Information Processing Patterns of Postsecondary American Indian/ Alaska Native Students

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In the last of a three-part series, this study examined the information processing patterns of postsecondary American Indian/Alaska Native students attending community and tribal colleges in the southwest. Using a survey design, students completed the Kolb *Learning Style Inventory,* the Briggs and Myers *Myers-Briggs Type Indicator,* and the Oltman, Raskin, and Witkin *Group Embedded Figures Test*. Three major results were revealed from the study. First, the students described their learning as a combination of learning by thinking and learning by watching. This is the same cognitive processing pattern found in elementary and secondary students. Second, the 'ISTJ' from the *Myers-Briggs Type Indicator* best described the personality influences on learning for these students. These individuals are practical, orderly, logical, and earn success by concentration and thoroughness. Finally, the results suggest that these students can draw equally from both analytical (field-independent) and global (field-dependent) forms of information processing.

Although the last four decades have brought improved social status and access to education for students of color, African Americans, Hispanics, Asians/Pacific Islanders, and American Indians/Alaska Natives remain disenfranchised (Aragon, 2000). According to researchers, students of color are more likely than their White counterparts to be at risk for academic failure at the elementary, secondary, and postsecondary levels (O'Brien & Zudak, 1998). The risk factors associated with not completing a postsecondary program include delayed enrollment, part-time attendance, being self-supporting, single-parent status, full-time work schedules, caring for a dependent, and holding a GED certificate. According to a National Postsecondary Student Aid Study (as reported by O'Brien & Zudak, 1998), 35% of American Indian/Alaska Native students exhibit four or more of these risk factors, compared to 22% of White students, 27% of Hispanic students, and 31% of African American students. Another potential risk for these

students is that they often are attempting to break new ground as the first in their families to attend college. While these data represent the averages for the different groups of students, enormous diversity exists within these four populations.

Rendon and Hope (1996) listed research that assesses how students of color learn best as one of the major needs for reforming higher education in response to current demographic trends. Within the context of Indian education, researchers have expressed this same need. Pipes, Westby and Inglebret (1993) state that "both students and faculty must have knowledge of both the Native American and mainstream culture if Native American students are to be successful in the university environment" (p. 148). More recently, Swisher and Tippeconic, III (1999) stress that the teaching-learning relationship between students and teachers must be a primary focus of research and practice.

Today, racial and ethnic minorities make up approximately 29% of the U.S. population (U.S. Census Bureau, 2000b, 2000c). According to the U.S. Census Bureau (2000a) projections, by 2050 minorities will constitute approximately 47% of the U.S. population. The implications of neglecting to better understand and address the learning needs of people of color for society, in general, and adult education, in particular, are staggering. In 1989, Briscoe and Ross stated:

> It is likely that young people will leave school early, will never participate fully in society or in the decision-making processes of government, and that they will neither enjoy the benefits of good health, nor experience the upward mobility needed as adults to make them full contributors and partners in shaping and participating in the larger society (p. 586).

A decade later, these issues have yet to be resolved (O'Brien & Zudak, 1998; Rendon & Hope, 1996). An emerging issue in higher education is the use of learning styles research to create more positive, effective learning environments for all students.

Problem Statement and Purpose

Over the last 25+ years, the learning style preferences of American Indians/Alaska Natives have received extensive attention in the literature, providing a comprehensive profile of these patterns (Aragon, 1996; Browne, 1984, 1986, 1990; Dunn & Griggs, 1995; Irvine & York, 1995; Lomawaima, 1995; More, 1987; Osborne, 1985; Pepper & Henry, 1986; Pipes, Westby & Inglebret, 1993; Rhodes, 1988, 1989, 1990; Ryan, 1992; Sawyer, 1991; Swisher & Deyhle, 1987, 1989; Swisher & Pavel, 1994; Vasquez & Wainstein, 1990; Wauters, Bruce, Black, & Hocker, 1989). The primary focus of this research has been in the area of cognitive learning patterns. While this body of research has collectively and without a doubt extended our knowledge and understanding of the cognitive learning styles of American

Indian/Alaska Native students, there are two significant reasons why another study in this area is warranted.

First, with the exception of a few studies, most of the learning styles research has been conducted with children rather than adults. Consequently, it is unclear how or whether these findings apply to the field of postsecondary Indian education. Second, much of the research reviewed as part of a meta-analysis conducted by Aragon (1996) was found to be weak in terms of describing the method used for the studies. Specifically, many of the studies reviewed lacked a discussion of methodological procedures or description of the instruments used and their psychometric ratings. Consequently, this brings the validity of these studies into question.

In response to these two limitations of the current learning styles research, the purpose of this study was to explore the cognitive learning styles of postsecondary American Indian/Alaska Native students in attendance at tribal and community colleges. This study was guided by the following research questions.

1. What are the cognitive learning style patterns found in postsecondary American Indian/Alaska Native students?
2. How do these patterns compare to those of elementary and secondary American Indian/Alaska Native students?

Theoretical Framework

In the last of a three-part series directed towards the construction of a theoretical model of learning for postsecondary American Indian/Alaska Native learners, the cognitive learning style patterns of students in attendance at tribal and community colleges were explored. In order to shape the understanding and extend the knowledge of postsecondary American Indian/Alaska Native learning styles, Curry's (1991) Theoretical Model of Learning Style Components and Effects has served as the framework on which this research has been based. She posits that there are three constructs that influence learning styles and/or successful learning. These include the maintenance of motivation, level of task engagement, and specific information processing habits (cognitive control functions).

According to Curry (1991), motivational levels are maintained once the learner establishes preferred environmental and social conditions for learning. Factors contributing to motivation include a general sense of self-efficacy (belief/confidence in oneself) and self-control. However, there may also be an element of biological need for different environmental elements such as quiet, heat, and/or light. Because this motivational level interacts directly with the learning environment, preferences for particular physical environmental and social conditions can easily be altered in the learning situation, possibly having direct bearing on learner motivation. Aragon (2002) previously identified the environmental and social learning

conditions found for postsecondary American Indian/Alaska Native students.

The engagement level is defined as "the point of contact between the motivational condition of the learner entering the learning situation and the active processing work required by the new learning task" (Curry, 1991, p. 251). The level of engagement in the intended learning behavior is influenced by the learner's prior history with learning situations similar to the new one encountered. A learner's level of task engagement is reflected in the amount of attention that is paid to features in the instructional situation, how persistent the learner will be, the degree of participation, the enthusiasm, and degree of concentration the learner sustains throughout and beyond the instructional situation. Aragon (2004) identified the learning and study strategies for postsecondary American Indian/Alaska Native students in attendance at tribal and community colleges.

Cognitive controls refer to the information processing habits or control systems that learners bring to learning situations (Curry, 1991). These controls "represent patterns of thinking that control the ways that individuals process and reason about information" (Jonassen & Grabowski, 1993, p. 83) resulting in their ability to make sense of the world. According to Curry (1991) these cognitive controls take place only after the learner becomes engaged in the task.

This model of learning style presents a way in which to link learner motivation, task engagement, and cognitive control. "The suggested connection is that engagement implies intention and willingness to stay focused on a particular learning task in a particular learning situation" (Curry, 1991, p. 252). Motivation must be maintained in order to keep this connection between the three components maintained. The level of task engagement permits information processing with whatever level of cognitive control the learner has mastered and becomes accustomed. Learning style itself, therefore, can be thought of as the combination of the learner's motivation, task engagement, and information processing habits.

The collection of these three components of learning style interact in order to make use of previously learned metacognitive skills such as situational analysis planning; self-pacing; self-evaluation and specific knowledge; and skills learned in the instructional situation in order to produce a detectable learning outcome (Curry, 1990). "By this model, investigators using learning outcomes as dependent variables must simultaneously measure metacognitive skills and the specific levels of required knowledge and skills in order to tease out effects of learning style" (Curry, 1991, p. 252).

The rationale behind the use of this particular framework over others was two-fold. First, all instruments used in the framework have been found to have good to strong psychometric ratings (Curry, 1990) which has been a common criticism of past learning styles research. Second, the model has

been previously utilized to provide valid learning style profiles for Native American/Alaska Native adult learners (Aragon, 1996) and Hispanic adult learners (Sanchez, 1996).

Method

Research Design

This study utilized a descriptive research design. The goal was to describe the cognitive learning patterns of one sample at one point in time. Gall, Gall, and Borg (2003) state "descriptive research is a type of quantitative research that involves making careful descriptions of educational phenomena" (p. 290). This design was appropriate for several reasons. First, in this particular study, the goal was to describe the information processing patterns that American Indian/Alaska Native community college students use to process information. Second, the goal behind generating a description of information processing patterns was to begin generating a basis for explanation leading to suggestions for changing the ways in which educational programs can be designed and delivered to these students' patterns of learning. Descriptive research builds the foundation for discovering cause-and-effect relationships through the use of experimental research designs (Gall, Gall, & Borg, 2003). Finally, research that generates knowledge about practices helps to "shape educational policy and initiatives to improve existing conditions" (Gall, Gall, & Borg, 2003, p. 290). The intended outcome of this study was to make recommendations as to how postsecondary instruction can be designed and delivered that best fits with how these students process information.

Participants

A total of 206 American Indian/Alaska Native postsecondary students participated in the study. This convenience sample consisted of students in attendance at community colleges in the southwest. Out of the four participating sites, one community college was a tribally controlled college. The demographics that follow are based on 199 reporting cases. Seven students chose not to complete the demographic information form for reasons unknown to the researcher.

A total of 53% (n = 105) of the participants were male and 47% (n = 94) were female. The age range spanned 16 to 60. Forty-nine different Indian tribes were represented by the sample with 99 participants reporting membership in two or more tribes.

Instrumentation

A total of three learning style instruments were used in the study to answer the research questions. The purpose for using three instruments was to establish the additional validity of the results through triangulation of the data. All instruments had acceptable levels of internal and temporal reliability

as well as construct and predictive validity as previously found through available psychometric evidence, reviews of written documentation, and extensive discussion with the instrument developers (Curry, 1990). The three instruments used to measure "Cognitive Control Functions" included the Kolb (1985) *Learning Style Inventory,* the Briggs and Myers (1987) *Myers-Briggs Type Indicator: Form G,* and the Oltman, Raskin, & Witkin (1971) *Group Embedded Figures Test*. These instruments are briefly described in the following paragraphs.

The *Learning Style Inventory (LSI)* consists of 12 sentence stems, each having four sub-items to be rank ordered. Responses are organized into two bipolar concepts: concrete experience vs. reflective observation, and abstract conceptualization vs. active experimentation (see Table 1). The LSI was developed around Kolb's (1985) experiential learning model. Respondents are identified as 'convergers,' 'divergers,' 'assimilators,' or 'accommodators.'

Table 1
Description of Scales for the *Leaning Style Inventory (LSI)*

Scale	Description of Scale
Concrete Experience:	Extent to which students rely on feelings for learning.
Reflective Observation:	Extent to which students learn by watching and listening.
Abstract Conceptualization:	Extent to which students learn by thinking.
Active Experimentation:	Extent to which students learn by doing.
Converger Learning Style:	Combines the learning steps of abstract conceptualization and active experimentation.
Diverger Learning Style:	Combines the learning steps of concrete experience and reflective observations.
Assimilator Learning Style:	Combines the learning steps of abstract conceptualization and reflective observation.
Accommodator Learning Style:	Combines the learning steps of concrete experience and active experimentation.

The *Myers-Briggs Type Indicator (MBTI)* contains 143 forced-choice items each with four alternatives. Each choice is oriented towards one of four bipolar concepts: extraversion vs. introversion, sensing vs. intuition, thinking vs. feelings, and judgment vs. perception (see Table 2). The MBTI was designed to measure the constructs in Jung's theory of personality types. "The patterns of results generated by the four bipolar concepts are interpreted in terms of Jungian personality theory which in turn is used to predict behavior and attitudes" (Curry, 1991, p. 254).

The Group Embedded Figures Test (GEFT) contains 18 pictorial items, each involving the identification of non-meaningful geometric target shapes hidden within larger non-meaningful geometric shapes. Items are scored for

Table 2
Description of Scales for the *Myers-Briggs Type Indicator (MBTI)*

Scale	Description of Scale
Extravert:	Extent to which students focus their perception and judgment on people and objectives
Introvert:	Extent to which students focus their perception and judgment on concepts and ideas.
Sensing:	Extent to which students report observable facts or happenings through one or more of the five senses.
Intuition:	Extent to which students report meanings, relationships and/or possibilities that have been worked out beyond the reach of the conscious mind.
Thinking:	Extent to which students rely on thought processes to make judgments.
Feeling:	Extent to which students rely on their feelings for making judgments.
Perception:	Extent to which students use a perceptive process for dealing with the outer world.
Judgment:	Extent to which students use a judgment process for dealing with the outer world.

both time and accuracy with scores placing respondents on one bipolar scale measuring the degree of field dependence-independence (see Table 3). The GEFT "reflects an individual's. . .tendency toward more differentiated or less differentiated psychological functioning" (Witkin, Oltman, Raskin, & Karp, 1971, p. 8).

Table 3
Description of Scales for the *Group Embedded Figures Test (GEFT)*

Scale	Description of Scale
Field Dependent:	Extent to which students think globally.
Field-Independent:	Extent to which students think analytically.

Procedures

Data collection occurred during multiple sessions at the various sites throughout the spring, summer, and fall semesters of one calendar year. During the initial contact with each group of participants, consent was secured, explanation of the study was provided, and demographic data obtained. All instruments received subject codes prior to the start of data collection. The instruments were randomized using a Greco-Latin Square design to ensure that the non-essential test order effect was randomly distributed across participants.

Research assistants were recruited to help during the data collection sessions. Research assistants were trained by the researcher prior to the sessions to ensure their understanding of the proper procedures for instrument administration.

As English was not the first language for many of the participants, it was realized that certain words and phrases on the various instruments might not be understood due to possible language barriers In order to help reduce this variance within the data set, three steps were taken.

First, the sample for the study was selected only from tribal and community college settings. It was assumed that these individuals would have a higher reading level due to the completion of a high school or GED program. Consequently, the sample did not include participants from community education or adult education programs.

Second, the readability of each instrument was assessed by a group of three American Indian/Alaska Native adult educators. This process allowed the researcher to be informed, prior to testing, about any potential misunderstanding of words or phrases within the various instruments. This step provided the researcher with an understanding of how the participants might interpret certain words and phrases. It also allowed the researcher to clarify the definition and meaning of these potentially problematic words and phrases with participants prior to the start of the data collection sessions. All definitions and meanings were provided from the *Merriam-Webster Collegiate Dictionary* (1995).

Third, participants were provided with the *Merriam-Webster Collegiate Dictionary* (1995). This allowed participants to look up additional words they did not understand and consistently obtain a reliable definition. It was realized that it was impossible for the readability assessment group to identify all of the possible misunderstandings that could be faced by the participants. This step prevented participants from receiving different definitions for the same word. It was expected that a higher percentage of the variance within the data set could be accounted for by taking these steps.

All completed instruments were returned to the researcher. Those instruments that were completed inaccurately and/or were missing data were discarded. The researcher and the assistants scored the usable instruments. As with the data collection, research assistants were trained by the researcher on how to score the different instruments. Instruments were randomly selected and re-scored by the researcher to check for accuracy. The data from the scored instruments were entered into an Excel data file and verified for accuracy. The data set was then transferred to the Statistical Package for Social Science (SPSS) for analysis.

Data Analysis

Data were analyzed in three ways. The data were first analyzed descriptively according to the scoring protocol for each instrument. For all three instruments, this involved calculating a mean score for each of the bipolar constructs using data directly produced by the respective test. Using the mean scores from the instruments and the formulas presented in the scoring protocols, an informational processing "type" or learning style was derived.

To bring additional validity to the information processing type found through the descriptive data, *t* tests for paired differences were conducted on the means produced by the bipolar scales for two instruments (LSI and MBTI). This allowed the researcher to determine the likelihood that one preference over the other was based on chance.

Finally, the data were subjected to the multivariate analysis of multidimensional scaling (MDS) as the purpose of the study was to discover new constructs and help in theory development. While the MDS procedures bear a certain conceptual similarity to techniques such as factor analysis, the advantage was that it is more applicable to a wider variety of data (Fitzgerald & Hubert, 1987). This technique is explicitly directed toward the task for spatial representation and, in many cases, it is capable of providing lower dimensional solutions that are substantively interpretable.

Results

Measures of Central Tendency and Statistical Differences

Kolb Learning Style Inventory. The dominant learning style found for this particular group of students was that of the 'Diverger' which combines the components of concrete experience (feelings) and reflective observation (watching). This particular style accounted for 32.3% (n = 60) of the total sample. The second learning style strongly reflected in the sample was that of 'Assimilator' which combines the components of abstract conceptualization (thinking) and reflective observation (watching). This particular style accounted for 29.6% (n = 55) of the total sample. The results of the *t* test of paired differences for the two bipolar scales revealed slightly different results.

The participants reported statistically significant preferences for 'abstract conceptualization' (M = 28.24, SD = 5.28) over 'concrete experience' (M = 26.66, SD = 6.60), t (188) = -2.26, p = .03. Additionally statistically significant preferences were found for 'active experimentation' (M = 33.44, SD = 6.12) over 'reflective observation' (M = 31.66, SD = 6.60), t (188) = -2.33, p = .02. Consequently, both the descriptive analyses and the *t* tests suggest stronger preferences for learning by thinking. However, the *t* test suggests a greater preference for learning by doing. Possible reasons for these outcomes will be discussed later in the paper.

Myers-Briggs Type Indicator. Using the scoring protocol for the *Myers-Briggs Type Indicator,* two types emerged from the data as being dominant. These included the "ISTJ" and "ISTP" types. Each accounted for 13.7% of the learning/personality types. Because 16 different possible types exist, the distribution percentages will be lower even for the ones identified as being dominant.

According to Myers and McCaulley (1985), both types are more comfortable with ideas than with people and things. They would rather work with known facts than look for relationships. Their judgments are based more on impersonal analysis than on personal values. For one group, the

preference is for planned, orderly ways of life (J) rather than flexible, spontaneous ways (P).

Looking at the results from the *t* test of paired differences, support is provided for the 'sensing' and 'thinking' factors; however, the remaining factors are still in question. There were no statistical differences found on the 'extravert' (M = 13.30, SD = 5.71) vs. 'introvert' scale (M = 13.26, SD = 5.88), t (182) = .05, p = .96. Additionally, there were no statistical differences found between the 'judgment' (M = 12.88, SD = 6.14) vs. the 'perception' scale (M = 14.31, SD = 6.34), t (181) = -1.49, p = .14. However, the participants reported statistical preference for the 'sensing' dimension (M = 16.47, SD = 6.06) over the 'intuitive' dimension (M = 10.16, SD = 4.62), t (182) = 8.50, p = .001. Finally, the participants showed statistical preference for the 'thinking' dimension (M = 14.46, SD = 6.54) over the 'feeling' dimension (M = 9.03, SD = 4.03), t (182) = 7.58, p = .001.

It should be noted that it can be difficult to find statistically significant differences on these scales but still be assigned a "type" according to the instrument scoring protocol. In the case where scores for the variables on a bipolar scale are tied, scoring instructions identifying which type to assign. For example, should the scores on the extravert-introvert scale be tied, 'introvert' is assigned as the type.

Group Embedded Figures Test. The results do not indicate a clear preference for either field-dependence or field-independence (M = 10.96, SD = 5.25). Field-independence is based on a mean score of 11.4 or higher. Rounding both the mean score of the participants and the cutoff score for the instrument would produce scores of 11 respectively. Without rounding off the means, the group appears to be field-dependent, representing a holistic, global approach to information processing.

Multidimensional Scale

The two-dimension solution for the information processing construct is presented in Figure 1. Normally, solutions can be found using two dimensions and, as Everitt and Dunn (1991) report, two dimensions are usually most practical because of their simplicity. Using Fitzgerald and Hubert's (1987) criteria, the two-dimension MDS solution had a "relatively good" goodness-of-fit at 8% stress. The RSQ for this scaled accounted for 98% of the variance in the data set.

For this scale, the horizontal axis (dimension 1) was labeled ***Degree of Importance.*** The vertical axis (dimension 2) was labeled ***Degree of Influence.*** Dimension 1 identifies the degree to which a particular factor is important for information processing. Dimension 2 identifies the extent to which each factor is used for information processing. This solution visually represents the information processing patterns for these participants.

Quadrant I (upper right) identifies abstract conceptualization and reflective observation as the factors that have both a higher degree of

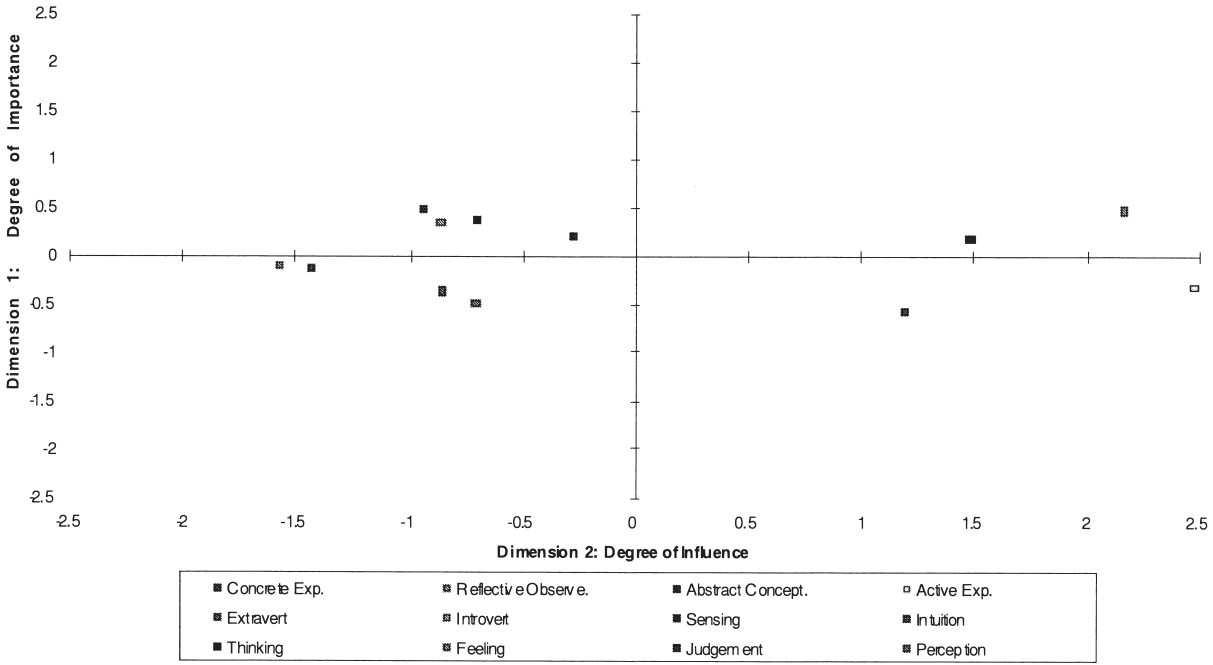

Figure 1. 2-Dimension MDS Solution for Information Processing

importance and higher degree of *influence* on information processing compared to the remaining three quadrants. Quadrant II (upper left) identifies judgment, introvert, thinking, and sensing as the factors that have a higher degree of *influence* on information processing compared to Quadrant III (lower left) but are not as *important* to information processing compared to Quadrant I (upper right). Quadrant III (lower left) identifies feeling, intuition, extravert, and perception as the factors that have both a low degree of *importance* and a low degree of *influence* on information processing compared to the remaining three quadrants. Quadrant IV (lower right) identifies concrete experience and active experimentation as factors that have a higher degree of *importance* on information processing compared to Quadrant II (upper left) but do not have as much *influence* in the actual process compared to Quadrant I (upper right).

Conclusions and Discussion

The purpose of this study was to examine the cognitive/information processing patterns of American Indian/Alaska Native students enrolled in community and tribal colleges. This study was important within an already existing body of research on the cognitive learning style patterns because of its focus on the postsecondary student. The conclusions and resulting discussion are drawn from descriptive and developmental as well as methodological and theoretical perspectives. The descriptive conclusions offer just that – descriptions of what is. However, the developmental conclusions are those that allow us to begin understanding the similarities and differences in these patterns from a longitudinal perspective over the course of the life-span. The one methodological conclusion suggests a way to think about future data analyses while the theoretical conclusion finds additional support for Curry's (1991) learning theory. Based on the results of this study, the following conclusions and discussion are offered.

Although three learning styles from the *Kolb Learning Style Inventory* could potentially describe the information processing patterns of these students, the 'assimilator' learning style best captures how these students process information. This learning style combines abstract conceptualization (learning by thinking) and reflective observation (learning by watching). According to Kolb (1985) "[p]eople with this learning style are best at understanding a wide range of information and putting it into concise logical form. [Assimilators] are less focused on people and more interested in abstract ideas and concepts. [Individuals] with this learning style find it more important that a theory have logical soundness and practical value" (p. 7). It is important to remember that until the solution from the multidimensional scaling (MDS) was generated, this pattern was not clear. From a developmental perspective, these same patterns of learning have been found for elementary and secondary students through literature reviews by Aragon (1996), Dunn and Griggs (1995), Irvine and York (1995), and Pipes, Westby

and Inglebret (1993) covering the last decade. Consequently, the findings from this study do suggest that learning through watching and thinking develops at a young age and carries the individual from elementary through the first two years of postsecondary education.

Second, the study suggests that the 'ISTJ' pattern best describes these postsecondary participants. According to Myers and Myers (1988), these individuals are "serious, quiet [and] earn success by concentration and thoroughness" (n.p.). They are described as practical, orderly, matter-of-face, logical, realistic, dependable, well-organized, and responsible. They "make up their own minds as to what should be accomplished and work toward it steadily, regardless of protests or distractions" (Myers & Myers, 1988, n.d.).

These findings are congruent with the findings from the Kolb *LSI* in the sense that both identify these individuals as relying on careful thought and use of data for learning. These findings conflict somewhat with those published by Nuby and Oxford (1998) who found a sample of American Indian high school students to represent the "ESTP" pattern. While both the present study and the Nuby and Oxford study found students to be sensing and thinking in their approach to learning, differences were found on the introvert/extrovert and judgment/perception scales. It is not clear that these differences are due to the fact that the participants in the Nuby and Oxford study were high school students while the participants in the present study were postsecondary students. However, as noted earlier, it is important to keep in mind that individuals can be separated on each scale by one point and with data scattered across 16 possible different types, it will be harder to detect differences. Equally important to remember, it was not until the data from the present study were subjected to a multivariate analysis that the 'ISTJ' pattern emerged. Up until this point, the previous data analyses could not find significant differences on the introvert/extrovert and judgment/perception scales. Unfortunately, few studies have looked at the learning style patterns of American Indian /Alaska Natives through the *MBTI,* which would allow better understanding for the differences found between the present and past studies. Consequently, both the present study and the Nuby and Oxford study should be viewed as starting points of additional research.

Third, while both the 'ISTJ' and 'assimilator' styles *influence* information processing for these students, the activities associated with the 'assimilator' learning style are more *important* to learning success. While both of these styles have similarities in what they offer to information processing and both clearly influence learning, reflective observation and abstract conceptualization are more dominant. This is a logical conclusion from the data as the 'assimilator' more closely matches the 'watch-then-do' approach that characterize these students as found through past research.

Fourth, the students in this sample appear to be able to draw equally from both analytical (field-independent) and global (field-dependent) forms

of information processing. At first glance, the findings from this study appear to be in conflict with previous reviews, which have identified American Indian/Alaska Native students as field-dependent (Dunn & Griggs, 1995; Pipes, Westby, & Inglebret, 1993). However, according to Jonassen and Grabowski (1993), FD/I appear to change over time. Children are generally field-dependent but their field independence increases as they become adults. Over time, however, field independence gradually declines with older individuals tending to be more field-dependent. Field independence has been found to increase with the amount of formal education an individual acquires. Consequently, the results from this study may be revealing the developmental shift from field dependence to field independence as the students move from adolescence into young adulthood and are exposed to more formal education.

While clearly in need of additional research, it is logical that the nature of the work and structure of the classroom environment to which students are exposed will lead to the development of abilities that will allow them to be successful in those situations. For example, while subjects such as math and science have global aspects, ultimately to be successful in each area requires the ability to apply analytical forms of thinking. The findings from this study are not suggesting a replacement of one form of thinking over another but rather an integration of the two over the course of the lifespan.

Fifth, the results of this study suggest that the cognitive learning patterns that American Indian/Alaska Native students develop early in life are relatively stable and possibly expand over the lifespan. This is congruent with Curry's (1991) theoretical framework of learning. Because cognitive controls/information processing does not interact directly with the environment, these patterns are relatively permanent dimensions of one's personality. It does not mean that no changes will take place or individuals cannot develop new processes. What it does suggest is those abilities we develop early in life tend to remain at the core of our learning.

Finally, using multivariate analyses are essential for detecting small differences in survey data. As was the case for the *LSI* and *MBTI* data, the strongest patterns were not found until the data were subjected to the multidimensional scaling (MDS) technique. Up until that point, it appeared that the results generated from the descriptive analyses and the comparative analyses were finding conflicting results. However, once the data were subjected to MDS the patterns became clearer and with the help from current literature, stronger conclusions were able to be drawn. It is especially important to use such multivariate analyses when the results from learning style instruments are calculated from simple means. While this is an adequate approach for finding the overall patterns of learning, in order to further validate and enhance the ability to base implications and future research upon the results requires much more rigorous analysis. The analyses need to be able to detect small amounts of variance in order to produce the highest level of validity possible.

Implications for Practice

The results from this study suggest various strategies that instructors can integrate into a tribal and community college classroom. Many of these strategies are not necessarily new in the sense they have been presented in previous studies. However, until this study, it was not clear if some of those same approaches could be implemented with postsecondary students due to the fact previous research was based on elementary and secondary students. The results from this study suggest that cognitive processing patterns students develop early in life carry through to postsecondary education. Therefore, similarities do exist among the ways learning can be facilitated for all students regardless of educational level. The following recommendations are offered to postsecondary instructors for optimizing learning based on the findings from this study.

First, as found by Aragon (2004) in his review of the literature, it is well-established that elementary and secondary students possess a 'watch-then-do' or 'listen-then-do' learning style. This approach to learning was found among the postsecondary students of this study. Consequently, instructors should incorporate instructional methods that allow for reflective observation (learning by watching and listening) and abstract conceptualization (learning by thinking). There are several methods that work well for addressing this approach to learning. Such strategies include lectures, demonstrations, case study, individual/group inquiry, reflection journals and application problems. The major point to keep in mind is regardless of what instructional method or assignment is used, it is important to allow these students the opportunity to watch a process take place and think about that process and related material before being asked to perform it themselves.

Second, instructors should facilitate the development of analytical thinking. As discussed in a previous section of this paper, research has found as individuals move into adulthood, their information processing shifts from field-dependent to field-independent. The data from this study suggest that these students are in the midst of transition. Piaget would describe this as the 'formal operational' period of cognitive development when adolescents or adults are able to think about abstractions and hypothetical concepts. Individuals can reach this stage as late as age 20 while many adults never reach this level (Merriam & Caffarella, 1998). Consequently, instructors should focus on presenting information in ways that use both global and analytical forms of thinking to help ensure that this period of cognitive development is achieved. Consequently, class content should be presented in ways and through instructional methods that move the student through deductive to inductive, inductive to deductive, general to specific, specific to general, etc. forms of thinking.

Finally, all individuals need to avoid what has been identified as the 'definitive answer syndrome' (Bonham, 1988a, 1988b; Conti & Welborn,

1986; Dixon, 1985; Sawyer, 1991). In this situation, learners, instructors, and other users of learning style instruments assume that these instruments are capable of providing definitive answers about an individual's or group's learning style. When the results of these tests are used to label or group students for instruction or when the students come to believe that they can learn in *only* one manner, the validity of the instruments have been stretched beyond supportable limits. Dixon (1985) states "learning style instruments are best used as tools to create awareness that learners differ and as a starting place for each individual's continued investigation of self as learner" (p. 17). It is essential that instructors keep in mind that all students possess all of the learning characteristics described through each of the three instruments. This is clearly represented through the results of the multidimensional scaling (MDS) solution. The instruments are designed to identify the areas in which the learners are strongest. While capitalizing on the learners' strengths, instructors should, at the same time, help students develop those information processing strategies that may not be as developed but valuable to the learning process.

Implications for Future Research

This research study filled an existing void in the current American Indian/Alaska Native research literature by examining the cognitive learning styles of postsecondary students in tribal and community colleges. This study was significant in that the research up to this point had, for the most part, examined only elementary and secondary students. While this body of research has been thorough and rather conclusive in its findings, whether the findings could be extended to postsecondary students was not clear. While this study has extended the understanding of learning related to postsecondary students, there is more that needs to be known. The following are recommendations for research that can help to further build this area of knowledge.

First, it is clear that more research is needed in the area of postsecondary student learning styles. While this study has extended the existing research, the findings were based on a small sample of the total American Indian/Alaska Native population. Just as the knowledge regarding elementary and secondary student learning styles has been built over several studies, the same is required to build a strong foundation of knowledge related to postsecondary students. It is recommended that future studies be replicated based on the method of the present study, using the same psychometrically sound instruments.

Second, more research is needed that identifies how the cognitive processing patterns of adult American Indian/Alaska Native students change throughout the college years. Such data would be beneficial to community colleges and universities in terms of identifying various instructional services, instructional practices, and instructional initiatives that could help

improve the learning success of these students. While longitudinal research would be ideal, the time it would take to collect enough data to be informative would be extensive. Therefore, cross-sectional research is recommended in which data would be collected from students with various demographic characteristics and from various educational settings. Cultivating such a data set over time would allow for numerous between and within group comparisons, leading to a wealth of knowledge and understanding non-existent at the present time.

Finally, research needs to be undertaken to better understand what students know about their learning processes. This is often times referred to as 'learning how to learn.' As Fink (2003) discusses, "this kind of learning enables students to *continue* learning in the future and to do so with *greater effectiveness*" (p. 32). However, students are able to achieve this continued effective learning only if they first know their strengths and weaknesses and how best to incorporate them into the learning process. Oftentimes a student's learning style is assessed without feedback to that student on what the results are or what they mean for learning. Developing a comprehensive profile of what students know about their learning has positive implications on student development as well as development and delivery of instruction.

Summary

Vasquez and Wainstein (1990) stated that much of the literature dealing with students of color had suggested that educational institutions and the faculty within them view student differences as "inherent deficiencies" in need of correction. The result of these so-called deficiencies had led to the academic failure of these students. I first read Vasquez and Wainstein's discussion in 1991 while taking a course in multicultural education as part of my doctoral program. It was at that time I knew I wanted to enlighten educators to the learning style patterns of American Indian/Alaska Native students because I was American Indian and had been successful in postsecondary education.

Over the course of this three-part series on postsecondary American Indian/Alaska Native learning styles, I hope I have done just that. However, it is important to remember that our understanding of the issues facing the success of these students within higher education settings – especially tribal and community colleges – is far from complete. This series of empirical studies has provided a good starting point for curriculum design and delivery. As educators and researchers, we must keep in mind that this series of articles included a select group of postsecondary students. There are large numbers of students in colleges and universities about which we know nothing. We must also remember that quantitative research methods are designed to understand the "average" or "typical" case. A number of the students did not fall into this category and should not be forgotten.

The risk factors for American Indian/Alaska Native students in particular as well as all students of color in general are continuing to grow. It is

not only essential that we begin exploring different ways of reaching these students through alternative instructional formats but, in the meantime, ensure the current ones to which they are exposed are high-quality. By taking proactive approaches to education and learning from those who have been successful, we help reduce the chances that these and future students will slip through the cracks and drop out of higher education.

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