Effects of Matching and Mismatching Corporate Employees' Perceptual Preferences and Instructional Strategies on Training Achievement and Attitudes

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Abstract

This study analyzed the: (a) effects of matching and mismatching instructional strategies on the training-achievement test scores of employees classified according to their learning style perceptual preferences-- auditory, visual, tactual, kinesthetic, or non-preferenced and (b) results each strategy produced on attitudes toward each of the two instructional strategies-- auditory/visual and tactual/kinesthetic/visual. The perceptual preferences of 314 Route Sales Representatives were identified. Advanced driving-safety training materials were translated into two lessons--one auditory strategy with visuals, and one tactual/kinesthetic strategy with visuals-- which the subjects received during a one-month period. A semantic differential scale assessed attitudes toward each of the two strategies. Four 3 x 2 ANOVAS for the identified, and then matched and mismatched, perceptual preferences were employed. Dependent variables of achievement and attitude toward instruction were assessed for each of the two training sessions. Significant differences emerged when subjects were matched and mismatched with instructional strategies congruent and incongruent with their diagnosed perceptual preferences. Achievement scores were significantly higher ($p > .0001$) for both sessions, as were attitudes ($p > .0001$) for Session 2, in complementary instructional treatments.

Introduction

The re-education of adults has become a critical national issue for eight reasons. (1) The United States has shifted from a manufacturing economy to one that is service-centered and seventy-five percent of all currently-existing jobs will have been eliminated by 1995 (Richie, Hecker, & Burgan, 1983). (2) Many previous jobs were replaced by technology and new jobs that emerge are likely to require advanced skills. (3) There is competition for all existing jobs and an intense competition for the limited number of upper-level positions. (4) As technology creates a need for new and different skills, the United States' no-mandatory-retirement-age will ensure an older work force required to change jobs as many as five or six times in their lifetimes (Galagan, 1987). (5) In the past, three quarters of our large corporations were required to provide their employees with remedial education and basic skills at a cost of more than $300,000,000 annually (Naisbitt & Aburdene, 1985). In a depressed economy, if corporations do provide training, it is likely to be for college graduates who learn quickly with conventional methods. (6) Despite the unwillingness of corporations to spend capital on re-training, continuing education is made necessary by technologically-controlled computer processes that increase the kinds and complexities of skills that workers require to maintain employment (Eurich, 1985). (7) There are 25 million illiterate, and an additional 46 million marginally-illiterate, adults in the United States. These adults are likely to be difficult to re-train, but they face two alternatives-- either unemployment or re-training. (8) Conventional retraining is not likely to be effective with adults who performed poorly in school. There are, however, learning style-responsive approaches that improve the academic performance of underachieving high school and college students (Brunner & Majewski, 1990; Dunn, Bruno, Sklar, & Beaudry, 1990; Dunn & Griggs, 1988; Mickler & Zippert, 1987). Those learning-style approaches might be applicable to job re-training.

Perceptual Learning Styles and Student Achievement

Various studies have shown that: (a) when taught first through their perceptual preferences, students remember more than when they are taught through their non-preferences; (b) underachievers require initial teaching through their perceptual strengths and reinforcement through one or more different modalities if they are to perform better than previously on standardized achievement tests; (c) teaching students K-12 through their perceptual strengths increases learning in mathematics, reading, science, social studies, and vocabulary short-and long-term memory; (d) when provided as introductory learning, tactual and kinesthetic instructional resources contribute to significantly higher standardized achievement test scores for underachievers; and (e) students vary significantly in the perceptual preferences through which they are able to achieve (Dunn & Dunn, 1992, 1993).

Perceptual Learning Styles and Adult Achievement

By 1985, interest had developed concerning how culture impacts on group learning styles. On the basis of analysis with the Productivity Environmental Preference Survey (PEPS) (Dunn, Dunn, & Price), it was revealed that high-risk, Puerto Rican adults were highly kinesthetic, but low auditory and low visual, and that asian adults were significantly more auditory and visual than caucasians (Dunn & Griggs, 1990).

Four subsequent studies indicated that, when college students' perceptual preferences were identified and they then were shown how to study using their unique learning-style strengths, they achieved statistically higher grades than when they did not use their learning styles (Clark-Thayer, 1987; Lenehan, Dunn, Ingham, Murray, & Signer, 1994; Mickler & Zippert, 1987; Nelson, Dunn, Griggs, Primavera, Fitzpatrick, Bacillious, & Miller (1993). At about the same time, Buell and Buell (1987) examined the effects of perceptual preferences on nurses and teachers during staff development. They reported that the closer the match between the participants' and their instructors' perceptual preferences, the more positive the teachers' achievement and attitudes. Thereafter, Ingham (1991) reported corporate training in which adults evidenced significantly higher achievement and attitudes when their perceptual preferences were responded to during training sessions.

The Dunn and Dunn Learning Style Model

People begin to concentrate, process, and remember new and difficult information under different conditions and through different strategies. For example, auditory and visual perceptual strengths, passivity, and self-motivation correlate with high school achievement, whereas tactual and kinesthetic strengths, a need for mobility, and peer-motivation correlate with low school underachievement. However, when underachievers were permitted to learn with a classmate or two while using tactual and kinesthetic instructional resources, they achieved significantly higher standardized test scores than when they were taught with dissonant strategies (Dunn & Dunn, 1992; 1993). Thus, the Dunn and Dunn Learning Style Model is based on the assumptions that: most individuals can learn; instructional environments, resources, and approaches respond more or less effectively to different learning style strengths (Dunn, 1987; most students have strengths, but different people have different strengths (Dunn & Dunn, 1992, 1993); individual instructional preferences exist and can be measured reliably (Dunn, 1988); given responsive environments, resources, and/or approaches, students attain statistically higher achievement and attitude test scores in matched, rather than mismatched treatments Andrews, 1990; Brunner & Majewski, 1990; Stone, 1992); most teachers can learn to respond to students' learning styles (Andrews, 1990; Brunner & Majewski, 1990 Stone, 1990; and students can be taught to capitalize on their learning style strengths when concentrating on new or difficult academic material (Dunn & Dunn, 1992, 1993).

Findings from research on high school students and college adults suggested that the effectiveness of re-training might increase if it were to respond to individuals' perceptual learning styles. Thus, when the high accident rate among truck drivers for a national bakery chain contributed to that company's increased insurance rates, management perceived that the original training the truck drivers had received through lectures and a safety manual had been ineffective. When they saw the need for re-training the truck drivers, it was proposed that driver safety should be taught with strategies that complemented the truck drivers' individual perceptual strengths.

Population and Materials

Population

The population for this study consisted of 518 truck drivers employed in the northeast region of a large, national producer of cakes, cookies, and pies. There were a total of 14 branches established in the Baltimore-to-Boston region responsible for the distribution of this firm's products of which 4 branches were not included because fewer than eight workers were employed at each of three and the fourth agency had no appropriate training room at that site.

Although subjects were predominantly male, caucasian, high-school graduates, 12 females and 53 African-Americans were included. The average age was 45 and the majority had been with the company for more than five years. The turnover rate of these employees averaged one percent per year.

Materials

1. The Productivity Environmental Preference Survey (PEPS) (Dunn, Dunn, & Price, 1982) identifies the learning-style preferences of adults. The instrument consists of 100 dichotomous questions that elicit self-diagnostic responses to 18 discrete learning-style elements on a 5-point Likert scale. Processing style is extrapolated from correlations with sound, light, design, persistence, and intake (Dunn, Cavanaugh, Eberle, & Zenhausern, 1982; Dunn, Bruno, Sklar, & Beaudry, 1990) (see Figure 1). The Ohio State University's National Center for Research in Vocational Education reported that the PEPS had "established impressive reliability and face and construct validity" (Kirby, 1979), p. 72). Hoyt reliability coefficients for each of the four perceptual areas were reported as follows: auditory, .78; visual, .79; tactual, 79; and kinesthetic, .76 (Price, Dunn, & Dunn, 1991). Construct validity for the perceptual sub-tests of the PEPS was established by Buell & Buell, (1987), Ingham (1991) and LaMothe, Belcher, Cobb, & Richardson, 1991).

This instrument identifies how individuals concentrate on new and difficult academic knowledge. The learning style preferences revealed by the PEPS include: (a) environmental (sound versus quiet, bright versus dim illumination, warm versus cool temperature, and a formal versus an informal seating design); emotional (high or low motivation, persistence versus requiring periodic breaks, conformity versus nonconformity, and a need for structure versus options); sociological (learning alone, in a pair, with peers and/or with an authoritative figure such as a supervisor or consultant, and in routines or patterns versus in a variety of groupings); and physiological (perceptual preferences, needing intake while concentrating, chronobiological times-during-the-day, and need for mobility versus passivity) preferences. Previous studies reported that (a) relationships exist among the cognitive dimensions of global versus analytic processing and students' environmental, emotional, sociological, and physiological traits and that (b) those traits often clustered together (Dunn, Beaudry, & Klavas, 1990). Learning persistently (with few or no intermissions), in quiet and bright light, in a formal seating arrangement, and with little or no intake often related to being an analytic, "left" processor whereas requiring breaks and learning better in soft lighting, with sound while seated informally and snacking often correlated with high scores as a global, "right" processor. Field dependence versus field independence correlated in many ways with a global versus analytic cognitive style and seemed to elicit the same clustering as left- and right-preferenced students (Dunn, Bruno, Sklar, & Beaudry, 1990; Dunn, Cavanaugh, Eberle, & Zenhausern, 1982).

2. Through the 5-point Semantic Differential Scale (SDS) (Pizzo, 1981), subjects' reactions to 12 word pairs assess their attitudes toward instructional materials. The 12 word pairs used in this investigation were: Evaluation (confused / clear-minded, bad / good, successful / unsuccessful); Potency (strong / weak, confident / uncertain, dull / sharp,); Activity (energetic / tired, shaky / steady, tense / relaxed); and Stability (nervous / calm, peaceful / frustrated, wonderful / terrible). The Kuder Richardson Formula 21 (KR21) assessed the reliability coefficient of the SD. For the Session 1 administration, the KR21 coefficient was .98; for the session 2 administration, the KR21 coefficient was .99.

3. The Training Sessions' Content on advanced driver safety: (a) was drawn from the pre-established 1988 training series schedules of the bakery firm; (b) constituted new content not previously taught to the participants; and (c) was of sufficient value and scope to permit its presentation in two distinct training sessions; (d) was presented on two different days, one month apart. The training package was organized into two parts. Part One was taught during Session 1 and Part Two was taught during Session 2. The Smith System, Advanced Driving Safety (1986), was divided into two discrete parts (techniques for driving forward and techniques for backing up); each section covered five main points.

Two different instructional approaches were used during each session--an auditory/visual method and a tactual/kinesthetic/ visual method. The workshop content was organized into four sets of instructional materials; two different instructional methods for each of two training sessions. All participants received both treatments and the order in which they received the treatments was randomized.

The auditory/visual lesson was conducted with a lecture approach based on the outline provided in the trainer's manual, accompanied by flip-chart visuals. The tactual/kinesthetic/visual approach was conducted with tactual manipulatives and simulation activities to teach safety procedures with a hands-on approach. The subjects manipulated various board pieces to learn the safety techniques. The verbal components to this approach were limited strictly to the directions given at the beginning of each session.

Procedures

The 518 truck drivers' perceptual preferences were identified with the PEPS (Dunn, Dunn, & Price, 1985). Computer analysis indicated that: 18.2 percent of the employees had an auditory preference; 17.3 percent had a tactual/kinesthetic preference; only one percent had a visual preference; and 34.6 percent had a combination of perceptual strengths. Research has demonstrated that preferences are equivalent to strengths (Dunn, 1988).

For the first training session, subjects were stratified by perceptual preference and occupation. Because only one percent of the truck drivers had a visual preference, that preference affected too few employees to be isolated as a singular approach for developing safety skills. However, because the drivers had to see the resources, a visual component was included in both treatments for each group.

The truck drivers received the two training sessions in a randomized order. The following month, subjects were exposed to the alternative treatment. All individuals experienced two different treatments-- one complementary to, and the other dissonant from, their individual perceptual preferences.

At the conclusion of each training session, everyone completed a 15-question, multiple-choice, criterion-referenced test to measure how much information had been mastered during that meeting. Each question was related directly to the 15 recommended safe-driving techniques--three techniques for each of five keys to safety, thus establishing content validity. The tests were adapted from the evaluation tests constructed by Smith System (1986). The reliability coefficients for each of the two tests were generated using the Kudar-Richardson Formula 21. For test One, the KR21 coefficient was .84; for test Two, the KR21 coefficient was .96. In addition, after each session, each employee completed the semantic differential scale (Pizzo, 1981). Although the PEPS was administered to 518 employees, of those, a total of 430 completed the training program. For the purposes of this research, the only data used for statistical analyses were for those employees who (a) were identified as having an auditory or tactual/kinesthetic preference or no perceptual preference and (b) had completed all three phases of the training program. Therefor, the actual experimental sample included 314 employees.

This experimental research used a "randomized factorial design with two within-factors" (Huck, Cormier, & Bounds, 1975, p. 75). Hypotheses were examined using four 3 x 2 ANOVAs. The independent variables were perceptual preference (auditory, tactual/ kinesthetic, non-preferenced) and instructional method (auditory, tactual/kinesthetic). The two dependent variables were achievement and attitude-toward-instruction for each of the two training sessions. The unweighted means ANOVA was employed to handle the unequal cell means properly. Where appropriate, tests for simple main effects and Scheffe post-hoc analyses were conducted.

Findings

Employees with an auditory preference who were taught with a lecture and visuals obtained significantly higher test scores than when taught with the tactual/kinesthetic approach and visuals. (The visual aspect on all lessons was seeing the resources that were used during the two treatments that each group received.) Employees with a tactual/kinesthetic preference who were taught with the tactual kinesthetic method produced higher (.01) test scores than when they were taught with the lecture supplemented with visuals. In addition, the mismatch of preference and method generated statistically lower test scores. Those employees with no perceptual preference obtained higher test scores when they were instructed with the lecture than when they were instructed with the hands-on approach (see Table 1). Table 2 shows the results of the ANOVA and Table 3 shows the simple main effects.

Employees reported significantly more positive attitudes when they were instructed through methods that matched, rather than mismatched, their perceptual preferences. The reverse also occurred; mismatches of methods and preferences resulted in statistically less positive attitude scores. Those with no perceptual preference expressed equally positive attitudes toward both--the lecture and the tactual/kinesthetic--methods. See Table 4 for the mean attitude scores and Table 5 for the results of the ANCOVA; Table 6 displays the simple main effects.

Implications

Data revealed that matching the truck drivers' perceptual preferences with complementary instructional resources significantly affected training achievement and attitude test scores toward their instruction. These findings are consistent with results reported by: Buell and Buell (1987) with nurses and teachers in staff development workshops; Dunn, Bruno, Sklar, and Beaudry (1990) with middle-aged adults and non-matriculated college freshmen in remedial mathematics (1990); Lenehan, Dunn, Ingham, Signer, and Murray (1994) with nursing majors in science courses; and Mickler and Zippert (1987) with poorly-achieving college students. However, this may have been the first time that the learning-style element of perception was the basis of training in a corporate setting. Because the results of one experimental study does not necessarily suggest that

Table 1
Means and Standard Deviations on Training Test Achievement Scores of Subjects Categorized by Perceptual Preference and Instructional Method: Session 2

Perceptual Preference		Instructional Method: Auditory	Tactual/ Kinesthetic	Row Totals
Auditory	$\bar{X}$	12.03	8.69	10.36
	SD	7.21	2.77	
	n	40	42	82
Tactual/Kinesthetic	$\bar{X}$	9.91	11.15	10.53
	SD	3.71	2.20	
	n	32	48	80
Non-Preferences	$\bar{X}$	10.39	9.55	9.97
	SD	2.43	2.74	
	n	70	66	136
Column Totals	$\bar{X}$	10.78	9.80	
	n	142	166	

Table 2
Results of the 3 x 2 ANOVA of Training Test Achievement Scores:
Session 2

Source	SS	DF	MS	F
Instructional Method (A)	66.10	1	66.10	4.96*
Perceptual Preference (B)	17.54	2	8.77	.66
Interaction (A x B)	208.82	2	104.41	7.83**
Error	3891.60	292	13.33	

*$p < .03$
**$p < .0001$

Table 3
Results of a Test of Simple Main Effects Analysis of Training Achievement Test Scores: Session 2

Source	SS	DF	MS	F
Instructional Methods				
A at B1 (auditory)	226.99	1	226.99	17.03****
A at B2 (tact/kin)	36.69	1	36.69	2.75*
A at B3 (non-pref)	23.15	1	23.15	1.74
Employee Perceptual Preference				
B at A1 (auditory)	97.08	2	48.54	3.64**
B at A2 (tact/kin)	142.91	2	71.46	5.36***

*p < .10
**p < .03
***p < .005
****p < .0001

Table 4
Means and Standard Deviations on Attitudinal Questionnaire Scores of Subjects Categorized by Perceptual Preference and Instructional Method: Session 2

		Instructional Method		
Perceptual Preference		Auditory	Tactual/ Kinesthetic	Row Totals
Auditory	$\bar{X}$	47.73	40.05	43.89
	SD	10.14	11.307	
	n	40	42	82
Tactual/Kinesthetic	$\bar{X}$	41.39	47.52	44.46
	SD	9.25	10.65	
	n	31	48	79
Non-Preferenced	$\bar{X}$	43.51	42.60	43.05
	SD	8.67	9.64	
	n	70	65	135
Column Totals	$\bar{X}$	42.21	43.39	
	n	141	155	

Table 5
Results of the 3 x 2 ANOVA of Attitudinal Questionnaire Scores:
Session 2

Source	SS	DF	MS	F
Instructional Methods (A)	45.92	1	45.92	.47
Perceptual Preference (B)	100.66	2	50.33	.52
Interaction (A X B)	1872.28	2	936.14	9.60*
Error	28278.30	290	97.51	

*p < .0001

Table 6
Results of a Test of Simple Main Effects Analysis of Attitudinal Questionnaire Scores: Session 2

Source	SS	DF	MS	F
Instructional Methods (A)				
A at B1 (auditory)	1204.49	1	1204.49	12.35***
A at B2 (tact/kin)	818.98	1	818.98	8.40**
A at B3 (non-pref)	25.55	1	25.55	.26
Perceptual Preference (B)				
B at A1 (auditory)	774.99	2	387.49	3.97*
B at A2 (tact/kin)	1328.55	2	664.28	6.81***

*p < .02
**p < .004
***p < .001

similar procedures will be equally effective in other business or industrial settings, the generalizability of these findings should be viewed with caution.

Suggestions for Future Research

Because the adults in this study (a) learned differently from each other and (b) performed significantly better when the training complemented, rather than was dissonant from, their identified perceptual preferences, it is recommended that businesses involved in either training or re-training employees experiment with identifying the participants' perceptual preferences and translating the training materials into complementary materials as suggested by Dunn and Dunn (1993). Corporate training may be improved and the need for re-training and its related costs may be reduced, if perceptual preferences are identified and complementary, rather than dissonant, training strategies are provided.

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