The Learning Flexibility Index: Assessing Contextual Flexibility in Learning Style

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ABSTRACT

This chapter describes the concept of learning flexibility in Experiential Learning Theory and its relationship to integrative learning and adult development. The Learning Flexibility Index (LFI), an improvement over previous measures of learning flexibility, is introduced. We introduce a new measure for calculating learning flexibility based on the Kendall's Coefficient of Concordance or W. Construct validity for the LFI measure is shown by confirming six hypotheses about the place of the LFI in a nomological net. The LFI is negatively related to age and educational level. Women and those in concrete professions tend to be more flexible. Individuals with an assimilating learning style tend to be less flexible. Learning flexibility is positively related to Akrivou's Integrative Development Scale. Discriminant validation of the LFI shows that adaptation of learning style to context in the LFI is different than random variation in the Kolb's Learning Style Inventory (KLSI). Finally, a case studies of individuals with high and low LFI score illustrates how learning style and learning flexibility can combine to produce unique patterns of adaptation to different learning contexts. Implications for future research and practice are discussed.

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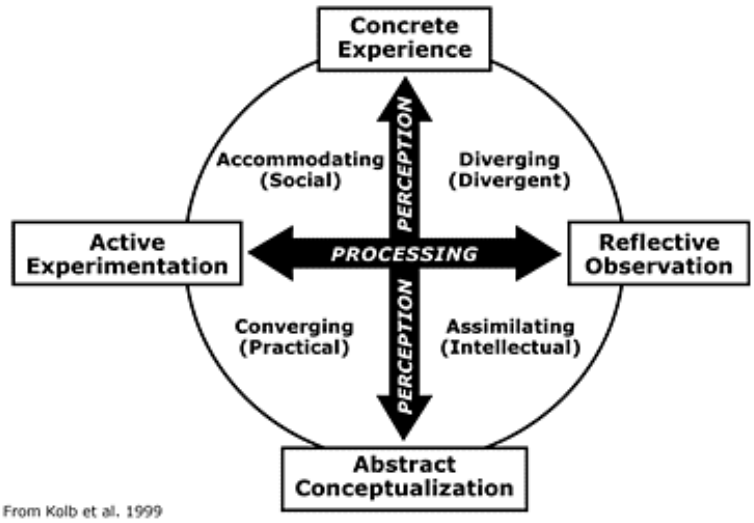
Experiential learning theory (ELT—Kolb 1984) draws on the work of prominent 20th century scholars who gave experience a central role in their theories of human learning and development—notably John Dewey, Kurt Lewin, Jean Piaget, Lev Vygotsky, William James, Carl Jung, Paulo Freire, Carl Rogers and others—to develop a dynamic, holistic model of the process of learning from experience and a multi-linear model of adult development. ELT is a dynamic view of learning based on a cycle of learning with four learning modes—Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE). It is a holistic theory that defines learning as the major process of human adaptation involving the whole person. As such, ELT is applicable not only in the formal education classroom but in all areas of life. The holistic nature of the learning process means that it operates at all levels of human society from the individual, to the group, to organizations and to society as a whole. For forty years research based on ELT has been conducted all around the world supporting the applicability of the model in different cultures, educational specializations, and life contexts. The 2009 Experiential Learning Theory Bibliographies (Kolb & Kolb, 2009a & b) include over 3000 research studies.

Most style typologies in cognition, learning and personality conceive of styles as fixed traits or preferences that vary little from situation to situation or over time. The learning style concept in experiential learning theory (ELT—Kolb 1984) is different in that learning style is not conceived as a fixed trait but a dynamic state resulting from synergistic transactions between the person and the environment in a cycle of learning with four learning modes—Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE; See Figure 1).

Figure 1. Experiential Learning Theory



From Kolb et al. 1999

This dynamic state arises from an individual's preferential resolution of the dual dialectics of the experiential learning cycle—experiencing/conceptualizing (AC-CE) and acting/reflecting (AE-RO). Nine distinct learning styles have been identified that can be portrayed on a two dimensional learning space defined by AC-CE and AE-RO (Kolb & Kolb 2005a. See Figure 3 & 4).

The stability of learning style arises from consistent patterns of transaction between individuals and learning situations in their life. This process is called accentuation—the way we learn about a new situation determines the range of choices and decisions we see, the choices and decisions we make influence the next situation we live through and this situation further influences future choices.

Learning styles are thus specialized modes of adaptation that are reinforced by the continuing choice of situations where a style is successful (Kolb & Kolb 2005b).

Since a specialized learning style represents an individual preference for only one or two of the four modes of the learning cycle, its effectiveness is limited to those learning situations that require these strengths. Learning flexibility indicates the development of a more holistic and sophisticated learning process. Following Jung's theory that adult development moves from a specialized way of adapting toward a holistic integrated way, development in learning flexibility is seen as a move from specialization to integration. Integrated learning is a process involving a creative tension among the four learning modes that is responsive to contextual demands. This is portrayed as an idealized learning cycle or spiral where the learner "touches all the bases"--experiencing, reflecting, thinking, and acting--in a recursive process that is responsive to the learning context and what is being learned. The theory argues that this development in learning flexibility results from integration of the dual dialectics of conceptualizing/ experiencing and acting/reflecting that allows the learner to move freely around the learning cycle using all four modes to learn from an experience.

In this chapter we further develop the concept of learning flexibility in ELT. We introduce a new measure of learning flexibility, The Learning Flexibility Index (LFI), an improvement over the measures of learning flexibility used earlier. We provide empirical construct validity evidence for the LFI and illustrate through a case studies how learning style and learning flexibility influence individual learning.

Previous ELT Research on Learning Flexibility

Previous research on learning flexibility (previously named adaptive flexibility) was conducted with the Adaptive Style Inventory (ASI—Boyatzis & Kolb, 1993). The ASI was originally developed to assess individuals' level of integrative complexity as they progressed from the specialized to integrated stage of the ELT developmental model (Kolb, 1984). The instrument assessed adaptive flexibility by measuring how individuals change their learning style in response to different situational demands. It was based on the theory that if people show systematic variability in their response to different contextual learning demands, one could infer a higher level of integrative development because systematic variation would imply higher order decision rules or meta-cognitive processes (Kolb & Kolb, 2009) for guiding behavior.

A number of researchers have found evidence to support the link between learning flexibility and integrative development. Early studies found that adaptive flexibility is positively related to higher levels of ego development on Loevinger's sentence completion instrument (Kolb & Wolfe, 1981; Kolb, 1984). Individuals with higher levels of adaptive flexibility perceived themselves to be more self-directed in their current life situation and to have greater flexibility. They had higher levels of differentiation in their personal relationships, and used more constructs to describe their life structure. In addition, they experienced less conflict and

stress in their life despite experiencing their life to be more complex. Subsequent research on learning flexibility has replicated some of these findings. Perlmutter (1990) studied 51 medical professionals and found significant relationships between Loevinger's ego development instrument and adaptive flexibility. Thompson (1999) in a sample of 50 professionals from various fields found that self-directed learners had higher levels of adaptive flexibility than learners who were not self-directed.

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

In her comprehensive review of ASI research, Bell (2005) reported other construct validity evidence but suggested a need for revision of the original instrument and the creation of new measures of adaptive flexibility.

Using an earlier version of the current LFI instrument, Akrivou (2008) found a relationship between learning flexibility and integrative development as measured by her Integrative Development Scale (IDS). She created this scale by identifying items that describe the integrative stage of adult development as defined in the works of Loevinger (1966, 1976, 1998), Rogers (1961), Perry (1999), Kegan (1982, 1994) and Kolb (1984, 1988, 1991). Another study by Moon (2008) using the early LFI examined sales performance in financial services, finding that learning flexibility influenced sales success as measured by monthly volume of sales.

Construct Validation of the LFI

Based on this previous work we will empirically test six hypotheses about the relationship of the LFI to variables comprising a nomological net of construct validity—the demographic variables of age, gender, educational level and educational specialization as well as learning style and integrative development.

Demographic variables. These variables were chosen because of previous demonstrated relationships with learning style (Kolb & Kolb 2005a). While we have found no previous research on the relationship between flexibility in learning and demographic variables, other research on individual flexibility and related variables suggests the following hypotheses.

Hypothesis 1: Learning flexibility will decrease with age. Negative relationships have been found between age and cognitive flexibility (Salthouse, & Meinz, 1995; Collins, & Tellier, 1994), motivation to change (Morrison & Hall, 2001), and the inability to deal with change and to shift sets in task accomplishment (Ridderinkhof, Span, & van der Molen, 2002).

Hypothesis 2: Women will exhibit higher learning flexibility than men. Women have been shown to have greater gender-role flexibility (Green, Bigler, & Catherwood 2004; Raffaele, Mendez, and Crawford, 2002; Levy, Taylor, and Gelman, 1995) and flexibility in coping with stressful life events like immigration (Remennick, 2005).

Hypothesis 3: Higher levels of education will result in lower learning flexibility.

Hypothesis 4: Learning flexibility will be lower for individuals in educational specializations that emphasize abstraction.

Hypotheses 3 and 4 are based on the positive relationship between educational level and the preference for the abstract learning style (Kolb & Kolb 2005a) and that Mainemelis, Boyatzis & Kolb (2002) found abstract learning styles to be less flexible on the ASI.

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

Hypothesis 5a: A balance between an assimilative and accommodative learning style will be related to higher learning flexibility.

Hypothesis 5b: A preference for the assimilative vs. the accommodative learning style will be related to lower learning flexibility.

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

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

Method

Samples

The primary sample for this study was obtained from the publisher of the Kolb Learning Style Inventory (KLSI), Hay Group Transforming Learning. This database comprises a large sample with diversity in gender, age, education, profession, country of residence and birth and learning styles. This included all individuals who took the inventory between March 2008 and May 2009. From a sample of over 10,000 we use 7536 after excluding those with missing data. We decided to use a large sample rather than selecting a smaller more homogeneous sample, recognizing that effect sizes were likely to be smaller due to greater error variance in the large heterogeneous sample but that these conservative estimates would be more generalizable. This sample is used for assessing the KLSI, the LFI, and demographic variables. The second sample is from Akrivou's (2008) study; consisting of 169 individuals 75% of whom are middle and senior level managers in three multinational companies and medium sized organizations based in the Midwestern United States. The remainder are managers or professionals in multinational or professional service firms (See Table 1).

Measures

The Kolb Learning Style Inventory, Version 3.1 (Kolb 2007). The KLSI contains 12 items that ask respondents to rank four sentence endings that correspond to the four learning modes – CE, RO, AC and AE. The LSI assesses six variables, four primary scores that measure an individual's relative emphasis on the four learning modes and two combination scores that measure an individual's preference for abstractness over concreteness (AC-CE) and action over reflection (AE-RO). To create a continuous variable to assess an individual's preference for the accommodative versus the assimilative learning style a new combination score was created (this is used to test hypotheses 5a & b): Accommodation /Assimilation = ((AE+CE)-(AC+RO)). This measure has been used in previous studies by Wiersta, and de Jong (2002) and Allison and Hayes (1996).

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

We introduce a new measure for calculating learning flexibility based on the Kendall's Coefficient of Concordance or W (Legendre, 2005), a non parametric statistic typically used to measure the degree of agreement among judges. In the LFI, W is calculated for each individual by assessing the degree of agreement in their ranking of the four learning modes across the 8 different learning contexts. A low W score for an individual indicates that the learner varies their ranking of learning modes across learning contexts thus showing high learning flexibility.

W finds the deviation between the mean response ranking (by learning mode) and the grand mean of the ranking. This deviation is divided by the maximum possible sum of squares deviation. The coefficient varies from 0 to 1 with 1 denoting complete agreement (Sigler, & Tallent-Runnels, 2006). We thus define Learning Flexibility Index (LFI) as: LFI= 1-W. The modified formula for W is:

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

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

p= number of learning contexts (=8)

n= number of learning modes (=4)

R= row sum of ranks

Demographic variables. The variable for age comprised of 7 ordinal categories from under 19 to over 65. This was transformed into a continuous variable from 1 to 7. Gender was coded as 1 for males and 0 for females. The five categories for education from primary school to doctoral degree were re-coded into a continuous variable from 1 to 5. The different educational specializations from the database were ranked so that a lower rank indicated concrete contextual learning demands and a higher rank indicated abstract conceptual learning demands in the

specialty based on data reported by Kolb (1984:126-7). For example, social work as a profession will have a lower rank while mathematics will have a higher rank.

Integrative Development Scale. The measure for this variable is from Akrivou's (2008) study. The following items were used from her scale: "My life's work is a deep expression of my principles, values and identity", "In all my roles and relationships I am able to be authentic and express my true inner self", "When it comes to life satisfaction the journey as important as the destination", "I feel I am the creator of my own life story", and "I am committed to making the world a better place". The alpha reliability for this scale was .70.

Results

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

Table 1 Means, Standard Deviations and Correlations

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

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

** $p < .01$, *$p<.05$

Regression analysis.

Table 2. Regression for Learning Flexibility Index

Variable	Learning Flexibility Index			Integrative Development
	Hyp1-4	*Hyp 5b*	*Hyp 5a*	*Hyp 6*
	Model 1	Model 2	Model 3	Model 1
Age	-0.03*	-0.02*	-0.02	0.18*
Gender	-0.07**	-0.04**	-0.04**	-0.18*
Education	-0.05**	-0.04**	-0.03**	0.00
Specialization	-0.03*	-0.01	-0.02	-0.03
Acc-Assm	---	0.24**	0.23**	0.01
Square of Acc-Assm	---	---	-0.14**	---
Learning Flexibility Index				0.25**

R	0.11	0.25	0.29	0.36
R^2	0.01	0.07	0.09	0.13
Adj. R^2	0.01	0.06	0.08	0.10
$R^2\Delta$	0.01**	0.05**	0.02**	0.06**

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

***p<.001, *p<.05*

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

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

To understand the findings in model 2 and 3 we plotted the regression predicted value of learning flexibility controlling for the demographic variables against the variable accommodation- assimilation (See Figure 1). The conflicting linear and curvilinear relationships

between accommodative-assimilative learning style and learning flexibility found by Mainemalis, et al. (2002) are resolved by splitting the difference at the accommodative end of the learning style continuum. Both hypotheses agree at the assimilative end of the learning style continuum (that is balanced learning style is related to higher learning flexibility and assimilative learning style results in lower learning flexibility) and are confirmed in the result shown in Figure 2. At the accommodative end the relationship is neither linear nor curvilinear declining from the balance point only slightly. This suggests that inflexibility in learning occurs primarily when the assimilative process of internally organizing thought is not counter balanced by some external accommodative orientation. In other words, it is the assimilative learning style that is the most inflexible. Boyatzis and Mainemalis in chapter 7 in this book found similar results. In their sample of MBA students they found a high preference for abstraction and lower flexibility in learning from concrete experience, supporting our finding that it is the assimilative learning style that is the most inflexible.

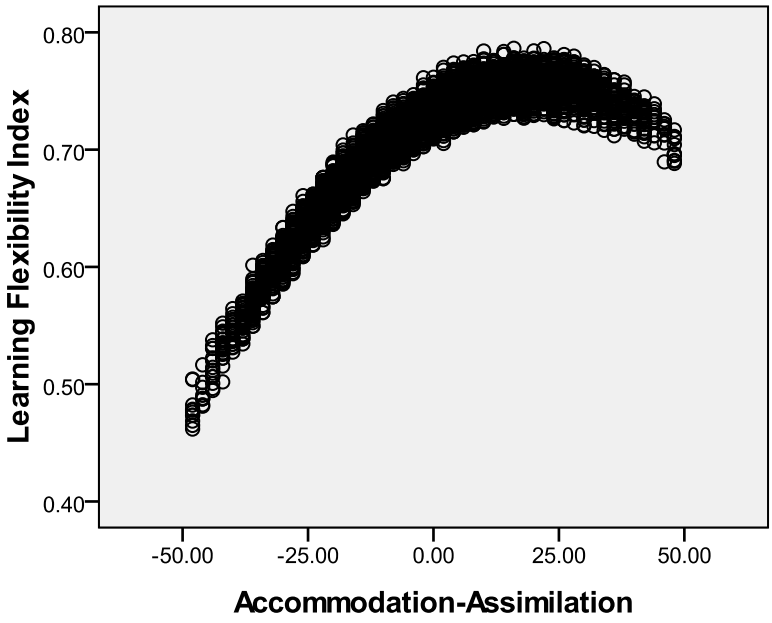


Figure 2. Graph of Predicted Value of LFI from the regression and the variable for accommodation-assimilation

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

To test for discriminant validity of the LFI, we calculated Kendall's W using items from KLSI (items 1-12 that measure learning style). We then correlated integrative development variable with both LFI and 1-Kendall's W from the KLSI items. LFI will have discriminant validity if the correlation of LFI with integrative development is significant while that of 1-Kendall's W from the LSI items is not. LFI and integrative development show a significant correlation ($\rho = 0.23$, $p < .01$) while 1-Kendall's W from the KLSI items does not show a significant correlation with integrative development ($\rho = .09$, $p > .01$). What these results show is that the LFI variability in response to different learning contexts that is hypothesized to relate to higher order decision rules for learning is related to integrative development; but the variability in response to general descriptions of oneself as a learner on the KLSI is not related to integrative development.

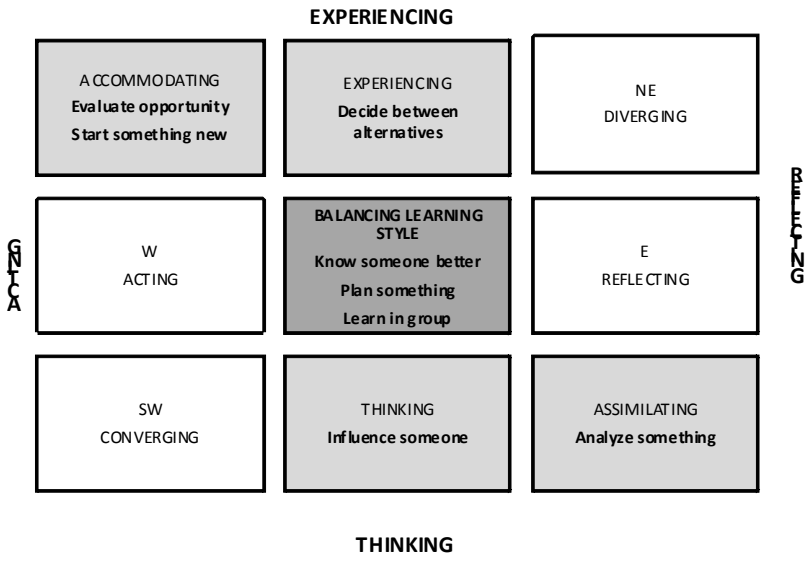
While the first order correlations and regressions showed statistical confirmation of the hypothesized nomological net of construct validation for the LFI, effect sizes for the demographic variables are negligible explaining less than 1% of the variance in each case. Effect sizes for the learning style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

Using the LFI for Personal Development.

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

To illustrate we provide below a profile of a person with a high LFI score along with excerpts from his self analysis of how he learns (This report was written to describe the learning style results he was given and did not include his LFI score feedback). This is followed by the profile of another person with a low LFI score and excerpts from his self analysis of how he learns. Figure 3 shows the LFI contextual learning style results for Mark, a mid-forties executive for an international non-profit organization, who had a high LFI score at the 98th percentile. Mark's learning style on the KLSI was balancing and he used this style when *getting to know someone better*, *to plan* and *to learn in a group*. In the *deciding between two alternatives* context he became more concrete using the experiencing style. *To evaluate opportunities* and *start something new* he changed his style to become accommodating, concrete and active. *To influence someone* he became more abstract and *to analyze something* he adopted an abstract and reflective learning style. Thus Mark shows flexibility in all four learning modes in response to the learning demands of different situations.

Figure 3. HIGH LEARNING FLEXIBILITY INDEX (98 %tile)



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

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

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

> *As I look back at my educational experience, I can see how I have grown toward the Balancing style. My exposure to a wide variety of learning experiences strengthened my skills in the different learning styles over the years. I majored in civil engineering in*

college. While I discovered that I didn't like engineering very much, the education strengthened my Converging skills. Throughout college, I was heavily involved in the campus retreat program and other faith-related activities, which placed a strong emphasis on reflection and finding meaning in concrete personal experience. I believe these experiences strengthened my Diverging skills. After college I volunteered for a year with a Habitat for Humanity affiliate in Alabama. I began the year with almost no construction knowledge but learned to build houses exclusively through hands-on experience. This bolstered my Accommodating skills and strengthened my confidence that I could learn through hands-on experience. After practicing engineering for a year and determining that it wasn't for me, I earned a master's degree in Religion and Religious Education. This required a good deal of reading and research, which helped to develop my Assimilating skills. In my career experience since, I have used all of the learning styles at different times and to varying degrees.

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

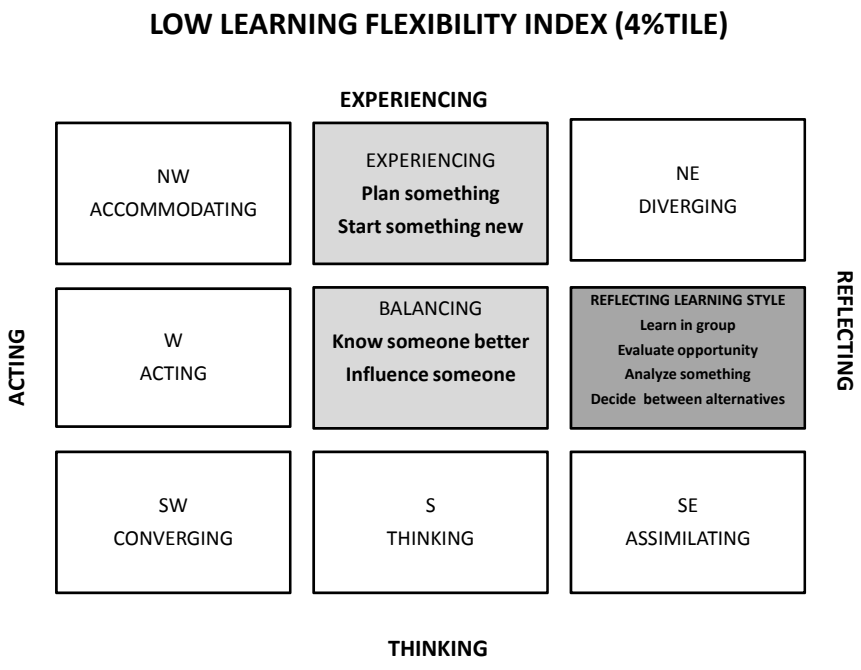
I am most interested in a career that involves a variety of activities. I have a number of different functions in my current job, from one-on-one coaching to creating informational resources and developing training programs to facilitating trainings and planning meetings. I primarily work alone but also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

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

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

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

In contrast, Figure 4 provides an example of someone with a Low LFI score at the 4th percentile. Jason is a minister in his late thirties who recently became the head of a small congregation. His learning style on the KLSI is reflecting and he uses that style in four of the eight learning style contexts in the LFI—learning in a group, evaluating an opportunity, analyzing something and deciding between alternatives. He changes that style to become a bit more active in the remaining four situations. To know someone better and to influence someone he uses the balancing style. To plan something or start something new he becomes a little more concrete as well more active using the



experiencing style. Jason's emphasis on reflection is dominant or important in all learning situations and there is no flexibility in abstraction indicated and only moderate flexibility in action.

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

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

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

> *In terms of implications for my career path, I began my professional journey as an educator working as a teacher and administrator of a pre-K through 8th grade school. Because it was my first real full time position, I didn't have much of a basis for comparing it to anything else. However, I did notice that I was constantly feeling a higher level of stress and anxiety than I had ever remembered feeling in my life. Looking back on that experience in light of the LSI, it strikes me that a position in a school requires a fairly high degree of AE focus. Eight and a half years ago, I made the switch from the school environment to the modest congregation I currently serve. While I have not eliminated stress from my work life, the ratio of moments that feel barely under control to moments when I feel I am making a solid and worthwhile contribution has undergone a profound shift in a positive direction. I have much more time now for both internal and interpersonal reflection which is much better suited to how I most comfortably function in the world. I have probably learned most of what I know about the*

"Accommodating" style through my family experience and it has continued to feel like a stretch to me. As a "diverger", I think it would be helpful if in my family we could set aside some regularly scheduled time for a family meeting so that I could get beyond the constant sense that millions of decisions need to be made on the fly.

The challenge here feels like more than mere lack of preference for or experience with the particular skill set involved. It feels like a deeper psycho-emotional discomfort with the experience of being at the center of things and of seeing myself as a or "the" driving force for an event or an organization. In meetings, I tend to sit back and listen and often even wait for someone to ask me a question before I open my mouth, but I have repeatedly received feedback from my lay leadership that they would like to hear more from me outside of the formal context of sermons and service leading.

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

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

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

The above case illustrates how the LFI contextual learning style analysis relates to the lives of a high and low flexibility person. Coupled with learning style results the LFI can give learners a rich portrait of how they learn in the many contexts of their life. By using the examples that they created to answer the LFI questions, individuals can plan strategies to deal with these real learning situations.

Conclusion and Implications

Thus far, we have described the development of the Learning Flexibility Index and a measure of learning flexibility based on the Kendall's W statistic. We have shown construct validity for the LFI measure by testing six hypotheses about the place of the LFI in a

nomological net. The LFI is negatively related to age and educational level. Women and those in concrete professions tend to be more flexible. Individuals with an assimilating learning style tend to be less flexible. Learning flexibility is positively related to Akrivou's Integrative Development Scale. Finally, the case study of an individual with a high LFI score illustrates how learning style and learning flexibility can combine to produce unique patterns of adaptation to different learning contexts.

While these results provide general support for the validity of the LFI in a large diverse sample, further research is needed to extend the LFI nomological net, particularly in more specific contexts. For example, building on Moon's (2008) study showing a relationship between learning flexibility and relationship sales of complex financial products, we would predict relationships between the LFI and performance in roles that involve multiple learning demands, e.g. managers of cross-functional teams or entrepreneurs. Similarly, learning flexibility may be related to performance in interdisciplinary educational programs. It might also be related to communicating effectively with persons whose learning style differs from one's own. Another important line of future research is the exploration of the relationship between learning flexibility and adult development, e.g. relating the LFI to measures of adult development stages in the theories of Loevinger, Perry and Kegan.

Further refinements can be developed for LFI measurement. While we have noted the methodological benefits of using Kendall's W to assess contextual differences in learning style, the index only gives an overall assessment of flexibility. It would be useful to develop quantitative indices of the specific ways an individual changes their style in different contexts as illustrated in the case study of Mark. Specifically sub-measures of flexibility in the four learning modes and indicators of whether the flexibility is toward or away from the learning demands of the context might be illuminating.

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

A related issue concerns the priority placed on specialized over integrative learning in education. Specialization in subject matter and the learning style most suited to learning it may

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

The LFI offers an important additional perspective in the ongoing debate about how to use learning style information to enhance learning. In chapter 11 of this volume Peterson and Cairne describe the great emphasis placed on matching learning style and teaching style in order to increase student learning. This approach may well facilitate learning of specialized material. The concept of learning flexibility, however, shifts the focus from specialized style matching to the process of movement through all modes of the learning cycle. This holistic process oriented approach that combines a matching strategy with a corresponding emphasis on increasing learning skills in non-dominant learning styles may well prove to be the most effective educational strategy. Teachers can respond to the diversity of learning styles present in nearly every classroom by teaching around the cycle using approaches that fit with all four learning modes.

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

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APPENDIX A

Percentiles for LFI Scores (Online sample N = 7536)

Learning Flexibility Index

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	2	.0	.0	.0
	.04	3	.0	.0	.1
	.07	1	.0	.0	.1
	.10	2	.0	.0	.1
	.12	2	.0	.0	.1
	.13	2	.0	.0	.2
	.14	4	.1	.1	.2
	.16	3	.0	.0	.3
	.17	3	.0	.0	.3
	.18	3	.0	.0	.3
	.18	3	.0	.0	.4
	.19	6	.1	.1	.5
	.19	2	.0	.0	.5
	.21	6	.1	.1	.6
	.22	11	.1	.1	.7
	.22	4	.1	.1	.8
	.23	8	.1	.1	.9
	.24	2	.0	.0	.9
	.24	6	.1	.1	1.0
	.26	6	.1	.1	1.0
	.26	7	.1	.1	1.1
	.27	9	.1	.1	1.3
	.28	2	.0	.0	1.3
	.28	19	.3	.3	1.5

.29	6	.1	.1	1.6
.29	7	.1	.1	1.7
.30	2	.0	.0	1.7
.31	23	.3	.3	2.0
.32	15	.2	.2	2.2
.32	17	.2	.2	2.5
.33	16	.2	.2	2.7
.34	20	.3	.3	2.9
.34	10	.1	.1	3.1
.35	6	.1	.1	3.2
.36	49	.7	.7	3.8
.36	12	.2	.2	4.0
.37	18	.2	.2	4.2
.38	18	.2	.2	4.4
.38	32	.4	.4	4.9
.39	14	.2	.2	5.1
.39	73	1.0	1.0	6.0
.40	1	.0	.0	6.0
.41	14	.2	.2	6.2
.42	50	.7	.7	6.9
.43	22	.3	.3	7.2
.43	45	.6	.6	7.8
.44	23	.3	.3	8.1
.44	40	.5	.5	8.6
.45	8	.1	.1	8.7
.46	56	.7	.7	9.5
.46	14	.2	.2	9.6
.47	64	.8	.8	10.5
.48	19	.3	.3	10.7
.48	45	.6	.6	11.3

.49	54	.7	.7	12.1
.49	43	.6	.6	12.6
.50	22	.3	.3	12.9
.51	59	.8	.8	13.7
.52	63	.8	.8	14.5
.53	42	.6	.6	15.1
.53	79	1.0	1.0	16.1
.54	17	.2	.2	16.4
.54	140	1.9	1.9	18.2
.55	17	.2	.2	18.5
.56	31	.4	.4	18.9
.56	42	.6	.6	19.4
.57	85	1.1	1.1	20.6
.58	48	.6	.6	21.2
.58	144	1.9	1.9	23.1
.59	43	.6	.6	23.7
.59	46	.6	.6	24.3
.60	11	.1	.1	24.4
.61	159	2.1	2.1	26.5
.62	139	1.8	1.8	28.4
.63	46	.6	.6	29.0
.63	64	.8	.8	29.8
.64	96	1.3	1.3	31.1
.64	126	1.7	1.7	32.8
.66	174	2.3	2.3	35.1
.66	35	.5	.5	35.6
.67	96	1.3	1.3	36.8
.68	94	1.2	1.2	38.1
.68	72	1.0	1.0	39.0
.69	49	.7	.7	39.7

.69	125	1.7	1.7	41.3
.70	44	.6	.6	41.9
.71	144	1.9	1.9	43.8
.72	200	2.7	2.7	46.5
.73	51	.7	.7	47.2
.73	201	2.7	2.7	49.8
.74	84	1.1	1.1	51.0
.74	87	1.2	1.2	52.1
.75	34	.5	.5	52.6
.76	98	1.3	1.3	53.9
.76	40	.5	.5	54.4
.77	238	3.2	3.2	57.6
.78	68	.9	.9	58.5
.78	121	1.6	1.6	60.1
.79	88	1.2	1.2	61.2
.79	212	2.8	2.8	64.0
.80	11	.1	.1	64.2
.81	212	2.8	2.8	67.0
.82	41	.5	.5	67.5
.83	113	1.5	1.5	69.0
.83	206	2.7	2.7	71.8
.84	58	.8	.8	72.5
.84	204	2.7	2.7	75.3
.85	25	.3	.3	75.6
.86	118	1.6	1.6	77.1
.86	53	.7	.7	77.9
.87	113	1.5	1.5	79.4
.88	66	.9	.9	80.2
.88	174	2.3	2.3	82.5
.89	95	1.3	1.3	83.8

.89	123	1.6	1.6	85.4
.90	36	.5	.5	85.9
.91	127	1.7	1.7	87.6
.92	205	2.7	2.7	90.3
.93	63	.8	.8	91.1
.93	72	1.0	1.0	92.1
.94	60	.8	.8	92.9
.94	101	1.3	1.3	94.2
.95	14	.2	.2	94.4
.96	161	2.1	2.1	96.6
.96	17	.2	.2	96.8
.97	58	.8	.8	97.6
.98	45	.6	.6	98.2
.98	84	1.1	1.1	99.3
.99	19	.3	.3	99.5
.99	32	.4	.4	99.9
1.00	4	.1	.1	100.0
Total	7536	100.0	100.0	

APPENDIX B

APPENDIX C

Correlation of LFI with previous measures of Learning Flexibility

	Bauback (2006)		Akrivou (2008)	Moon (2008)	Mainemalis et al. (2002)
	ASI Abs ACCE	ASI Abs AERO	Abs Flex Total	Abs Flex Total	Total Vector for ACCE and AERO
LFI	-0.68**	-0.54**	0.60**	0.43**	-0.73**

** p<.01

Note: ASI Abs ACCE is the absolute value of AC-CE using the ASI items, ASI abs AERO is the absolute value of AE-RO using the ASI items. Lower the score higher will be learning flexibility

Abs Flex Total (ASI Modes) is calculated by taking each item for ASI, multiplying it by 12 and subtracting it from the modal score of LSI items and taking its absolute value. This was done for each of the four modes (CE, RO,AC, AE). The total flex score is the sum of all four modal scores. Higher the score higher will be learning flexibility.

Total vector for ACCE and AERO is calculated by:

If AC > CE, Vector AC/Item 1 =1, Vector CE / Item1= 0
If AC = CE, Vector AC/Item 1 = Vector CE/Item 1 = 1
If AC < CE, Vector AC/Item 1 = 0, Vector CE / Item 1 = 1

The valence of individuals' preference for each mode is given by summing the vectors of the eight items:
SUM (Vectors AC) = Vector AC/Item 1+…+ Vector AC/Item 8
SUM (Vectors CE) = Vector CE/Item 1+…+ Vector CE/Item 8
SUM (Vectors AE) = Vector AE/Item 1+…+ Vector AE/Item 8
SUM (Vectors RO) = Vector RO/Item 1+…+ Vector RO/Item 8
The formulae for adaptive flexibility in the two ASI dimensions are the following (note that due to subtraction the scoring is inverse: i.e. the lower the score, the higher the adaptive flexibility):
Adaptive (Learning) flexibility in AC / CE = ABS [SUM (Vectors AC) – SUM (Vectors CE)]
Adaptive (Learning) flexibility in AE/RO = ABS [SUM (Vectors AE) – SUM (Vectors RO)]

APPENDIX D.

LFI ITEM RANKINGS FOR REGIONS OF THE LEARNING SPACE

LEARNING REGION	CE	RO	AC	AE	ACCE	AERO
EXPERIENCING	4	3	1	2	-3	-1
EXPERIENCING	4	2	1	3	-3	1
DIVERGING	4	3	2	1	-2	-2
DIVERGING	3	4	1	2	-2	-2
REFLECTING	3	4	2	1	-1	-3
REFLECTING	2	4	3	1	1	-3
ASSIMILATING	1	4	3	2	2	-2
ASSIMILATING	2	3	4	1	2	-2
THINKING	1	2	4	3	3	1
THINKING	1	3	4	2	3	-1
CONVERGING	2	1	4	3	2	2
CONVERGING	1	2	3	4	2	2
ACTING	2	1	3	4	1	3
ACTING	3	1	2	4	-1	3
ACCOMMODATING	4	1	2	3	-2	2
ACCOMMODATING	3	2	1	4	-2	2
ACCE BALANCE	4	2	3	1	-1	-1
ACCE BALANCE	4	1	3	2	-1	1
ACCE BALANCE	3	2	4	1	1	-1
ACCE BALANCE	3	1	4	2	1	1
AERO BALANCE	1	4	2	3	1	-1
AERO BALANCE	1	3	2	4	1	1
AERO BALANCE	2	4	1	3	-1	1
AERO BALANCE	2	3	1	4	-1	1