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Home
Contents

An Analysis of Freshmen Learning Styles and their Relationship to Academic Achievement

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Abstract

Although postsecondary education and advanced skills are critical for a better quality of life and greater earning potential, a large percentage of college students fail to earn degrees. In an attempt to understand this problem and improve student achievement and retention, this study identified the relationship between learning-style preferences and academic achievement among incoming freshmen at a large, private, urban university. The results revealed that specific learning-style preferences correlated with achievement and that learning-style preferences varied according to academic performance.

Introduction

Recent statistics have revealed that the rate of degree completion at four-year and two-year colleges is extremely low (Hunt & Carruthers, 2004). Only sixty-four percent of students matriculated in four-year institutions of higher education earned bachelor degrees in fewer than six years, and less than sixty-three percent of community college freshmen returned for a second year (National Center for Public Policy and Higher Education, 2004). The statistics for minorities are even more dismal. In fact, although more than one-third of Caucasian Americans earn a four-year degree, only eighteen percent of African-Americans and ten percent of Hispanics receive baccalaureate degrees by the time they are in their late twenties (U. S. Department of Education, National Center for Education Statistics, 2002). Consequently, many college administrators, student affairs professionals, and faculty have begun to investigate alternative approaches to prepare students for college courses in order to enhance student learning and performance. It is imperative that institutions of higher education improve academic achievement and increase retention rates while they simultaneously prepare their students for the demands of professional careers.

Purpose of the Study

To improve academic success and retention, these researchers investigated the relationship between grade-point-average (GPA) and the learning-style preferences of college freshmen at a large private urban university. It is intended that the results of this study will assist college administrators, faculty, advisors, and counselors in

comprehending how students acquire new and difficult information so that learners and instructors can understand what techniques maximize or hinder student performance.

Literature Review

In the quest to improve academic achievement and retain students, many traditional study-skills programs have been implemented at the college level (Brown, 1986; Pascarella, 1986). However, according to Biggs (1978), Derry and Murphy (1986), Ford (1981), and Rochford (2004c, 2006), these approaches have been ineffective for large numbers of students. Conversely, when Mangino and Griggs (2003) examined experimental research conducted in college courses, they determined that when instruction was congruent with college students' learning-style preferences, they achieved significantly higher scores than when mismatched. In fact, researchers at various institutions of higher education have demonstrated that when individuals were instructed in environments and with resources compatible with their learning-style preferences, these students demonstrated statistically higher achievement and attitudinal scores than those who received traditional instruction (Boyle & Dolle, 2002; Boyle, Russo, & Lefkowitz, 2003; Dolle, 2000; Hamlin, 2001; 2002-2003; Lefkowitz, 2001; Lenehan, Dunn, Ingham, Murray, & Signer, 1994; Miller, Ostrow, Dunn, Beasley, Geisert, & Nelson, 2000-2001; O'Hare, 2002; Rochford, 2003, 2004a, 2004b, 2004c, 2006; Russo, 2002a, 2002b).

In addition, researchers have documented that learning-style traits vary according to academic achievement (Clark-Thayer, 1987; Giordano & Rochford, 2005), gender (Bovell, 2000; Giordano & Rochford, 2005), culture (Franchi, 2002; Ponce-Meza, 1997), age (Bovell, 2000; Giordano & Rochford, 2005), and processing style (Dunn, Bruno, Sklar & Beaudry, 1990). These investigations have revealed that the less academically successful college students are, the more important it is to accommodate their learning-style preferences (Dunn, 2003). In fact, Claxton and Murrell (1987) and Garcia-Otero and Teddlie (1992) reported that students' mere knowledge of learning styles increased academic success in college courses. Of greater consequence, Nelson et al. (1993), Ingham (2003), and Rochford (2004c) demonstrated that knowledge of learning-style preferences also improved college students' rate of retention.

The Dunn and Dunn Learning-Style Model

The Dunn and Dunn Learning-Style Model focuses on understanding how individuals learn best and defines learning styles as the way in which individuals begin to concentrate on, process, internalize, and retain new and difficult information (Dunn & Dunn, 1992, 1993). This model consists of five stimuli, which include environmental, emotional, sociological, physiological, and psychological elements (Dunn & Dunn, 1999). An individual's

environmental preferences refer to the need for (a) formal versus informal room design, (b) warm or cool temperatures, (c) quiet or sound, and (c) bright or dim lighting. The emotional elements include (a) conformity, (b) motivation, (c) structure, and (d) persistence. Sociological preferences consist of the need to study (a) alone, (b) in a pair, (c) with peers, (d) as a member of a team, (d) with an authority or a collegial figure, or (f) with varied approaches. Physiological elements indicate a learner's: (a) perceptual preferences of auditory, visual, tactile, and kinesthetic learning; (b) need for intake or food; (c) time of day preferences; and (d) desire for mobility. The psychological strand encompasses (a) global or analytic processing, and (b) reflective or impulsive behavior.

Processing Styles. Learning-style elements also appear to cluster together to create global or analytic processing styles (Dunn & Dunn, 1999). Approximately 50 to 60 % of adults are global processors, whereas from 25 to 30 % are analytical. The remaining individuals tend to be integrated learners because they can learn either globally or analytically, depending on their level of motivation (Dunn & Dunn, 1999). In general, global processors exhibit preferences for: (a) low lighting; (b) intake, which refers to food or drink; (c) background sound such as conversations, music, or television; and (d) an informal room design, which permits learners to study in an easy chair, sofa, bed, or on the floor. Finally, globals are simultaneous processors and can handle several projects at a time.

In contrast, analytic processors prefer (a) bright light, (b) no intake, (c) formal seating arrangements such as sitting at a desk on a straight-back chair, and (d) quiet. They are persistent learners, who do not desire breaks, and prefer to complete one task at a time (Dunn, Bruno, Sklar, & Beaudry, 1990; Dunn, Cavanaugh, Eberle, & Zenhausern, 1982). In fact, researchers have documented statistically higher achievement scores when global and analytic students were taught with methods that matched processing styles (Dunn, Bruno, et al., 1990; Tanenbaum, 1982; Trautman, 1979).

Each individual has unique learning-style preferences and strengths (Dunn, 2003). These instructional preferences can be measured reliably (Burke et al., 1999-2000) by the Building Excellence (BE) (Rundle & Dunn, 2000) survey, which is based on the Dunn and Dunn Model.

Methodology

Instrumentation

The BE (Rundle & Dunn, 2000) questionnaire was employed to identify the participants' learning-style preferences. This survey is an online formatted assessment for adults, and it consists of six parts, which examine the psychological, environmental, physiological, emotional and sociological strands of the Dunn and Dunn Learning-Style Model.

After the participants responded to the questionnaire's 118 statements by indicating their level of agreement or disagreement on a five-point Likert scale, each learner's individual learning style was determined through factor analysis. Then each student received a report entitled, Learning—and Productivity—Style Profile, and an individualized Personal Development Plan. These two resources were designed to (a) help adults learn more efficiently, (b) improve their academic performance, and (c) increase their motivation. The report specified each participant's learning-style profile and preferences, and it recommended how each student could improve his/her academic performance by capitalizing on individual learning-style strengths (Dunn & Griggs, 2003). Rundle, Honigsfeld, and Dunn (2002) found that when students utilized the recommended approaches, they gradually became adept at strategies that enhanced their communication, concentration, and team interactions. Moreover, the reliability of the BE (Rundle & Dunn, 2000) ranged from 0.68 to 0.87 with Cronbach alpha using SPSS Reliability Analyses (Stockham, Rundle, & Dunn, 1997, 2001).

Population and Sample

The private university in this study was located in a large metropolitan area and consisted of five campuses. The study was conducted on the major campus with the incoming Fall 2004 freshmen. At this campus, 2,597 incoming freshmen were administered the BE (Rundle & Dunn, 2000) learning-styles assessment as part of their orientation. Of the 2,597 new freshmen, 1,880 completed the survey.

After the University's Institutional Review Board granted permission to conduct the study, the University's Department of Institutional Research merged the learning-style data, collected through the BE (Rundle & Dunn, 2000) instrument, and the demographic data, retrieved from University records, into a Microsoft Excel file. The students' names and social security numbers were deleted and substituted with a code to maintain student anonymity. The Department of Institutional Research then forwarded the newly created data file to the researcher. The Microsoft Excel file was transferred to the Statistical Package for Social Science (SPSS) Version 11.5 for statistical analyses. It should be noted, however, that because of incomplete demographic data, the number of participants was reduced to 1,533.

Participants

The sample of 1,533 incoming freshmen consisted of 60.9 % females and 39.1 % males. Their ages were as follows: (a) 75 % were 18; (b) 19.1 % were 17; (c) 5.3 % ranged between 19 and 23; and (d) .6 % were 16. Their ethnicities consisted of (a) 35.2 % White, (b) 20.7 % Asian, (c) 20.3 % Black, (d) 14.3 % Hispanic, and (e) 9.5 % Other. At the end of their first academic year, the mean college GPA for this population was 2.94 with a SD of .74

Research Hypotheses

The following research hypotheses were examined.

H01:	There will be no significant differences in achievement of first-year freshmen according to ethnicity.
H02:	There will be no significant differences in achievement according to gender.
H1:	There will be significant differences in the learning styles of first-year freshmen according to age (Giordano & Rochford, 2005).
H2:	There will be significant differences in the learning styles of first-year freshmen according to their academic achievement levels (Given, Knight, Patrick, & McGuire, 1999-2000; Giordano & Rochford, 2005; Jenkins, 1991; Reese, 2005).

Data Analyses
Group Profile

The BE (Rundle & Dunn, 2000) questionnaire measures the preference for learning-style elements as slight, moderate, or strong. Because a slight preference is considered non-essential, this group profile focuses on the moderate and strong preferences. It is essential for a learner to accommodate a moderate preference most of the time and a strong preference all of the time because when students are instructed or study with methods incongruent with their learning-style preferences, a negative impact on academic achievement may result (Lefkowitz, 2001; Lenehan et al., 1994; Miller et al., 2000-2001; O'Hare, 2002; Rochford, 2003, 2004a, 2004b, 2004c, 2006).

The majority of the participants (see Table 1) desired analytic learning, which contrasted with Dunn and Dunn (1999), who reported that approximately 50 to 60 % of adults were global processors. It is theorized that divergence from the Dunn and Dunn (1999) findings may have resulted because the participants were limited to young adult college freshmen. However, the majority also preferred intake and informal seating, two characteristics of global processors. Morton-Rias (2005), Giordano (2005) and Giordano and Rochford (2005) corroborated these findings when they discovered that allied health and college business students required analytic learning, but also exhibited the global desire to snack and learn in a casual classroom environment.

Less than 47 % of the freshmen reported a desire for reflective learning and far fewer, less than 15 %, were impulsive learners. Although the majority of the participants exhibited a desire for analytic or structured learning, they also depicted themselves as non-conforming, internally motivated, and did not desire the presence of an authority figure while learning. More than 50 % of the subjects were single task persistent, preferring to complete one activity before

beginning another.

Less than half of the freshmen indicated a desire for auditory learning. In contrast, the majority of the participants reported the desire for verbal kinesthetic, tactile kinesthetic, and visual picture activities, whereas approximately 64 % of the subjects displayed a desire for visual text learning.

Approximately 78 % of the freshmen required informal seating. A little more than half of the participants preferred studying in bright light. In contrast, less than 10 % preferred dim lighting.

The majority of students also exhibited a need for a routine, rather than variety, when learning. These subjects also reported preferences for working alone, in pairs, in small groups or on a team. More students preferred late morning/early afternoon or late afternoon classes, and therefore would not choose to study early in the morning.

Table 1
Percent with Moderate to Strong Preference

Stimuli	Elements	*P*
Perceptual	Verbal Kinesthetic	92.6
	Tactile/Kinesthetic	89.0
	Visual Picture	85.4
	Visual Text	63.7
	Auditory	44.9
Environmental	Informal Seating	78.9
	Formal Seating	10.3
	Bright Light	53.8
	Dim Light	9.4
	Quiet	38.4
	Sound	12.8
	Cool Temperatures	28.3
	Warm Temperatures	15.1
Emotional	Internal Motivation	66.7
	External Motivation	2.5
	Multiple Task Persistence	6.1
	Single Task Persistence	52.2
	Conforming	3.2
	Non Conforming	76.9
	Structure	78.1
Sociological	Alone/Pairs	79.6
	Small Group	70.9
	Team	61.5
	Less Authority Figure Present	54.1
	Routines	72.4
Physiological	Intake	40.1
	Early Morning	19.8

	Late Morning/Early Afternoon	51.6
	Late Afternoon	52.1
	Evening	44.2
	Less Mobility	30.3
Psychological	Analytic Processing	67.4
	Global Processing	.9
	Integrated	29.6
	Reflective	46.6
	Impulsive	14.5

Comparison of Achievement Groups by Ethnicity and Gender

Students' GPAs were divided into the three categories: (a) low achievers with GPAs less than 2.0; (b) medium achievers with GPAs between 2.01 and 2.99; and (c) high achievers with GPAs greater than or equal to 3.0. More than half the students were high achievers. Approximately 37 % were categorized as medium achievers, whereas 10 % exhibited low GPAs (see Table 2).

Ethnicity. A Chi-Square analysis demonstrated a significant difference ($p < .000$) between achievement and ethnicity; therefore, the null hypothesis, H01, was rejected. White subjects were among the highest achievers, and were followed by the ethnic categories of Asian, Black, Hispanic and Other (see Table 3). White and Black students encompassed the largest percentage of medium achievers. Finally, the largest groups of low achievers were White and Black, and they were followed by Hispanics, Asians and Others (see Table 3).

Gender. A Chi-Square analysis evidenced a significant difference ($p < .000$) between achievement and gender; therefore, the null hypothesis, H02, was rejected. Women constituted the vast majority of high achievers. In contrast, a closer distribution was exhibited among male and female medium and low achievers (see Table 4).

Table 2
Achievement Categories

High Achievers		**Medium Achievers**		**Low Achievers**	
N	*P*	*N*	*P*	*N*	*P*
808	53.0	564	37.0	152	10.0

Table 3
Achievement by Ethnicity

Ethnicity	**High Achievers**	**Medium Achievers**	**Low Achievers**
White	41.2	28.0	29.6

Asian	24.3	17.7	13.8
Black	14.5	27.5	24.3
Hispanic	11.9	16.5	18.4
Other	8.1	10.3	13.9

Table 4
Achievement by Gender

	High Achievers		Medium Achievers		Low Achievers	
	N	*P*	*N*	*P*	*N*	*P*
Male	269	33.29	245	43.33	83	54.9
Female	539	66.71	319	56.67	69	45.1

Age and Learning Styles

A Pearson Product Moment Correlation, which examined the relationship between the students' learning-style characteristics and age, exhibited very small coefficients ranging from r = .001 to r = .082. It was theorized that the small correlation coefficients resulted because the vast majority of the subjects, 94.1 %, ranged from 17 to 18 years of age. The learning-style elements for afternoon learning and informal seating were significantly correlated; however, they evidenced small coefficients of -.058 and .082, respectively. Thus, although hypothesis H1 was supported by these analyses, the small coefficient size mitigated the relationship between age and learning-style elements.

Learning-Style Elements and Achievement

To examine the relationship between achievement and the 26 learning-style elements, a One-Way Analysis of Variance (ANOVA) was performed based on the participants' achievement levels of high, medium, or low. Significant differences were evidenced for the ten learning-style elements of visual text ($p < .01$), verbal kinesthetic ($p < .05$), analytic ($p < .01$), reflective ($p < .001$), temperature ($p < .05$), light ($p < .01$), sound ($p < .01$), late afternoon ($p < .05$), structure ($p < .05$), and alone/pairs ($p < .05$).

To determine which achievement groups displayed significant differences in their desire for these ten learning-style elements, a Tukey HSD post-hoc multiple comparison was performed (Table 5). In contrast with low achievers, high and medium achievers preferred significantly more (a) visual text learning, (b) analytic tasks, (c) reflective activities, and (d) structured assignments. While high, medium and low achievers all displayed moderate preferences for analytical and structured learning, their need for reflective activities was slight. Although both high and medium achievers demonstrated a moderate preference for visual text learning, low achievers only

exhibited a slight preference.

High achievers demonstrated the greatest need for silence. While medium achievers desired less quiet than high achievers, they also revealed a need for less noise than low achievers; however, the preference for silence was slight for all three groups. A comparison of high achievers with low achievers revealed that high achievers exhibited moderate preferences for verbal kinesthetic activities and working alone or in pairs, and they also expressed a slight preference for bright light. When compared with high achievers, medium achievers evidenced a greater need for late afternoon classes and cooler temperatures, although the preference for both groups was slight.

Table 5
Tukey's HSD for Achievement Levels

	High Achievers		Medium Achievers		Low Achievers	
	M	*SD*	*M*	*SD*	*M*	*SD*
Visual Text	17.10 $_{a}$	14.75	15.48 $_{b}$	15.73	11.22 $_{a,b}$	17.05
Verbal Kinesthetic	30.67 $_{a}$	12.28	29.96	12.31	27.83 $_{a}$	11.66
Analytic	-32.26 $_{a}$	19.32	-31.44 $_{b}$	21.55	-26.28 $_{a,b}$	21.13
Reflective	-12.46 $_{a}$	21.77	-8.64 $_{b}$	22.14	-3.32 $_{a, b}$	24.45
Temperature	2.63 $_{a}$	15.34	4.67 $_{a}$	14.75	4.64	14.683
Light	12.33 $_{a}$	15.88	10.79	16.09	7.73 $_{a}$	16.92
Sound	-9.66 $_{a}$	17.514	-5.59 $_{a, b}$	16.532	-1.61 $_{a, b}$	16.594
Late Afternoon	12.46 $_{a}$	11.32	13.95 $_{a}$	10.58	12.99	10.46
Structure	19.72 $_{a}$	13.13	19.66 $_{b}$	12.87	16.48 $_{a, b}$	14.82
Alone/Pairs	18.60 $_{a}$	9.17	18.22	9.41	16.38 $_{a}$	10.05

Note: Means sharing subscripts are significantly different at $p < .05$.

Correlation Analyses of Learning-Style Elements

The Pearson Product Moment Correlation demonstrated that the higher the GPA, the more the students desired: (a) visual text ($p < .01$); (b) verbal kinesthetic activities ($p < .05$); (c) early morning learning ($p < .01$); (d) bright light ($p < .01$); (e) working either alone or in pairs ($p < .01$); and (f) task persistence ($p < .05$). The lower the GPA, the less the students were internally motivated, and the less they revealed a need for: (a) analytic tasks ($p < .05$); (b) reflective learning ($p < .01$); and (c) a quiet study environment ($p < .01$). Low

achievers did, however, evidence preferences for: (a) cooler temperatures ($p < .05$); (b) intake ($p < .05$); and (c) studying in the late afternoon ($p < .05$). These findings are partially supported by Giordano and Rochford (2005) who discovered that low achieving community college business students displayed a need for intake and late afternoon classes. In addition a Spearman Rank Correlation was computed to determine the correlation between ranks to adjust for non-normal distributions of data because the Pearson r may underestimate the strength of the relationship if some degree of non-linearity exists (Pallant, 2003). However, both the Pearson Product Moment Correlation and the Spearman rho demonstrated significant correlations for GPA among the same 12 learning-style variables of visual text, verbal kinesthetic, reflective, analytic, sound, temperature, light, intake, early morning, late afternoon, task persistence, and motivation. The only variable that was not significant in the Spearman rho was alone/pairs.

These correlations support the findings from the previously mentioned ANOVA and Tukey HSD procedure (see Table 5), and they imply that high achievers prefer early morning classes and activities that permit them to read, interact and engage in whole body movement. They are task persistent and like to continue working until the job is completed. Conversely, low achievers crave late afternoon classes and do not benefit from analytic, step-by-step, structured activities, but instead crave more global assignments. In view of the differences in learning styles according to achievement levels, research hypothesis, H2, is accepted.

Discussion

In numerous college courses, because of time constraints, many instructors must present the required curriculum by employing the traditional lecture method even though this highly auditory approach to teaching fails to benefit the majority of students. However, with some rather simple straight-forward modifications, students can begin to learn and study with techniques that are congruent with their learning-style strengths so that they can take control of and responsibility for their learning. The first step is to assess students learning styles by administering BE (Rundle & Dunn, 2000). Next, professors should determine their own learning styles because self-knowledge is an essential part of developing flexible, varied approaches to learning, inasmuch as teaching strictly in a style compatible with the instructor's preferences can obstruct learning (Terregrossa & Englander, 2000).

Subsequently, students should be provided written reports and interpretations of their learning styles to comprehend fully what aids or obstructs their learning so that they can study with methods compatible with their learning-style preferences. For instance, analytic learners who prefer early morning classes should be advised to register for difficult courses early in the day with professors who are highly structured and sequential. In addition, these learners would

probably benefit from a course that provides a clear syllabus that specifies all the readings, assignments and projects. In contrast, global learners who cannot concentrate in the morning should be dissuaded from taking difficult courses early in the day. In addition, they might prefer teachers who present material deductively and who permit informal seating and snacking during class because a formal environment makes them feel uncomfortable and distracted.

Auditory learners can tape record lectures and replay them when their concentration levels are highest. For instance, some auditory students benefit from listening to classroom lectures while on an exercise bike or treadmill. In contrast, a visual text learner typically benefits from reading a chapter in a textbook before listening to a classroom lecture. This approach would prepare a student who is not auditory to take notes and absorb what the professor presents during lecture, instead of feeling frustrated by new course content. Verbal kinesthetic students should be encouraged to participate in presentations, simulations, role plays or to make videos to demonstrate his/her knowledge. Visual picture learners can highlight or underline important information and create charts or diagrams that contain vital points or data to form a mental image of what they have just read or learned.

Students' needs for warmer or cooler temperatures while studying may be attended to by reminding those students who desire warmth to wear layers of clothing or to sit near a heating vent, whereas those who prefer cooler temperatures could be seated near an open window or air conditioning unit. In addition, to address the contrasting need for dim or bright light, the professor can lower the shades, turn off one bank of lights, or students can wear caps to block the sun. Learners who need silence to study could work in a quiet section in the library or insert ear plugs to block out noise. Conversely, those who require background noise can use headphones to listen to music without lyrics.

Since some students thrive in groups while others dislike them, instructors should offer students the option to work alone, in pairs or in small groups so that no one is coerced into an awkward learning situation. Furthermore, because many students indicated they were non-conformists, whenever possible, professors should offer choices in projects and assignments so that non-conformists don't waste their time and energy challenging the authority figure, but instead focus on learning.

Conclusion

Colleges are critical components in the development of a successful global economy because they prepare citizens for the demands of an ever-growing technological worldwide market. However, retention and graduation rates imply that the traditional pedagogical methods used in colleges are not effective in addressing the needs of a new, more diverse college population. Therefore, it is

essential that college administrators, faculty and student affairs professionals recognize and address the wide-ranging ways in which students learn so that they can assist them in maximizing their learning potential and earning degrees.

Clearly, the time has come to reevaluate and adjust instructional methods employed in colleges inasmuch as too many students fail to graduate because they have been trapped into using ineffective learning strategies (Clark-Thayer, 1987) since it is assumed that methods that were successful for previous generations will be effective for a new diverse group of pupils who have varied ways of learning.

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Contents
