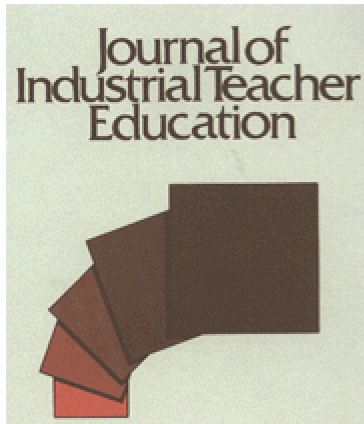

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ARTICLES

Topography of Learning Style Preferences of Undergraduate Students in Industrial Technology and Engineering Programs at Historically Black and Predominantly White Institutions

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There has been a growing awareness among educators of the increasing diversity in college classrooms. Currently, institutions are seeing an increase in students of color who are pursuing advanced degrees. Pallas, Natriello, and McDill (1989) predicted that by the year 2020, 46% of the student population in this country will be students of color. During the same period of time, European-American enrollment in universities is projected to decrease from approximately 84% in 2000 (U.S. Census, 2000) to approximately 63% by the year 2015 (Degroat, 2000). This change in the demographics of our nation and schools will have tremendous impact on the way faculty teach at universities and colleges.

An understanding of how individuals or groups of individuals learn is essential to designing and implementing the shift in teaching practice so that all students benefit. According to Sims and Sims (1995), "Educators must have more knowledge and understanding of the learning process, particularly how individuals learn" (p. 1). Research has been undertaken pertaining to the learning style preferences of students of color, particularly for those enrolled in technological programs at universities, as capable of greatly influencing the educational future of our nation; in the 21st century, students of color and European-American students will be faced with increasing technological demands.

Learning style research is not just a concept anymore, but rather a viable and necessary teaching methods reality check for educators. As practitioners become more aware of various learning styles, they are more apt to modify their teaching behaviors. Although some educators do not favor learning style research, there is support for the use of this research in the classroom (Kaminski, 1999). Wooldridge (1995) defined learning styles as ". . . an important element in the design of effective instruction and design and delivery" (p. 65). Brown (1998) gave further emphasis to this definition by adding, "Learning styles and the creation of effective learning environments are of emerging significance in education as the changing nature of work requires higher-order thinking" (p. 1).

Learning style research originally focused primarily on K-12 students (American Association of School Administrators, 1991). Those early studies also focused primarily on nonminority individuals. In addition, though few studies exist at the post-secondary level, even fewer dealt with students of color (Swanson, 1995). Furthermore, only a limited number of studies have been conducted in technology and engineering programs at post-secondary institutions. More recently there has been an emergence of studies on learning styles of students of color at the elementary and secondary school levels, but postsecondary and technological program studies remain rare.

African-American students at predominately white institutions (PWIs) continue to experience academic difficulty in their disciplines (Allen, 1987). The majority of African-American students, who continue to struggle academically, are faced with a traditional pedagogy that does not complement the way they prefer to learn in the classroom (Hale-Benson, 1986; Kunjufu, 1984).

As the population of students of color increases, faculty will have a more challenging and difficult task in preparing these students for a high-skilled technological society. This point is all the more critical because all educational institutions are functioning in a state of greater accountability (Wooldridge, 1995). Many of these mandates focus on quality evaluation of instruction in the classrooms.

Students of color bring different kinds of learning style preferences to the classroom that faculty may not be able to address accordingly. Anderson and Adams (1992) stated:

> One of the most significant challenges that university instructors face is to be tolerant and perceptive enough to recognize learning differences among their students. Many instructors do not recognize learning differences among their students. Many instructors do not realize that students vary in the way that they process and understand information. The notion that all students' cognitive skills are identical at the collegiate level [indicate] arrogance and elitism by sanctioning one group's style of learning while discrediting the styles of others. (p. 19)

"The aim of learning style research is to find clusters of people who use similar patterns for perceiving and interpreting situations. Based on this information, educational environments can be adjusted to make them more efficient and successful places" (O'Connor, 2000, p. 2). O'Connor further explained learning style research as being ". . . drawn out of studies about the psychological, social, and physiological dimensions of the education process" (p. 1). These dimensions are a fundamental part of the learning process.

Purpose of Study

The purpose of this study was to determine the learning style preferences of African-Americans and European-Americans enrolled in industrial technology and engineering (ITE) programs. This was the first step toward gathering information on the learning styles possessed by ethnically diverse students in the two disciplines. Information from this study can help faculty in ITE programs become aware and informed of the learning styles of students in the classroom of their given environment.

Research Questions

In order to examine to learning style preferences of African- American students in ITE programs at the historically black colleges and universities (HBCU) and European-American students at the predominately white institutions (PWI), these questions were addressed:

1. Is there a difference between the factor loading profiles of the learning style preferences of African-American students at the HBCU and the factor loading profiles of the learning style preferences of European-Americans at the PWI?
2. Does a difference exist between the factor loading profiles of ITE African-American students in the HBCU and for ITE European-American students at the PWI?

Review of the Literature

An individual's learning style includes cognitive, affective, and physiological domains which are influenced by environmental factors (Keefe, 1987). Keefe (1979) described learning style as a:

> ". . . diagnosis [that] opens the door to placing individualized instruction on a more rational basis. It gives the most powerful leverage yet available to educators to analyze, motivate, and assist students in school . . . it is the foundation of a truly modern approach to education." (p. 132)

According to Dunn, Beaudry, and Klavas (1989), "Learning style is a biologically and developmentally imposed set of personal characteristics that make the same teaching method effective for some and ineffective for others" (p. 50).

Early Research Between the 1890s and the 1940s

Learning style research first emerged around 1892, with the majority of the research appearing in the 1940s (Keefe, 1987). At that time, learning style research results represented only one cultural group. Specifically, these early studies were conducted using students who were American males of European descent from middle class backgrounds (Swanson, 1995).

After World War II, research on cognitive learning continued at Brooklyn College, at the Fels Institute, and at the Menniger Foundation (Keefe, 1987). The results from these studies varied. Researchers at Brooklyn College developed the bipolar trait of field dependence-independence. Researchers at the Fels Institute researched analytic and nonanalytical functions. For example, an analytical learner will analyze a situation carefully then proceed to answer the question, while a non-analytical learner makes quick responses or judgments. Researchers at the Menniger Group studied various ways of thinking and problem solving using analytical modes of learning.

These early studies provided essential information that helped form the basis for brain research by exploring global/analytical, field independent/dependent, and right- or left-brain information processing (Dunn & Griggs, 2000).

Recent Learning Style Research Between the 1950s and the 1990s

Learning style research proliferated throughout the 1950s and 1970s, during which time educators began to apply, as a direct result from this research, new teaching techniques in the classroom (American Association of School Administrators, 1991). Soon models, inventories, surveys, and instruments of all kinds were developed to quantify, measure, and examine students' ways of perceiving and absorbing information.

Between 1979 and 1989, learning style research was conducted at more than 60 universities (Dunn, Beaudry, & Klavas, 1989). Dunn and Griggs (1989) pointed out that learning is not just receiving information from the teacher. Educators must recognize that students come to their classes with diverse ways of perceiving information and that students need suitable climates in order to perform to their maximum ability. Dunn and Griggs argued:

> Learning style is not simply a concept discussed by researchers and psychologists. It is the key to improving school climate and student achievement by recognizing that all people are not the same, and that all students do not learn in the same way. (p. 1)

In all facets of education, students must have the opportunity to explore their learning capabilities to succeed academically. Carbo and Hodges (1988) explain that "Students who understand and then are provided opportunities to make use of their learning styles tend to feel valued, respected, and empowered" (p. 57). Hein and Bundy (1999) similarly stated, "Acknowledgement of students' individual learning styles can play a critical role in the learning process. Furthermore, the use of formal learning style assessments can provide useful information that benefits the student as well as the instructor" (p. 7).

However, learning styles must first be assessed. That is the purpose of this paper. Moreover, the purpose of this study was to determine and then map in a topographical fashion (Lubinski & Dawis, 1992) the learning style preferences of African- American and European-American students enrolled in the ITE major at two major U.S. universities, one predominantly white institution and one historically black institution.

Learning Styles Assessment

The assessment and subsequent prediction of learning style differences may be cast in the light of the Lubinski and Dawis (1992) solution for mapping the positive ability manifold. The positive ability manifold refers to the existence of positive correlations among all cognitive-based tests. That there exists a strong correlation among tests of this type refers to the positive manifold of the cognitive domain.

Lubinski and Dawis (1992) recognized the three-fold manifestation of cognitive ability as being represented by verbal, quantitative, and spatial content areas, represented graphically by the radex of abilities. Hierarchically, at the vortex of these three rests the general cognitive ability index, which accounts for as much as 50% of the communality of the radex. Identifying a test's location within the radex makes it possible to identify other tests that are psychologically close in terms of subject matter. Progressing from the periphery to the center of the radix, test complexity increases, but content remains the same. Remaining at any one concentric level, but revolving around the radix, identifies tests with identical complexities but with different content areas. This system allows for the assessing of tests in terms of their covariation.

In an applied setting, testing may occur to identify individual aptitude for various applications and uses. Prior knowledge of the type of ability that is best suited for the application (e.g., job, mental task, etc.) will enable factor scores to be constructed (through factor analysis) for successful predictions. These may be tested for predictive efficacy (and thus scientific significance) by examining their external correlates (Lubinski & Dawis, 1992). Doing so would establish extrinsic convergent validation of the predicted criteria. It is in this way that learning style preference assessment is deemed scientifically useful. Learning style research results when it is applied through teaching, making learning style preference assessment practically useful. Theoretically, this practice rests upon the individual differences research identified as useful many years ago.

Treating each individual as a special combination of capacities, accomplishments, and tendencies has been far more productive than treating individuals as though they were all alike or as though they belonged to mutually exclusive types (Ackerman & Humphreys, 1990). The authors suggested that topographical mapping of students' abilities and aptitudes take place, to include learning style preferences and other scientifically relevant variables, as identified by research and practice. Such mapping would create an inventory that could be used to match students with high-yield educational situations by serving as a visual map of student ability, aptitude, and interest.

Methodology

Population and Sample

The population used in this study consisted of undergraduate students in ITE programs at two U.S. universities, one a PWI and the other an HBCU. The criteria for selecting the institutions for the study were based on their student population characteristics (i.e., the HBCU student population consists primarily of African-American students; the PWI student population consists primarily of European-American students) and the fact that both are land-grant institutions that offer accredited ITE programs. Convenience sampling was used to collect data from 540 students. This sampling technique ensured voluntary participation from ITE students at the two institutions.

Table 1 illustrates the breakdown of the sample according to the students' classification for the ITE programs at the PWI and the HBCU.

Table 1
Classification of Participants

	HBCU		**PWI**	
	IT	**ENG**	**IT**	**ENG**
Freshman	24	22	11	31
Sophomore	29	38	32	29
Junior	32	38	28	33
Senior	46	43	66	43
Total	131	136	137	136

Design of the Study

This study utilized a correlational statistical methodology and a quasi-experimental design to characterize the participants according to their learning style preferences, based on the independent variables utilized in the study. The independent variables for this study were (a) institution type (doctoral/research-extensive vs. master comprehensive I), (b) discipline (industrial technology or engineering), and (c) ethnicity (African-American and European-American). The dependent variables for this study were the 20 Learning Style Preferences from the Productivity Environmental Preference Survey (PEPS) inventory.

Instrumentation

The PEPS inventory (Price, 1996) was used to assess learning style differences among the participants because the PEPS survey is considered ideal to examine adult learning styles (Price, 1996; Dunn & Griggs, 2000). This instrument is based on the Dunn and Dunn learning style theory. The PEPS consists of a 100-question survey that is administered by paper, computer, or orally. This study employed the paper version.

The PEPS questions are answered using an interval scale with numerical values that yield a quantitative score. A five-point Likert-type scale, with anchors ranging from "least preferred" to "strongly preferred, is used to assess each learning style preference. Students are encouraged to select the first response to each question as if they were learning something new.

There are 20 learning styles question representations in the survey. The survey is standardized, with scores ranging from 20 to 80 points, with a mean of 50 points and a standard deviation of 10 points. A score of 40 or less represents a least preferred learning style, while scores of 60 or more represent a most preferred style (Price, 1996).

Procedure

The deans and department chairs from the HBCU and the PWI were contacted to obtain permission to conduct this research on campus. The survey was given to students in each college/school. A designated location was used for students to take the survey. The data collection process at the HBCU site took one week, as did the PWI site.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS®). Specifically, exploratory factor analysis was used to ascertain the constructive groupings and correlations among the 20 elements. Table 2 provides a description of the 536

Table 2
Demographic Data of Participants

	Institution			
	HBCU		**PWI**	
	IT	**ENG**	**IT**	**ENG**
African-American	131	131	3	2
European-American	0	5	134	134
Total	131	136	137	136

participants. Four PEPS were identified as unusable and discarded. This was the appropriate technique, since exploratory factor analysis may be used when there is no prior knowledge of factor structures or to determine the number of common factors that exist in a set of observed or latent variables (Kim & Mueller, 1978). Standardized scores from the PEPS 20 elements were used for the factor analysis. The factors were generated using the principal components extraction and varimax rotation methods. The factors for each of the structures generated for ethnicity and discipline were labeled.

Findings

The results of the factor analysis revealed several patterns among the ITE students. Variables that exhibited confused loadings were removed from the analysis. Confused loadings occur when variables load on more than one factor with acceptably high loading values. To help select the purest factors, the following decision rule was developed.

- If a variable's loading was equal to or less than .3, the variable was removed.
- If acceptably high double loading occurred (regardless of the sign of the loading), the variable was removed.

Each factor structure was given a label based on the characteristics of the variables that loaded strongly on the factor. Because the first variable (learning style) listed in each of the factor loading structures had the highest factor score, it was therefore considered the most influential learning style in that factor.

The factor analysis for the African-American students at the HBCU revealed eight factors with eigenvalues greater than 1.00. Together these explained 66.6% of the total variance in the factor structure for African-American students. The top three learning styles of factor one accounted for 33.5% of the total variance in the factor loading profile. Five learning styles were removed from the factor structure because of confused loading. The first learning style (motivated) in Factor One accounted for 13.4% of the variance.

The first factor loading profile for African-American students showed motivated (.789), persistent (.719), and kinesthetic (.643) as the top three learning style preferences. Table 3 provides the factor analysis results, and Table 4 provides the names for the factors.

Table 3
Factor Loading Profiles for African-Americans at HBCU

	Factors							
Learning styles	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Motivated	**.789**							
Persistent	.719							
Kinesthetic	.643							
Afternoon		-.936						
Late morning		.836						

Time of day		.783						
Alone/peers			.872					
Several ways			-8.36					
Auditory				.752				
Structure				.744				
Design					.686			
Temperature						.700		
Authority figure						.648		
Mobility							.828	
Visual								.916

Note: Factor loading score in bold is the most influential.

Table 4
Factors of African-Americans at HBCU

Factor	**Name**
1	Physically involved/independent oriented learner
2	Time oriented learner
3	Social Oriented learner
4	Detail by listening oriented learner
5	Environmental/no-time out learner
6	Attitudinal/dependent learner
7	Movement oriented
8	Sight oriented learner

In the factor structure for European-American students, seven factors were identified with eigenvalues greater than 1.00. Together they explained 64.5% of the total variance in the factor structure for European-American students. Two learning styles were removed from the factor structure because of confused loading. In Factor One, the three variables together accounted for 34.3% of the total variance for the factor loading profile. The first learning style (responsible) in Factor One accounted for 12% of the total variance. The first factor loading profile in the factor structure revealed responsible (.801), motivated (.703), and persistent (.694) as the top three learning style preferences. The factor loading and names of the factors are displayed in Tables 5 and 6. A comparison between the HBCU and the PWI is noted in Table 7.

For the industrial technology students at the HBCU, eight factors were identified with eigenvalues above 1.00. Together, they explained 68.4% of the total variance in the factor structure for those students. Three learning styles were removed from the factor structure because of confused loading. The combined top three variables on Factor One accounted for 33.7% of the total variance for the factor loading profile. The first learning style (motivated) in Factor One accounted for 13.9% of the total variance. The first factor loading profile for industrial technology students showed that motivated (.802), persistent (.774), and kinesthetic (.736) were the top three learning style preferences. Table 8 provides the factor analysis results, and Table 9 provides the names of the factors that explain the factor structure.

Table 5
Factor Loading Profiles for European-Americans at PWI

	Factors						
Learning styles	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Responsible	**.801**						
Motivated	.703						
Persistent	.694						
Afternoon		-.937					
Late morning		.848					
Time of day		.767					
Authority figure			.681				
Tactile			-.647				
Structure			.637				
Kinesthetic			.609				
Several ways				.865			
Alone/peers				-.853			
Design					-.656		
Intake					.656		
Noise					.598		

Auditory						.810	
Visual						-.764	
Temperature							.841

Note: Factor loading score in bold is the most influential.

Table 6
Factors of European-Americans at PWI

Factor	**Name**
1	Complex/independent oriented learner
2	Time oriented learner
3	Hands-on/coached oriented learner
4	Environmental/no-time out learner
5	Soft environmental/learner
6	Hear/sight oriented learner
7	Climate oriented learner

Table 7
A Comparison of the First Factor Loading Profiles by Ethnicity

African-American	**European-American**
Motivated	Responsibility
Persistent	Motivated
Kinesthetic	Persistent

In the factor structure for engineering students at the HBCU, eight factors were identified with eigenvalues greater than 1.00. Together, they explained 68.5% of the total variance in the factor structure. Three learning styles were removed from the factor structure because of confused loading. Factor One's combined top three learning styles accounted for 32.9% of the total variance in the factor loading profile. The first learning style in Factor One accounted for 12.2% of the total variance. Factor One revealed these learning style preferences for engineering students: motivated (.789), responsible (.753), and persistent (.700). Table 10 provides the factor analysis results, and Table 11 provides the names of the factors that explain the factor structure.

In the industrial technology program student responses, eight factors were identified with eigenvalues greater than 1.00. Together, they explained 71% of the total variance in the factor structure for students in industrial at the PWI. One learning style was removed from the factor structure because of confused loading. Factor One's top five learning styles combined accounted for 51.9% of the total variance in the factor loading profile. The first learning style (motivated) in Factor One accounted for 13.8% of the total variance. Factor One revealed these learning style preferences in the factor loading profile: motivated (.790), persistent (.714), responsible (.711), kinesthetic (.701), and tactile (.510). Table 12 provides the factor analysis results, and Table 13 provides the names of the factors that explain the factor structure.

For engineering student responses, seven factors were identified with eigenvalues greater than 1.00. Together, they explained 66.8% of the total variance in the factor structure. Two learning styles were removed from the factor structure because of confused loading. The top three learning styles combined accounted for 35% of the total variance in the factor loading profile. The first learning style (authority figure) in Factor One accounted for 12.1% of the total variance. Factor One revealed that authority figure (.715), kinesthetic (.701), and tactile (.660) were the learning style preferences for engineering students (see Tables 14 and 15).

There were visual component differences when comparing the Factor One loadings. When looking more closely at the factor structures for industrial technology and engineering at both institutions, the Factor One loadings were different in learning style composition. These differences are deemed important since the first factor, and the strongest loadings on that factor best represent the participants' learning style profiles.

Table 8
Factor Loading Profiles for Industrial Technology Students at HBCU

	Factors							
Learning styles	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Motivated	**.802**							
Persistent	.774							
Kinesthetic	.736							
Afternoon		-.927						
Late morning		.862						
Time of day		.742						
Alone/peers			.823					
Several ways			-.786					
Temperature			.518					

Design				.712				
Intake				-.646				
Auditory					.802			
Structure					.752			
Responsible					-.526			
Authority figure						.855		
Visual							.857	
Mobility								.750

Note: Factor loading score in bold is the most influential.

Table 9
Factor Loading Profiles for Engineering Students at HBCU

				Factors				
Learning styles	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Motivated	**.789**							
Responsible	.753							
Persistent	.700							
Afternoon		-.933						
Late morning		.843						
Time of day		.816						
Alone/peers			.881					
Several ways			-.874					
Temperature				.669				
Authority figure				.637				
Tactile				.566				

Auditory					.798			
Structure					.690			
Intake						.645		
Light						-.579		
Mobility							.788	
Visual								.932

Note: Factor loading score in bold is the most influential.

Table 10
Factors of Industrial Technology Students at HBCU

Factor	Name
1	Hands-on/independent oriented learner
2	Time oriented learner
3	Nonsocial/climate oriented learner
4	Environmental/no-time out learner
5	Independent/detailed/listener learner
6	Reassurance oriented learner
7	Sight oriented learner
8	Movement oriented learner

Table 11
Factors of Engineering Students at HBCU

Factor	Name
1	Complex/independent oriented learner
2	Time oriented learner
3	Social oriented learner
4	Balanced oriented learner
5	Detailed by listening oriented learner

6	Contentment oriented learner
7	Movement oriented
8	Sight oriented learner

Table 12
Factor Loading Profiles for Industrial Technology Students at PWI

	Factors							
Learning styles	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Motivated	**.790**							
Persistent	.714							
Responsible	.711							
Kinesthetic	.701							
Tactile	.510							
Afternoon		-.938						
Late morning		.854						
Time of day		.813						
Alone/peers			.875					
Several ways			-.847					
Design				-.722				
Intake				.611				
Authority figure					.726			
Structure					.720			
Visible						.788		
Auditory						-.735		
Temperature							.849	

Mobility								-.742
Noise								.589

Note: Factor loading score in bold is the most influential.

Table 14
Factor Loading Profiles for Engineering Students at PWI

	Factors						
Learning styles	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Authority Figure	**.715**						
Kinesthetic	.701						
Tactile	.660						
Responsible		.796					
Persistent		.760					
Motivated		.738					
Afternoon			.938				
Late morning			.854				
Time of day			.813				
Several ways				.866			
Alone/peers				-.841			
Visual					.814		
Auditory					-.736		
Intake						.758	
Design						-.574	
Light							.735
Structure							-.669

Note: Factor loading score in bold is the most influential.

Table 13
Factors of Industrial Technology Students at PWI

Factor	Name
1	Hands-on/independent oriented learner
2	Time oriented learner
3	Social oriented learner
4	Environmental/time-out oriented learner
5	Detailed oriented learner
6	Hear/sight oriented learner
7	Climate oriented learner
8	Sight oriented learner

Table 15
Factors of Engineering Students at PWI

Factor	Name
1	Hands-on/collaborative oriented learner
2	Independent oriented learner
3	Time oriented learner
4	Social oriented learner
5	Autonomy/social oriented learner
6	Perceptual oriented learner
7	Tranquil/illumination oriented learner

Discussions

The benefits of topographical mapping have been well established by individual differences theorists and practitioners (e.g., Ackerman&Humphreys, 1990). The application of the knowledge gained from the topographical map is relevant and necessary to accurately and efficiently prepare for the students of the future. Indeed, this practice may re-create teaching styles and contribute to reversing the downward trends in the nation's academic performance. Learning style preference may be an important piece of information in any student's map of academic abilities, aptitudes, and interests.

The primary purpose of this research was to better understand relationships that may exist among learning styles and ethnicity within the aforementioned academic majors. Furthermore, the establishing of scientifically significant variables in the field of industrial technology was also a primary concern of this research project. Such variables carry constitutive import and give researchers and practitioners the necessary support for sound empirical inquiry. It is the authors' belief that student learning style preference is such a variable. Furthermore, the specific differences between African-American and European- American students are of specific importance due to their potential weight in the student success equation.

Pursuant to the convenience sampling method employed, immediate generalizability of the aforementioned results is restricted to the universities and academic majors identified in this study. It is thought, however, that the results are still useful and potent where the formulation of theory and predictive utility of learning style differences are concerned.

The argument against learning style instrument score stability was a chief concern during this project. There was no intention to say that the "discovered" learning style preferences of the samples are permanent; no such claim is made. However, it is believed that the presence of underlying ethnic groupings may be permanent and may consistently drive student attitudes and preferences in classroom settings. Thus, for whatever the reason, if students' learning style preference scores group together, that is important information. Student learning style preference scores did group together in this study, along ethnic lines.

Industrial educators must be aware of and prepared for increasing diversity in the classroom. As technology grows, along with the increase in the number of diverse students (in particular, students of color), it is imperative for ITE teachers to develop different and flexible instruction methods to teach the complex technologies employed in the field. To this end, research on individual differences must continue to educate and further open the mind of Industrial Education teachers.

According to Kolb (1981), engaging in study in a specific major can impact the learning style of students by way of the teaching style, curriculum, and culture of the discipline encountered by students within the major. When individual learning styles do not match the culture of a specific discipline, students are believed to adapt their learning styles so that learning may occur. Such adaptation is believed necessary for success in any major. However, failure to adapt may result in failure for a student in a chosen program of study. Such experiences may negatively influence a student's psyche and contribute to academic withdrawal altogether. Adapting the curriculum and teaching style may prevent the loss of students who are intellectually capable of success in ITE, but have trouble adapting to the present learning culture. Thus it is beneficial for educators in the field to have knowledge of learning style differences so that they may adapt their style of teaching to facilitate student adaptation and academic success.

Given the findings, this study is viewed as a catalyst to conduct further research into the learning styles of students in technical programs at institutions of higher education. The following recommendations are proposed.

1. Further study is needed of the preferred learning styles of African Americans in other National Association of Industrial Technology (NAIT)-accredited Industrial Technology and American Board of Engineering and Technology (ABET)-accredited Engineering programs across the United States.
2. Further investigation is needed of the preferred learning styles of other ethnicities, e.g., Asian, Hispanic, and Native American.
3. There is a need to examine the preferred learning styles of males *and* females in Industrial Technology and Engineering.
4. There is a need to examine the preferred learning styles and teaching styles of faculty in Industrial Technology and Engineering programs at PWIs and HBCUs.

5. Further study is needed to determine if there are any differences in preferred learning styles of Industrial Technology and Engineering students based on socioeconomic status.

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