its intended purpose.

Case Study 5 - Investigating the Psychometric Properties of the LOQ (n=205)

Purpose - To investigate the psychometric properties of the Learning Orientation Questionnaire (LOQ) that measures learning orientation.

Q1 What are the internal consistency estimates for the LOQ score and three LOQ constructs?
Q2 What is the relationship between the overall LOQ score and the three LOQ construct scales?
Q3 What is the sample proportion by learning orientation for a population comprised of university students?

Participants - A total of 205 undergraduate and graduate students enrolled in a Western university participated in this study by taking the online version of the LOQ. The majority of the participants were White and came from middle-class backgrounds.

Statistical Analysis and Results
Investigators used the SPSS statistical package for a series of statistical analyses to accomplish the research goals.

Descriptive statistics were computed, including the LOQ minimum, maximum, and mean score, standard error, standard deviation, and variance (shown next) for the LOQ scores and its three-factors scores.

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
LOQ	205	3.48	6.20	4.8981	.03530	.50546	.255
Construct1	205	3.89	7.00	6.1989	.04274	.61195	.374
Construct2	205	3.00	6.71	5.0237	.04806	.68806	.473
Construct3	205	2.44	6.22	4.1946	.05129	.73433	.539
Valid N (listwise)	205						

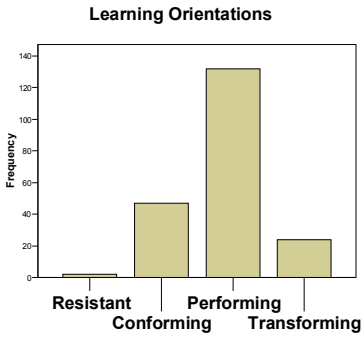
Descriptive statistics were computed, including minimum, maximum, and mean score, standard deviation, and variance for each of the LOQ items.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Q1	205	1	7	5.43	1.147	1.315
Q2	205	1	7	6.52	.783	.613
Q3	205	1	7	3.20	1.370	1.876
Q4	205	1	7	6.00	1.066	1.137
Q5	205	1	7	2.81	1.455	2.116
Q6	205	3	7	6.45	.800	.641
Q7	205	1	7	6.43	1.081	1.168
Q8	205	1	7	4.65	1.456	2.120
Q9	205	1	7	3.83	1.692	2.865
Q10	205	2	7	6.09	1.025	1.051
Q11	205	1	7	5.27	1.214	1.474
Q12	205	1	7	4.52	1.523	2.319
Q13	205	1	7	6.10	.952	.906
Q14	205	1	7	5.34	1.596	2.548
Q15	205	3	7	6.45	.743	.553
Q16	205	2	7	5.89	.964	.930
Q17	205	1	7	5.40	1.207	1.457
Q18	205	1	7	4.89	1.653	2.734

Q19	205	1	7	6.16	1.002	1.005
Q20	205	1	7	3.85	1.434	2.057
Q21	205	2	7	5.39	1.242	1.542
Q22	205	1	7	3.02	1.363	1.857
Q23	205	1	7	3.48	1.567	2.457
Q24	205	1	7	5.26	1.414	1.999
Q25	205	1	7	6.25	1.222	1.494
Valid N (listwise)	205					

The sample was examined regarding the proportions of learning orientations. The sample was typical of a university student populace with LOQ score distributions dispersed as a bell curve, (e.g., showing a large population of performing and much fewer resistant learning orientations). However, the addition of the high school students to the sample increased the proportion of the conforming learning orientation. The sample included Transforming (n=24, 12%, mean=5.79), Performing (n=132, 64%, mean=4.97), Conforming (n=47, 23%, mean=4.29), and Resistant (n=2, 1%, mean=3.48).



Learning Orientations

Cronbach's alpha reliability analysis using Pearson correlation coefficients were used to measure the relationship between the items, the LOQ score, and the three construct scales. For the 25 items, Cronbach's Alpha and Cronbach's alpha based on standardized items was used to measure the internal consistency of the scales used in this study. The high Alpha values (α=.80) produced by Cronbach's Alpha and the almost identical high Alpha values (α=.82) produced by the Cronbach's Alpha based on standardized items, and an estimated lambda reliability of .87 produced by Guttman's scale indicate a high degree of internal consistency of the items in the survey. Similar results for the LOQ score and construct scales show α=.84 and α=.86, respectively. These results demonstrate good internal consistency reliability and reflect the homogeneity of items intended to measure the same quantity, that is, the extent to which responses to the items are correlated.

Bivariate correlation coefficients were explored to measure the relationship between the overall LOQ score and the three LOQ construct scales. All relationships appear significant ($p < .01$) with some stronger than others. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. The magnitude of these correlations offer further construct validity evidence.

Correlations

		LOQ	Con1	Con2	Con3
LOQ	Pearson Correlation	1	.715(**)	.838(**)	.779(**)
	Sig. (2-tailed)	.	.000	.000	.000
	N	205	205	205	205
Con1	Pearson Correlation	.715(**)	1	.584(**)	.228(**)
	Sig. (2-tailed)	.000	.	.000	.001
	N	205	205	205	205
Con2	Pearson Correlation	.838(**)	.584(**)	1	.449(**)
	Sig. (2-tailed)	.000	.000	.	.000
	N	205	205	205	205
Con3	Pearson Correlation	.779(**)	.228(**)	.449(**)	1
	Sig. (2-tailed)	.000	.001	.000	.
	N	205	205	205	205

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

Discussion

This study's reliability coefficients and correlations between the subscales closely match expectations and are consistent with previous studies. This study adds to the growing literature about individual differences in learning. The constructs contribute to a deeper understanding of patterns in adult learning. Clearly, distinct groups do exist with learners who have particular preferences and processes in managing their learning efforts and accomplishing goals. The results were consistent with the theories that underlies the hypothesized construct and do not compromise the validity of the instrument for its intended purpose. This evidence suggests that future research should be directed towards item and rasch analysis and investigating the implications of learning orientation on academic success, learning ability, and learning efficacy.

Case Study 6 - Exploring Individual Differences in User Types (n=2035)

Purpose

The study's primary purpose is to explore individual differences demonstrated by the different user types and identify which audience attributes can significantly contribute to predicting user types who use support resources. The study results should help the GSA User Research Team make informed decisions about improving customer use of Microsoft support resources, particularly in helping large account users with new product launches and implementations.

Research Questions

Q1 Which critical psychological attributes correlate with learning-oriented data about users?
Q2 Which critical psychological attributes differentiate Microsoft's joint segments (with PSS) and user types?
Q3 Does the variable learning orientation, as measured by the Learning Orientation Questionnaire, differentiate Microsoft's user types?
Q4 What are the significant relationships between the study variables?

Participants

A total of 2035 data sets were collected for the corporate workers (organized by four user types) who participated in this study. The user types had differing levels of computer, job, and business expertise. There were about 290 to 818 surveys collected per user type.

Instrument

Participants completed the LOQ questionnaire online. Additional questions were added for validation purposes.

Procedure
Volunteers took a 15-minute inventory at an online support site within a one-week time period.

Statistical Analysis
Study investigators accomplished a series of statistical analyses to accomplish the research goals.
Cronbach's Alpha reliability analysis was computed for the LOQ and Rotter assessment items and construct scores. Descriptive statistics were computed for each of numerical variables from the demographic, user type, and success items and the scores from the LOQ and Rotter assessments. The statistics computed include the mean, median, standard deviation, variance, and standard error.

Bivariate correlation coefficients were used to measure the relationship between the items.

Results
Investigators used the SPSS statistical package. The sample was examined regarding the proportions of learning orientations. The sample had many more sophisticated computer user types showing an unusually large proportion of transforming learners (i.e., 49%) and a much smaller proportion of conforming learners (e.g., 8%). Typical university LOQ score distributions are a bell curve, (e.g., 12 – 20% transforming and conforming learners) in a corporate or undergraduate populace. The sample included Transforming (n=843, 41%), Performing (n=967, 48%), Conforming (n=214, 11%), and Resistant (n=11, 0%). The entire sample was 89% transforming and performing learners. The study's atypical proportion of transforming (more) and conforming (fewer) learners is probably due to the fact that general workers (low computer expertise) were not included.

Descriptive Statistics were computed, including the LOQ reliability coefficient, LOQ minimum, maximum, and mean score, standard error, standard deviation, and variance (shown next).

LOQ Descriptive Statistics

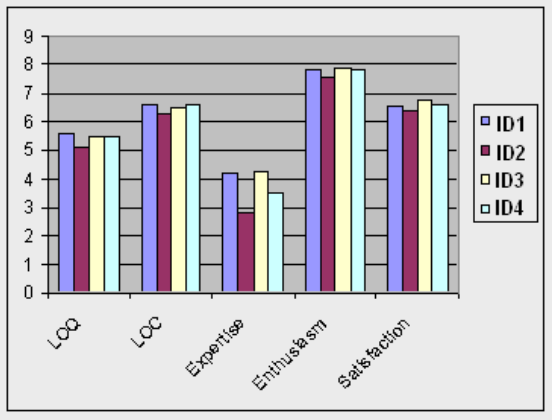
User Type	N	LO Reliability	LOQ MIN	LOQ MAX	LOQ MEAN	Std. Error	Std. Dev	Variance	LO
ID1	334	.880	3.44	7.00	5.59	0.035	0.65	0.42	T
ID2	593	.885	1.84	6.96	5.10	0.026	0.70	0.39	P
ID3	818	.884	1.48	6.96	5.44	0.023	0.68	0.43	C
ID4	290	.878	2.48	6.92	5.44	0.039	0.66	0.43	R
	2035								

The next table shows the study variables mean scores by Expertise. The Expertise scale is: Novice = 1, Beginner=2, Intermediate=3, Advanced=4, Expert=5. The LOQ scale is 1-7, the Locus of Control (LOC) scale was 1-10, and the Enthusiasm and Satisfaction scales were 1-9. The results consistently suggest that those with the higher LOQ score show higher enthusiasm and higher internal locus of control and show more overt striving towards expertise.

Group Statistics by Expertise

User Type	N	LOQ SCORE	STD	Enthusiasm	STD	LOC	STD	Satisfaction	STD
Expert	471	5.68	0.59	8.06	1.40	6.62	.088	6.74	1.63
Advanced	739	5.39	0.60	7.82	1.37	6.46	.073	6.72	1.54
Intermediate	615	5.25	0.65	7.65	1.42	6.46	.077	6.48	1.55
Beginner	141	5.03	0.70	7.23	1.55	6.33	.174	6.17	1.78
Novice	69	4.61	0.82	7.01	2.18	6.09	.197	6.26	2.15

Mean scores were computed for the study variables (shown below), including LOQ, LOC (autonomy), Expertise, Enthusiasm and Satisfaction. The graph below shows the user types grouped by the five study variables.



Reliability analyses were computed for each item and range between 0.822 and 0.889 and demonstrate strong reliability. The reliability score for the entire LOQ across all user types is equally strong at 0.876.

Correlations were computed and show significant correlations with the LOQ, Education, User Types, Ask Others, and other study variables. Correlations below show many significant correlations and demonstrate the importance of understanding the relationship between the selected study variables. Study variables that are particularly significant at the 0.01 level (2-tailed) and 0.05 level are the following: Satisfaction, Expertise, Enthusiasm, and LOQ variables. Significance for 0.01 and 0.05 is indicated with two asterisks (**) and one asterisk (*), respectively. These results provide evidence for convergent and discriminant validity and demonstrate evidence for construct validity.

Correlations

		Expertise	Enthusiasm	Satisfaction	LOQ	LOA
Expertise	Pearson Correlation	1	.173**	.100**	.344**	.049*
	Sig. (2-tailed)		.000	.000	.000	.026
	N	2033	2033	2033	2033	2033
Enthusiasm	Pearson Correlation	.173**	1	.273**	.240**	.099**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	2033	2033	2033	2033	2033
Satisfaction	Pearson Correlation	.100**	.273**	1	.080**	.107**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	2033	2033	2033	2033	2033
LOQ	Pearson Correlation	.344**	.240**	.080**	1	.215**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	2033	2033	2033	2033	2033
LOA	Pearson Correlation	.049*	.099**	.107**	.215**	1
	Sig. (2-tailed)	.026	.000	.000	.000	
	N	2033	2033	2033	2033	2033

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

The table above shows that the Locus of Action variable (a subset of Rotter's Locus of Control Survey) also has significant correlations with the Expertise, Enthusiasm, Satisfaction, and LOQ study variables suggesting the importance of understanding the impact of the internal locus on control on learning. Most educational research suggests the importance of understanding the impact of autonomy, locus of control, and self-directedness on learning.

Comparison of Means Report

Expertise		LOQ SCORE	Con1	Con2	Con3
1	Mean	4.6094	5.22	4.55	4.09
	N	72	72	72	72
	Std. Deviation	.80599	1.176	.807	.910
2	Mean	5.0037	5.44	4.81	4.40
	N	173	173	173	173
	Std. Deviation	.70850	.963	.752	.819
3	Mean	5.2614	5.34	4.92	4.45
	N	1123	1123	1123	1123
	Std. Deviation	.65573	.942	.751	.816
4	Mean	5.4581	5.31	4.90	4.51
	N	1653	1653	1653	1653
	Std. Deviation	.61783	.927	.788	.840
5	Mean	5.7006	5.50	5.04	4.68
	N	973	973	973	973
	Std. Deviation	.60075	.943	.814	.940
Total	Mean	5.4269	5.37	4.93	4.52
	N	3994	3994	3994	3994
	Std. Deviation	.66779	.945	.787	.866

To illustrate the significant relationships between the variables, in the comparison of means table above, you can see that the means for the LOQ scores and three scale scores increase as the means for the Expertise variable increases.

Correlations were computed and show significant relationships between the LOQ Score and the three LOQ constructs.

Inter-Factor Correlations for Study Variables

Correlations

		Con1	Con2	Con3	LOQ SCORE
Con1	Pearson Correlation	1	.639**	.525**	.826**
	Sig. (2-tailed)	.	.000	.000	.000
	N	2035	2035	2035	2035
Con2	Pearson Correlation	.639**	1	.579**	.811**
	Sig. (2-tailed)	.000	.	.000	.000
	N	2035	2035	2035	2035
Con3	Pearson Correlation	.525**	.579**	1	.829**
	Sig. (2-tailed)	.000	.000	.	.000
	N	2035	2035	2035	2035
LOQ SCORE	Pearson Correlation	.826**	.811**	.829**	1
	Sig. (2-tailed)	.000	.000	.000	.
	N	2035	2035	2035	2035

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

Discussion

The study purpose was to test a construct developed for describing four user types and explore the individual differences demonstrated by the different user types. The purpose included identifying which audience attributes are useful in predicting how the user types are generally inclined to learn, manage resources, and develop expertise. A secondary purpose was to investigate the psychometric properties of the Learning Orientation Questionnaire (LOQ). The study findings provided excellent support for the argument that it is possible to use the construct to identify key variables

helpful in predicting user types with increasing accuracy. The significance of this research is that the results are helpful in developing a learning and performance framework that considers audience learning needs from a mass customized perspective. Additional studies will consider which other variables, in tandem with the LOQ, are also predictive. The study results should also help refine the user type descriptions and improve how to support user needs effectively, especially requirements for learning and implementing change. Additionally, the results provide evidence for convergent and discriminant validity and demonstrate evidence for construct validity.

Study 7 - Exploring Individual Differences in User Types (n=1959)

Purpose
The study's primary purpose is to explore individual differences demonstrated by different user types and identify which audience attributes can significantly contribute to predicting those user types who use learning and help resources more successfully. Study results should help make informed decisions about improving customer use product learning and help resources, particularly with large account product launches and implementations.

Research Questions
Q1 Which critical psychological attributes correlate with learning-oriented data about user types?
Q2 Which critical psychological attributes differentiate or predict user types?
Q3 Does the variable learning orientation, as measured by the Learning Orientation Questionnaire, differentiate or predict user types?
Q4 What are the significant relationships between the study variables?

Participants
A total of 1959 data sets were collected for the corporate workers (organized by nine user types) who participated in this study. The user types had differing levels of computer and business expertise. There were about 150-250 surveys collected per user type, except for three user types with much fewer participants (21 and 75) and one user type with much more expertise (n=567).

Instrument
Participants completed the LOQ questionnaire online. Additional questions were added for validation purposes, including the Rotter Inventory. Demographic items included: gender, age, years of education, expertise, holistic thinking ability, autonomy, and level of education and enthusiasm.

Procedure
Volunteers took a 15-minute inventory at an online support site within a one-week time period.

Statistical Analysis
Study investigators accomplished a series of statistical analyses to accomplish the research goals.
Cronbach's Alpha reliability analysis was computed for the LOQ and Rotter assessment items and construct scores.
Descriptive statistics were computed for each of numerical variables from the demographic, user type, and success items and the scores from the LOQ and Rotter assessments. The statistics computed include the mean, median, standard deviation, variance, and standard error.
Bivariate correlation coefficients were used to measure the relationship between the items.

Results
Investigators used the SPSS statistical package. The sample was examined regarding the proportions of learning orientations. The sample had many more sophisticated computer user types showing an unusually large proportion of transforming learners (i.e., 49%) and a much smaller proportion of conforming learners (e.g., 8%). Typical university LOQ score distributions are a bell curve, (e.g., 12 – 20% transforming and conforming learners) in a corporate or undergraduate populace. The entire sample was 92% transforming and performing learners. The study's atypical proportion of transforming (more) and conforming (fewer) learners is probably due to the fact that general workers (low computer expertise) were not included. The sample included Transforming (n=965, 49%), Performing (n=833, 43%), Conforming (n=154, 8%), and Resistant (n=7, 0%).

Descriptive statistics were computed, including the LOQ reliability coefficient, LOQ minimum, maximum, and mean score, standard error, standard deviation, and variance.

LOQ Descriptive Statistics

ID	Num	Reliability	Min	Max	LOQ	StdError	StdDev	Var	LO	Expertise
9	75	0.822	4.36	7	5.765	0.06109	0.52903	0.28	T	4.67
6	264	0.875	2.08	7	5.652	0.03998	0.64966	0.422	T	4.08
5	275	0.87	3.72	7	5.562	0.03835	0.63604	0.405	T	4.36
4	567	0.869	2.36	7	5.530	0.02722	0.64816	0.42	P	4.04
8	267	0.881	3.84	7	5.511	0.03812	0.62282	0.388	P	3.65
7	150	0.889	3.8	7	5.461	0.05503	0.67402	0.454	P	4.16
3	21	0.845	4.44	6.52	5.370	0.13682	0.62698	0.393	P	3.33
2	147	0.84	3.88	7	5.333	0.05193	0.62965	0.396	P	4.24
1	193	0.886	3.44	6.76	5.076	0.04767	0.66221	0.439	P	2.83
Totals	1959	0.876		Mean	5.473				Mean	3.93

Reliability analyses were computed for each item and range between 0.822 and 0.889 and demonstrate strong reliability. The reliability score for the entire LOQ across all user types is equally strong at 0.876.

Correlations were computed and show significant correlations with the LOQ, Education, User Types, Ask Others, and other study variables. Correlations below show many significant correlations and demonstrate the importance of understanding the relationship between the selected study variables. Study variables that are positively related at the 0.01 level (2-tailed) and 0.05 level are: User type .203(**), Education .180(**), Enthusiasm .223(**), Expertise .272(**),and Locus of Control (Rotter items) .206(**). One variable was negatively related: Ask Others for Help -.230(**). Significance for 0.01 and 0.05 is indicated with two asterisks (**) and one asterisk (*), respectively. These results provide evidence for convergent validity and demonstrate evidence for construct validity.

Discussion

The study purpose was to test a construct developed for describing nine user types and explore the individual differences demonstrated by the different user types. The purpose included identifying which audience attributes are useful in predicting how the user types are generally inclined to learn, manage resources, and develop expertise. A secondary purpose was to investigate the psychometric properties of the Learning Orientation Questionnaire (LOQ). The study findings provided excellent support for the argument that it is possible to use the construct to identify key variables helpful in predicting user types with increasing accuracy. The significance of this research is that the results are helpful in developing a learning and performance framework that considers audience learning needs from a mass customized perspective. Additional studies will consider which other variables, in tandem with the LOQ, are also predictive. The study results should also help refine the user type descriptions and improve how to support user needs effectively, especially requirements for learning and implementing change. Additionally, the results provide evidence for convergent and discriminant validity and demonstrate evidence for construct validity.

Case Study 8 – Investigating the Psychometric Properties of the LOQ (n=869)

Purpose - To investigate the psychometric properties of the Learning Orientation Questionnaire (LOQ) that measures learning orientation.

Q1 What are the internal consistency estimates for the LOQ score and three LOQ constructs?
Q2 What is the relationship between the overall LOQ score and the three LOQ construct scales?
Q3 What is the sample proportion by learning orientation for a population comprised of university students?

Participants - A total of 869 undergraduate and graduate students enrolled in a Western online university participated in this study by taking the online version of the LOQ. The majority of the participants were White and came from middle-class backgrounds.

Statistical Analysis and Results

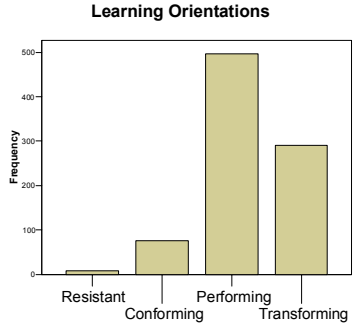
Investigators used the SPSS statistical package for a series of statistical analyses to accomplish the research goals.

Descriptive statistics were computed, including the LOQ minimum, maximum, and mean score, standard error, standard deviation, and variance (shown next) for the LOQ scores and its three factors scores.

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
LOQ score	869	3.28	7.00	5.2574	.01903	.56101	.315
score_1	869	2.11	7.00	6.2828	.02224	.65552	.430
score_2	869	2.50	7.00	5.2302	.02469	.72783	.530
score_3	869	1.63	7.00	4.1362	.02754	.81177	.659
Valid N (listwise)	869						

The sample was examined regarding the proportions of learning orientations. The sample was typical of a university student populace with LOQ score distributions dispersed as a bell curve, (e.g., showing a large population of performing and much fewer resistant learning orientations). However, the addition of the high school students to the sample increased the proportion of the conforming learning orientation. The sample included Transforming (n=290, 33%, mean=5.84), Performing (n=496, 57%, mean=5.09), Conforming (n=75, 9%, mean=4.24), and Resistant (n=8, 1%, mean=3.48).



Learning Orientations

Cronbach's alpha reliability analysis using Pearson correlation coefficients were used to measure the relationship between the LOQ score and the three construct scales. For the LOQ score and construct scales, Cronbach's Alpha and Cronbach's alpha based on standardized items was used to measure the internal consistency of the scales used in this study. The high Alpha values (α=.83) produced by Cronbach's Alpha and the almost identical high Alpha values (α=.85) produced by the Cronbach's Alpha based on standardized items indicate a high degree of internal consistency of the items in the survey. These results demonstrate good internal consistency reliability and reflect the homogeneity of items intended to measure the same quantity, that is, the extent to which responses to the items are correlated.

Bivariate correlation coefficients were explored to measure the relationship between the overall LOQ score and the three LOQ construct scales. All relationships appear significant ($p < .01$) with some stronger than others. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. The magnitude of these correlations offer further construct validity evidence.

Correlations

		LOQ score	score_1	score_2	score_3
LOQ score	Pearson Correlation	1	.751(**)	.852(**)	.714(**)
	Sig. (2-tailed)	.	.000	.000	.000
	N	869	869	869	869
score_1	Pearson Correlation	.751(**)	1	.584(**)	.190(**)
	Sig. (2-tailed)	.000	.	.000	.000
	N	869	869	869	869
score_2	Pearson Correlation	.852(**)	.584(**)	1	.413(**)
	Sig. (2-tailed)	.000	.000	.	.000
	N	869	869	869	869
score_3	Pearson Correlation	.714(**)	.190(**)	.413(**)	1
	Sig. (2-tailed)	.000	.000	.000	.
	N	869	869	869	869

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

Discussion

This study's reliability coefficients and correlations between the subscales closely match expectations and are consistent with previous studies. This study adds to the growing literature about individual differences in learning. The constructs contribute to a deeper understanding of patterns in adult learning. Clearly, distinct groups do exist with learners who have particular preferences and processes in managing their learning efforts and accomplishing goals. The results were consistent with the theories that underlies the hypothesized construct and do not compromise the validity of the instrument for its intended purpose. This evidence suggests that future research should be directed towards item and rasch analysis and investigating the implications of learning orientation on academic success, learning ability, and learning efficacy.

Case Study 9 – Investigating the Psychometric Properties of the LOQ – Nursing Students (n=162)

Purpose - To investigate the psychometric properties of the Learning Orientation Questionnaire (LOQ) that measures learning orientation.

Q1 What are the internal consistency estimates for the LOQ score and three LOQ constructs?
Q2 What is the relationship between the overall LOQ score and the three LOQ construct scales?
Q3 What is the sample proportion by learning orientation for a population comprised of students at a nursing university?

Participants - A total of 162 undergraduate and graduate students enrolled in a Western nursing university participated in this study by taking the online version of the LOQ. The majority of the participants were White and came from middle-class backgrounds.

Statistical Analysis and Results

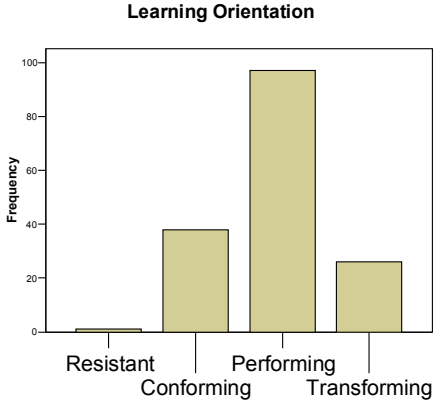
Investigators used the SPSS statistical package for a series of statistical analyses to accomplish the research goals.

Descriptive statistics were computed, including the LOQ minimum, maximum, and mean score, standard error, standard deviation, and variance (shown next) for the LOQ scores and its three factors scores.

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
LOQ	162	2.56	6.20	4.9551	.04600	.58547	.343
C1	162	1.22	7.00	5.8215	.06325	.80499	.648
C2	162	2.50	6.63	4.7607	.06496	.82683	.684
C3	162	1.88	6.00	4.1774	.05560	.70764	.501
Valid N (listwise)	162						

The sample was examined regarding the proportions of learning orientations. The sample was typical of a university student populace with LOQ score distributions dispersed as a bell curve, (e.g., showing a large population of performing and much fewer resistant learning orientations). However, the addition of the high school students to the sample increased the proportion of the conforming learning orientation. The sample included Transforming (n=26, 16%, mean=5.80), Performing (n=97, 60%, mean=5.03), Conforming (n=38, 24%, mean=4.23), and Resistant (n=8, 1%, mean=2.56).



Learning Orientations

Cronbach's alpha reliability analysis using Pearson correlation coefficients were used to measure the relationship between the LOQ score and the three construct scales. For the LOQ score and construct scales, Cronbach's Alpha and Cronbach's alpha based on standardized items was used to measure the internal consistency of the scales used in this study. The high Alpha values (α=.80) produced by Cronbach's Alpha and the almost identical high Alpha values (α=.82) produced by the Cronbach's Alpha based on standardized items indicate a high degree of internal consistency of the items in the survey.

These results demonstrate good internal consistency reliability and reflect the homogeneity of items intended to measure the same quantity, that is, the extent to which responses to the items are correlated.

Bivariate correlation coefficients were explored to measure the relationship between the overall LOQ score and the three LOQ construct scales. All relationships appear significant ($p < .01$) with some stronger than others. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. Instrument scores are said to have convergent construct validity if they correlate with quantities with which they should. The magnitude of these correlations offer further construct validity evidence.

Correlations

		LOQ score	score_1	score_2	score_3
LOQ score	Pearson Correlation	1	.751(**)	.852(**)	.714(**)
	Sig. (2-tailed)	.	.000	.000	.000
	N	869	869	869	869
score_1	Pearson Correlation	.751(**)	1	.584(**)	.190(**)
	Sig. (2-tailed)	.000	.	.000	.000
	N	869	869	869	869
score_2	Pearson Correlation	.751(**)	.584(**)	1	.413(**)
	Sig. (2-tailed)	.000	.000	.	.000
	N	869	869	869	869
score_3	Pearson Correlation	.714(**)	.190(**)	.413(**)	1
	Sig. (2-tailed)	.000	.000	.000	.
	N	869	869	869	869

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

Discussion
This study's reliability coefficients and correlations between the subscales closely match expectations and are consistent with previous studies. This study adds to the growing literature about individual differences in learning. The constructs contribute to a deeper understanding of patterns in adult learning. Clearly, distinct groups do exist with learners who have particular preferences and processes in managing their learning efforts and accomplishing goals. The results were consistent with the theories that underlies the hypothesized construct and do not compromise the validity of the instrument for its intended purpose. This evidence suggests that future research should be directed towards item and Rasch analysis and investigating the implications of learning orientation on academic success, learning ability, and learning efficacy.

Study 10 – Psychometric Properties of a Learning Orientation Questionnaire – Test-Retest - 13

Purpose - Gather more evidence about the psychometric properties of the Learning Orientation Questionnaire (LOQ) by investigating the LOQ's test-retest reliability.

Research Questions
Q1 What are the test-retest reliability estimates of the learning orientation score?
Q2 What are the internal consistency estimates for the LOQ score and three LOQ constructs?

Participants - A total of 13 undergraduate students enrolled in a Western U.S. university took the online version of the LOQ to participate in this study. The same students took the same LOQ version for a second time. The time in between ranged from .5 months to 28 months. The majority of the participants were White and came from middle-class backgrounds.

Statistical Analysis and Results
Investigators used the SPSS statistical package for a series of statistical analyses to accomplish the research goals.

Descriptive statistics were computed, including the minimum, maximum, mean score, and standard deviation for age, LOQ scores, and construct factor scores (shown next).

Descriptive Statistics

	N	Minimum	Maximum	Mean		Std.	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
LOQ_Score1	13	3.92	5.48	4.8646	.14030	.50584	.256
Con1	13	4.22	7.00	5.9923	.22298	.80398	.646
Con2	13	3.38	5.38	4.6085	.16786	.60521	.366
Con3	13	2.75	4.38	3.8577	.14591	.52609	.277
Valid N (listwise)	13						

The sample was examined regarding the proportions of learning orientations.

Learning Orientations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Conforming	3	23.1	23.1	23.1
	Performing	10	76.9	76.9	100.0
	Total	13	100.0	100.0	

Test-retest reliability analysis was computed to give a sense of how stable or variable an individual's normative score is likely to be over time. The high Alpha values (α=.83) and the almost identical high Alpha values (α=.84) produced by Cronbach's Alpha based on standardized items indicate a high degree of stability and reliability.

Discussion

Test-retest reliability is a measure of the correlation between the scores of the same people on the same test given on two different occasions. The level of the alpha coefficients in this study indicate that the scales were reliable over time to roughly the same extent as the instrument is reliable at a single point in time.

Conclusion

These studies add to an ongoing effort to gather evidence about the psychometric properties of the Learning Orientation Questionnaire (LOQ). Because multidimensional psychological learning constructs are complex and difficult to conceptualize, develop, and measure a great deal of thought has been given toward collecting evidence to refine the hypothesized theories and constructs continually. Messick's validity and reliability strategies were especially helpful in the planning and validation process. The LOQ was hypothesized, developed, and continually tested using Messick's strategies. The exploratory factor analyses proved especially instrumental in the refinement of the psychological measuring instrument for learning.

This study focused primarily on construct validity and reliability issues. Clearly, researcher need to investigate the LOQ's ability to predict performance criteria. For example, one important unexplored issue is how, if at all, the LOQ can predict achievement Future research may include a hypothesis that the LOQ can increase its predictive validity for academic achievement. To provide predictive validity evidence, the study needs to explore this issue more fully by including achievement criteria as a research variable.

Future studies will continue to focus on the continued refinement of the LOQ. Subsequent versions of the LOQ will help accomplish the following:

- Clearer, more reliable understanding and interpretation of the instrument, construct, and study results
- Include phases for exploring second- and third-order factor analysis
- Include methods for using the LISREL confirmatory analysis
- Use iterative study results to refine a theory, construct, and model describing intentional learning
- Present proven principles and methods that truly integrate diagnostic assessment with instruction
- Include strategies and processes to predict achievement
- Explore the different variables that support successful learning practice.

Research Benefits

This series of studies offers several research benefits, including it:

- Offers tested strategies, models, and interpretations for designing, developing, evaluating, and validating a learning assessment instrument.
- Adds to the existing knowledge about using instruments to measure psychological constructs.
- Offers evidence for improving the learning orientation theory, construct, and orientation model.
- Helps general readers understand psychological learning processes and implications for more successful learning performance.
- Offers solutions that help worldwide companies and institutions understand and diagnose learning differences as they attempt to reduce escalating training costs with economical methods for delivering more effective, customized training.
- Suggests methods that help worldwide companies and institutions take competitive advantage of the benefits of assessment and integration of evolving technology.
- Helps designers integrate psychological measuring instruments into instructional models.
- Offers a manual that enables others to administer and interpret the intentional learning orientation questionnaire.