

**EFFECTS OF  
TACTUAL KINESTHETIC  
INSTRUCTIONAL RESOURCES ON  
THE SOCIAL STUDIES ACHIEVEMENT  
AND ATTITUDE TEST SCORES  
AND SHORT- AND LONG-TERM  
MEMORY OF SUBURBAN  
FOURTH-GRADE STUDENTS**

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**ABSTRACT**

This investigation analyzed the effects of tactual and kinesthetic resources on the social studies achievement and attitude test scores and short- and long-term memory of fourth- grade suburban students. Students' learning-style perceptual preferences were identified using the *Learning Style Inventory* and subsequently youngsters were taught social-studies content using tactual and kinesthetic instructional resources and traditional method (alternately). A multivariate analysis of variance (MANOVA) revealed a significant interaction ( $p < .0001$ ) between tactual and kinesthetic preferences and instructional methods and simple main effects analysis supported those results. Tactual and kinesthetic learners scored significantly higher ( $p < .0001$ ) mean posttest scores when instructional methods were congruent rather than incongruent with their learning styles. Furthermore, the analysis of variance (ANOVA) main effect of instructional treatment was highly significant ( $p < .001$ ), revealing statistical differences in social studies long-term memory for content taught with tactual/kinesthetic and traditional instructional resources. Additional simple main-effects tests demonstrated that students achieved significantly higher posttest scores ( $p < .0001$ ) for social-studies content taught using tactual/kinesthetic instruction than with a traditional approach. Students rated tactual/ kinesthetic lessons statistically higher ( $p < .0001$ ) than when they were taught social studies content with traditional methods. The findings of this investigation veri-

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**fied that, when the appropriate instructional method was matched with students' tactual and kinesthetic strengths, higher achievement gains and more positive attitudes resulted than with traditional instruction. Some recommendations are suggested.**

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**R**esearch has demonstrated that many students do not become strongly visual before third grade; auditory acuity first develops in many after sixth grade, and boys are often neither strongly visual nor auditory even during high school (Restak, 1979). Young children are almost exclusively tactual/kinesthetic learners (Crino, 1984; Keefe, 1982; LeClair, 1986; Price, 1980). Students who are unsuccessful or who are underachievers in school, learn best through tactual (hands-on) and kinesthetic (active) resources and their strongest perceptual strength is neither auditory nor visual (Drew, Dunn, Quinn, Sinatra, & Spiridakis, 1994; Dunn et al., 1994). When those children are initially taught new and difficult information auditorally, many become confused and find it difficult to process the information (Dunn & Dunn, 1992). These findings are substantiated by Dunn (1997-98) who reported:

Less than 12% of elementary school children are "auditory" learners; few children or adults are capable of remembering approximately 75% of academic information they listen to for between 30-40 minutes. Less than 40% are "visual" learners; few children or adults are capable of remembering information they read for between 30-40 minutes. (p. 5)

Despite these facts, conventional teaching practices continue to be unresponsive to the needs of tactual and kinesthetic learners who tend to process and remember new and difficult information or skills when they use manipulative materials or participate in concrete "real life" activities. Those students comprise the majority of elementary school classrooms (Dunn & Dunn, 1992).

Each individual has a learning-style that is uniquely his or her own and it will differ significantly from other individuals. The stronger the preference the more important it is to provide compatible instructional strategies (Braio, Dunn, Beasley, Quinn, & Buchanan, 1997). According to Dunn and Dunn (1992), "Instruction should be introduced through an individual's strongest perceptual strength and reinforced through the weaker modalities sequentially" (p. 137). However, classroom teachers seldom introduce new information through students' tactual/kinesthetic preferences (Drew et al., 1994). Teachers usually teach by lecturing and explaining (auditory); by writing on the blackboard and assigning readings (visual). Students who are able to process information in these ways (visually and auditorally) are the ones who retain what they have been taught and therefore perform well on written and teacher directed tests. Thus, educators believe that the brighter students are auditory and/or visual learners because they are the youngsters who tend to be successful in our schools (Dunn & Dunn, 1992). They are not aware that, because students' learning styles vary, instructional practices that are beneficial to one group are unlikely to be beneficial to all students. Instead, those same instructional practices will impede or diminish learning in another group of children (Dunn & Dunn, 1993).

Since very little is done instructionally in most classes to accommodate the tactual and kinesthetic perceptual strengths, these youngsters are in a real sense handicapped (Dunn & Dunn, 1992). As children mature and grow older, some may begin to combine their tactual strengths with visual preferences while others eventually might develop auditory strengths. If and when they do, only then will they be able to function successfully in the traditional classroom where lecture, discussion, and visual stimulation are the norm (Dunn & Dunn 1992). However, "Many males remain essentially tactual or kinesthetic all their lives" (Dunn, 1997-98, p. 5). It is crucial therefore, to individualize instruction to accommodate tactual and kinesthetic learning styles and provide a positive learning environment in which all students can achieve academic success (Dunn & Dunn, 1992).

Many experimental studies have reported significantly higher achievement for students when their perceptual preferences were accommodated. That conclusion was documented at the elementary level by (a) Carbo (1980) with kindergarten students in Reading; (b) Drew (1992) with fourth, fifth, and sixth-grade Cajun and Louisiana Indian students in story recall; (c) Jarsonbeck (1984) with fourth-grade underachievers in Mathematics; (d) Turner (1992) with fifth graders in spelling; (e) Weinberg (1983) with third-grade underachievers and (f) Wheeler (1980, 1983) with second-grade Learning Disabled students. Similar results were evidenced by Curry (1994), Gardiner (1986), Garrett (1991), Kroon (1985), and Martini (1986) at the junior high and high school levels. Those researchers confirmed that students who were identified as tactual and kinesthetic learners were far more likely to achieve when taught through their tactual and kinesthetic strengths than through either visual or auditory strengths. Research conducted at adult levels also substantiated that when instructional methods were complementary to adults' perceptual preferences, they achieved significantly higher test scores than when instructional methods were incongruent (Buell & Buell, 1987; Ingham, 1989). In addition, they found that more positive attitudes were evidenced through a close match between participants and their instructors.

Thus we investigated the impact that tactual and kinesthetic instructional resources would have on students' social studies achievement and short- and long-term memory when students identified as tactual and kinesthetic learners were taught in a manner that was complementary rather than dissonant to their learning styles. We also assessed students' attitudes toward learning social studies as instructional methods were altered.

## Method

### Sample

Subjects for this investigation were selected from the total population of fourth-grade students who attended a suburban, public, elementary school 25 miles north of New York City. The school community was racially and socioeconomically diverse. The ethnic composition of the school was comprised of 63% European-American, 28% African-American, 6% Hispanic-American, and 3% Asian-American descendants. One sector of the community was primarily residential and consisted of high- and middle-income homes. The other sector of the community resided in small apartments and subsidized housing complexes located in the downtown business district. In this school, students were grouped heterogeneously and assigned to classes based on teachers' observations and standardized test scores. Academic performance of the majority of the students ranged from average to above average. This assessment was based on the *California Achievement Tests* and other standardized tests results. The selected school housed kindergartners through fifth graders and, at the time of the study, enrollment was approximately 480 students.

The experimental sample consisted of 72, 10-year-old subjects drawn from the total fourth-grade population of 80 students. There were four classes consisting of about 20 students each. The pool of students was limited only to those whose parents consented to have them participate in this investigation. It was further limited to those students who had a consistency score of 70 and above on the *Learning Style Inventory* (Dunn, Dunn, & Price, 1996). The participants comprised 38 girls and 34 boys. Students were unaware of their diagnosed learning-style preference(s) during the observation period. Rather they were advised at the completion of the study. Therefore, students' knowledge of their learning-style preferences could not have had any impact on their achievement or attitudes.

### Materials

The following instruments were used in this investigation:

1. The *Learning Style Inventory* (LSI) (Dunn, Dunn, & Price, 1996). This instrument was used to identify students' learning-style preferences. Learning style has been defined by Dunn and Dunn as the way individuals concentrate on, process, internalize, and retain new and difficult information (1992, 1993). This model identifies the following five stimuli and 21 corresponding elements: (a) *environmental* (light, sound, temperature, and design); (b) *emotional* (structure, persistence, motivation, responsibility or conformity); (c) *sociological* (pairs, peers, adults, self, group, varied); (d) *physiological* (perception, intake, time-of-day, energy levels, and mobility needs); *psychological* (global/analytic, impulsive/reflective, and cerebral dominance).

The LSI is a comprehensive assessment of an individual's learning style and the most "widely used assessment instrument in elementary and secondary schools" (Keefe, 1982, p. 52). It was developed through content and factor analysis and is a self-report instrument consisting of 104 dichotomous items. The LSI has been employed in doctoral research at more than 112 institutions of higher education in the United States and abroad (Research on the Dunn and Dunn Model, 1998). In a two-year study of various learning-style models and instrumentation conducted by the Ohio State University's National Center for Research in Vocational Education, Kirby (1979) reported that the LSI had established "impressive reliability and face and construct validity" (p. 72). Later, in a comparison of 11 major learning-style models and their instrumentation, DeBello (1990) reported the comparatively high reliability and validity of the LSI in contrast with other assessments. A review of 21 different learning/cognitive style models through psychometric analysis of nine different instruments that measure learning-styles identified the LSI as having one of the highest reliability and validity ratings (Curry, 1987). The LSI also evidenced predictive validity (Dunn et al., 1986; Dunn, Krinsky, Murray, & Quinn, 1985; Pizzo, Dunn, & Dunn, 1990).

2. Tactual and kinesthetic resources, developed by the researcher, were used in the tactual and kinesthetic treatment condition. These included Task Cards, Learning Wheels, Fact Fans, Electroboards, and Flip Chutes, while the kinesthetic resources included Floor Games and role playing (Dunn & Dunn, 1992). Tactual and kinesthetic materials are naturally motivating, particularly for young children (Dunn & Dunn, 1992). These materials are self-corrective, so that, should children experience difficulty while using them, they can manipulate them to find the correct answers. Youngsters who usually are apathetic in class may become highly motivated when these resources are incorporated into their daily instruction because of their interest and enjoyment in learning with them. Beyond the need for motivation, persistence, responsibility, and structure, students who have visual and tactual, or tactual and kinesthetic preferences and who do not learn easily either by listening or by reading, usually respond well to those resources.

3. Four publisher's end-of-unit tests in the Test Masters, *New York Yesterday and Today* (Larkin, Cunningham, & Dearsteyne, 1990) which were used to assess youngsters' social-studies achievement. Long-term memory was assessed using a 20-item test consisting of five questions randomly chosen from each of the four end-of-unit tests. These tests have evidenced high reliability and validity and have been used for many years with fourth graders across New York State.

4. The *Semantic Differential Scale* (SDS) (Pizzo, 1981) was used to assess changes in attitude toward learning social studies as instructional methods were altered. The SDS isolates four dominant factors: (a) evaluative, (b) activity, (c) potency, and (d) stability. Each of the four factors includes 12 bipolar adjective pairs. The 12 pairs used in this investigation were: (a) evaluative (confused-clear-minded, bad-good, successful-unsuccessful); (b) activity (energetic-tired, shaky-steady, tense-relaxed); (c) potency (strong-weak, confident-uncertain, dull-sharp); (d) stability (nervous-calm, peaceful-frustrated, wonderful-terrible). On a scale from 1 to 5, students rated their feelings toward learning a specific skill using the 12 pairs of words. Number 1 on the SDS corresponded to a negative word, for example, "terrible" and indicated a very negative attitude toward learning, while number 5 corresponded to a positive word, for example, "wonderful" and represented a very positive attitude toward learning a specific skill.

Pizzo (1981) developed the scale to “compare the attitudes of students tested in an acoustic environment congruent with their preferences for an element of learning style, with those of students tested in an acoustic environment incongruent with their preferences for sound . . .” (p. 155). Her research revealed that the students who were matched with their preferred acoustic environments yielded significantly higher attitude scores than when they were mismatched ( $p > .01$ ). The SDS also was employed by Hodges (1985) to assess students’ attitudes toward learning mathematics in both a formal and informal classroom setting. That investigation revealed that students taught in an environment congruent with their learning-style preference, evidenced statistically improved attitude test scores. DeBello (1985) used an adaptation of the SDS to investigate social studies writing instruction. He found that youngsters who revised their compositions in ways that matched their identified learning-style proclivities evidenced increased satisfaction when writing.

### Procedures

This investigation was conducted during the latter part of the winter semester. Four fourth-grade classes (72 students) participated in this study. Two classes were grouped together for the investigation and were randomly assigned to treatments. There were approximately 36 students in each group and they experienced four instructional treatments—two traditional and two tactual and kinesthetic. Traditional instructional methods included reading from the textbook, discussion, and answering questions at the end of each section. The tactual resources included Task Cards, Learning Wheels, Fact Fans, Electroboards, and Flip Chutes, while the kinesthetic resources included Floor Games and role playing (Dunn & Dunn, 1992). All students were taught social studies for four weeks. One week was devoted to each of the four units of study. At the beginning of each unit, students were pre-tested to establish prior knowledge of each unit. At the end of each unit, the identical 18-item test that paralleled the objectives of each unit was administered as a posttest to assess achievement under each condition. Also, students were administered the SDS (Pizzo, 1981) at the completion of each unit to determine attitude changes toward social studies as a result of instructional treatments used. The four units of study were (a) *The English Colony of New York*, (b) *New York in the American Revolution*, (c) *The New State in the New Nation*, and (d) *New York Becomes the Empire State*. Each unit was comprised of three lessons. The investigation was conducted in the mornings and each lesson lasted 45 minutes.

During the first week, the researcher introduced each of the three lessons in Unit 1 (*The English Colony of New York*) to Group One by using self-corrective tactual and kinesthetic resources. Prior to this, the researcher told students the objectives of the lesson so that they knew what they were expected to learn by the end of instruction. Subsequently, the researcher read aloud and discussed the lessons with the students while they followed along in their text. Role-playing was encouraged to further clarify the objectives. Reading aloud helped to control for differences in reading ability among the students. At the completion of each lesson, students were required to answer questions to verify their understanding. Instruction lasted three days, and, on the fourth day students were allowed to review the information using self-corrective tactual and kinesthetic materials. On the fifth day, the post-test was administered to students, followed by the SDS (Pizzo, 1981). During that same week (one), the researcher taught Group Two the same unit using traditional methods. Instruction occurred only through teacher-directed lessons and followed the same format used for group one with the exception that the tactual and kinesthetic resources and role playing were excluded from the lessons. On the fourth day, students used their text to review the objectives covered in the unit.

During the second week, the researcher introduced Unit 2 (*New York in the American Revolution*) to Group Two using tactual and kinesthetic resources while Group One was taught traditionally. During week three, Group One was introduced to Unit 3 (*The New State in the New Nation*) through tactual and kinesthetic resources while group two received a traditional treatment lesson. During the fourth week, Group Two was taught Unit 4 (*New*

*York Becomes the Empire State*) using tactual and kinesthetic resources while Group One received a traditional treatment lesson. When using a counterbalance design, it is desirable to balance the order of the experimental treatments rather than have them administered in the same sequence to all subjects. In this way, if the order of receiving the experimental treatments has some effect, this effect can be balanced to some extent (Wiersma, 1991).

The four units were in the fourth-grade, social studies text, *New York Yesterday and Today* (Larkin et al., 1985, 1990). The tests for the four units were in the Test Masters, *New York Yesterday and Today* (Larkin et al., 1985, 1990). These tests have evidenced high reliability and validity and have been used for many years with fourth graders across New York State.

One month after instruction was completed, students were administered a 20-item posttest (without any review), to determine if long-term retention of social studies knowledge was greater for units taught using tactual and kinesthetic resources or traditional methods. The four instructional units and tests were validated by six, fourth-grade teachers and the Curriculum Coordinator for Social Studies in the school district where the study was conducted. All the teachers had more than eight years of teaching experience at the fourth-grade level. This panel of experts considered the units and tests to be appropriate and equivalent in difficulty.

### Results and Discussion

A multivariate analysis of variance (MANOVA) assessed the effects of treatments and attitudes in this investigation. The analysis of variance revealed a significant interaction effect ( $p < .0001$ ) between tactual and kinesthetic and traditional instructional methods. The means are presented in Table 1. Simple main effects tests were conducted to determine exactly where the interaction occurred. The results can be seen in Table 2 and Table 3. That analysis indicated that the students identified as having tactual and kinesthetic learning-style preferences obtained a mean gain score of 10% higher when instructional methods were congruent rather than incongruent with their learning styles. This mean difference was significant at the .0001 level. Non tactually and kinesthetically preferred students also evidenced 3% higher when taught with tactual and kinesthetic resources versus traditional methods. However, this difference was not significant.

Furthermore, the analysis of variance (ANOVA) main effect of instructional treatment was highly significant ( $p < .0001$ ), revealing statistical differences in social-studies long-term memory for content taught with tactual and kinesthetic and traditional instructional resources. Additional simple main-effects tests results presented in Table 3 and Table 4 demonstrated that students achieved 20% higher mean posttest scores for social-studies content taught using tactual/kinesthetic instructional resources than with a traditional approach. This was significant at the .0001 level. Long-term memory was more efficient for all students when instructed with tactual and kinesthetic resources than with traditional methods.

A multivariate analysis of variance revealed a significant difference in students' attitude toward tactual and kinesthetic versus traditional instruction. Youngsters consistently rated tactual and kinesthetic lessons statistically higher ( $p < .0001$ ) than when they were taught social studies content with traditional methods. Students found the learning process more enjoyable when they were taught with tactual and kinesthetic resources than with traditional methods.

The findings of this investigation verified that, when the appropriate instructional method was matched with students' tactual and kinesthetic strengths, higher achievement gains and more positive attitudes resulted than with traditional instruction. The significant results obtained makes a powerful statement for including tactual and kinesthetic resources in the classroom instructional environment.

Table 1  
Mean Test Scores for Traditional Versus Tactual and Kinesthetic Treatments by Preference

Presentations	Preference	Mean	Std. Error
Traditional	Tactual/Kinesthetic	46.62	1.81
	Non-Pref.	51.93	1.92
Tactual/Kinesthetic	Tactual/Kinesthetic	56.48	1.09
	Non-Pref.	54.84	1.07

Table 2  
Simple Main Effects Tests Results For Tactual/Kinesthetic Versus Traditional Instruction by Preference

Presentations	Preference	Mean Diff.	Std. Error	Sig. (a)
Tactual/Kinesthetic vs. Traditional	Tactual/Kinesthetic	9.79	1.81	.0001*
	Non-Pref.	2.91	1.92	.133

\* The mean difference is significant at the .0001 level

Table 3  
Mean Posttest Scores for Long-Term Retention of Social Studies Content for Traditional Versus Tactual/Kinesthetic Instruction

Treatments	Mean	Std. Error
Traditional	57.98	2.03
Tactual/Kinesthetic	77.77	1.71

Table 4  
Pairwise Comparison Results of Mean Long-Term Retention Posttest Scores for Social Studies Content Taught Using Traditional Versus Tactual/Kinesthetic Instruction

	Mean Difference	Std. Error	Sig. (a)
Tactual Kinesthetic vs. Traditional	19.78	1.647	.0001*

\* The mean difference is significant at the .0001 level

### Implications

Many studies have documented the academic gains that accrued when individuals' perceptual strengths were accommodated (Carbo, 1980; Dunn & Dunn, 1992; Drew, 1992; Jarsonbeck, 1984; Weinberg, 1983; Wheeler, 1983). Elementary students appear to have auditory and visual deficits but strong tactual and kinesthetic preferences. Too often, those children are unsuccessful in our schools because instructional methods are dissonant from their learning styles.

Schools that provide instruction only through auditory and visual channels miss the advantages gained by incorporating tactual and kinesthetic instructional resources to meet

the needs of those students who find it difficult to retain new and difficult information auditorially and visually. Since our educational system tends to focus on traditional methods of teaching, this practice may alienate many youngsters from school and, in so doing, educators may forgo the rich dividends that could result from tactual/kinesthetic instruction. It is imperative therefore, that educators experiment with any of the following suggestions:

1. Reexamine the delivery systems used to instruct our youngsters and implement changes to ensure that all students are provided opportunities in which to be successful—not only those who have been endowed with auditory and visual strengths.
2. Provide inservice training for all teachers so that they become knowledgeable about learning styles and the benefits that accrue when students' learning styles are accommodated. In addition, they should be taught how to identify students' learning styles using a valid and reliable instrument—namely the *Learning Style Inventory*, and taught how to design tactual and kinesthetic resources to accommodate those students who do not conform to traditional instructional strategies.
3. Administer the *Learning Style Inventory* (LSI) (Dunn, Dunn, & Price, 1996) to all youngsters early in the school year to identify their learning-style strengths. This knowledge should be used to plan instructional strategies and resources on a daily basis to accommodate the needs of tactual and kinesthetic students who often comprise the majority of elementary students.
4. Include manipulative resources and role-playing techniques as a vital part of instructional strategies used in the classroom since elementary students tend to be tactual and kinesthetic learners.

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