

## Chapter 3 METHODS AND PROCEDURES

According to Ladd (1993), identification of teaching and learning styles is the first step in improving instruction and implementing variety in the classroom. Numerous inventories are available that attempt to identify teaching and learning styles. A Learning Styles Inventory developed by Canfield (1992) measures the affective behaviors of learning style. Further, Canfield and Canfield (1988) developed an Instructional Styles Inventory to identify conditions under which instructors teach best. The Instructional Styles Inventory and the Learning Styles Inventory parallel each other allowing the two to be linked. Together, these inventories provide the ability to compare instructor and learner preferences.

The purposes of this study were to identify the teaching styles of business instructors and the learning styles of their students in a specific content area to determine whether a match between the two existed. This study further determined if relationships existed between student success and style match and between student perceptions of instructor effectiveness and style match. This chapter delineates the sampling technique used in the study, the population sampled, the instrumentation used in the study, the data collection procedures, and the statistical analysis. The research questions addressed were:

1. What are the teaching style profiles, including typologies, of the business instructors as measured by the Canfield Instructional Styles Inventory?
2. What are the learning style profiles, including typologies, of students in specified business classes as measured by the Canfield Learning Styles Inventory?
3. What is the percentage of match of teaching styles and learning styles across the classes of business instructors?
4. What is the relationship between students' success as indicated by course grades and a match between their learning styles and the instructors' teaching style?
5. What is the relationship between students' success as indicated by final exam scores and a match between their learning styles and the instructors' teaching style?
6. What is the relationship between student evaluations of their instructors and a match between teaching style and learning style?

### Population

The subjects of the study were business instructors and students from two community colleges in Southwestern Virginia. Both community colleges are two-year state institutions of higher learning operating under a state-wide system of community colleges. Both colleges offer certificate, diploma, and associate degree programs. Associate degree programs include Accounting, Administrative Support Technology, Business Management, Computer Applications, Computer Graphics, Early Childhood, Fashion Merchandising, Forensic Science, Gerontology, Human Services, Information Systems Technology, Marketing, Medical Office Systems, Microcomputer Applications, Paralegal Office Systems, and Police Science. Additionally, the colleges offer degree programs designed for transfer to four-year colleges such as the Associate of Arts Degree

program in Liberal Arts and the Associate in Science Degree programs in Science, Education, Business Administration, and General Studies. Both colleges are accredited by the Commission on Colleges of the Southern Association of Colleges and Schools to award the associate degree.

One community college has an enrollment of 3,643 students. The Business, Community, and Computer Services Department offers degrees in Administrative Support Technology, Accounting, Business Management, Human Services, Information Systems Technology, Marketing, and Police Science. The number of full-time faculty is 54 with 14 in business.

Enrollment at the other college is 4,351 students. The Division of Business, Humanities, and Social Sciences offers degrees in Accounting, Administrative Support Technology, Business Administration, Education, General Studies, Liberal Arts, and Management. Certificates may be obtained in Clerical Studies and Medical Office Clerk. The number of full-time faculty is 46 with 16 in business.

The specific subject areas included in this study were keyboarding, word processing, machine transcription, desktop publishing, and introduction to computers. Study participants were 5 business instructors and 99 students as shown in Table 1.

#### Sampling Technique

The non-probability, incidental sampling technique was utilized (Castetter & Heisier, 1988). The sample consisted of an available population at the two community colleges. Business instructors were asked to volunteer for the study. Their participation was requested verbally, followed by written correspondence from the researcher.

#### Instrumentation

The Canfield Learning Styles Inventory and the Canfield Instructional Styles Inventory were used to obtain a profile of the teaching styles of the business instructors and the learning styles of their students. The profile has 21 different scale units, each expressed as a percentile or t-scores.

A typology, which is a combination of individual learning and instructional styles scales, was used to identify learners and instructors by type. The typology yields a concise set of results. The typology and profile are different in format, but they are not mutually exclusive nor competing analyses. The typology has a finite set of nine outcomes. The typology results were used to identify the scales that most reflect the instructors' and students' interests. The form and content of both learner and instructor typologies are identical. These identical formats make it easy to assess the similarity of student and instructor style preferences, a primary use of the two instruments.

#### Canfield Learning Styles Inventory

The Canfield Learning Styles Inventory is divided into four major categories: Conditions for Learning, Area of Interest, Mode of Learning, and Expectation for Course Grade. Canfield (1977) explains these four major categories. The Conditions for Learning category constitutes about two-fifths of the items in the inventory. These items

Table 1.

Business Instructors (n=5), Students Taking Business Classes (n=99), and

Specific Subject Areas Included in This Study.

Instructor	Subject Area	Number of Students
1	Word Processing	17
2	Keyboarding	6
	Introduction to Computers	12
3	Keyboarding	8
	Word Processing	15
	Machine Transcription	7
	Desktop Publishing	7
4	Word Processing	17
5	Keyboarding	<u>10</u>
	Total	99

are designed to measure student motivational qualities. Additionally, the “items are phrased in terms of typical classroom or instructional situations and are oriented around the four major motivational areas of affiliation, eminence, structure, and achievement” (p. 4). The items in the Area of Interest category were developed to measure students’ preferred subject matter or objects of study: numerical, qualitative, inanimate, and people. These measures provide the instructor with “an advance suggestion about the topical areas in the student’s experience which are most likely to be attractive, and where particular efforts to encourage or excite the student might be helpful. These scores...may also suggest specific kinds of assignments or projects within any given course or program of study” (p. 4). The Mode of Learning category concentrates on identifying the specific modality through which students learned best. Included are four modes: listening or auditory, reading, iconic which includes graphs and pictures, and direct experience. The Expectation for Course Grade category is designed to “contrast the relative prediction of success or failure for the individual learner and provides significant leads as to those individuals most likely to accept failure as what they expected, or to seek failure to confirm their self concepts” (p. 5).

These major categories are then differentiated into 21 distinct scales. These scales include eight preferred Conditions for Learning (Peer, Organization, Goal Setting, Competition, Instructor, Detail, Independence, Authority); four preferred Areas of Interest (Numeric, Qualitative, Inanimate, People); four preferred Modes of Learning (Listening, Reading, Iconic, Direct Experience); and five Expectations for Course Grades (A, B, C, D, and Total Expectation) as shown in Appendix A.

Validity. Validity is the extent to which an instrument measures what it is supposed to measure. Traditionally, validity refers to testing the relationship of a given measure to some standard measure of success. For example, “comparing results on a new measure of math aptitude to a criterion of success in a math course or a widely accepted math achievement test” (Canfield, 1992, p. 38). However, the Canfield Learning Style Inventory is not this type of traditional test. For example, there is no expectation that consequences in any broadly defined area will be derived from a student’s preference for the Iconic or Competition scale. Instead, the Learning Styles Inventory provides students with a detailed description of their characteristic preferred learning styles. The expected outcome is that greater success and satisfaction will be provided to the students when their learning style is matched to the instructional environment.

“The most obvious test of whether learning style preferences are sensibly estimated is to collect them in a group for whom one has prior expectations. Do math majors show a preference for the Numeric scale, trade school students for Direct Experience...?” (Canfield, 1992, p. 38). Research studies reveal that there is a relationship between the academic and career choices of those tested and the preferences revealed by scales and sets of scales of the Learning Styles Inventory. For example, Llorens and Adams (1978, in Canfield, 1992) studied occupational therapy students and found that they had a higher preference for Direct Experience, Instructor, Goal Setting, People, and Independence than the normed group. These students had a lower preference for Numeric and Reading than the normed group. Additionally, Pettigrew and Zakrajsek (1984, in Canfield, 1992) studied physical education majors and found that they in

comparison to the normed group had a higher preference for Direct Experience, Iconic, and Organization; but a lower preference for Numeric and Reading. “Collectively, these reports reflect many hundreds of administrations of the Learning Styles Inventory and give solid preliminary evidence that the preferences discriminated by scales and sets of scales do relate to the academic and career choices of those tested” (Canfield, 1992, p. 38).

Canfield (1992) suggested that the ability to demonstrate whether teaching students through techniques congruent with their learning style preferences will enhance achievement and satisfaction with the learning experience is another more critical kind of validity test. Three studies which used different curricular content and a variety of student characteristics demonstrated this concept in the affirmative. Pettigrew and Heikkinen (1985, in Canfield, 1992) “compared psychomotor learning in junior high school students who were taught using eclectic techniques that took their learning style preferences into account, to their peers who were taught using techniques that the instructor preferred” (p. 39). Students who were taught through techniques congruent with their learning style preferences performed better on 9 of 12 tasks. They didn’t perform any lower on the remaining three tasks. Robertson (1978, in Canfield, 1992) found that “instructional prescriptions to improve reading were more effective when based on matching learning materials to Learning Styles Inventory scores” (p. 39). Additionally, Irby (1977, in Canfield, 1992) reported that “medical residents and their faculty preceptors both experienced greater satisfaction on a three-month follow-up when preceptor-student and student-preceptor evaluations were supplemented with information about fits and mis-fits in the residents’ learning style preferences and the preceptors’ instructional style preferences” (p. 39).

Evidence of concurrent and discriminant validity for the Area of Interest scales (Numeric, Qualitative, Inanimate, People) was provided by Davis (1979, in Canfield, 1992). Canfield (1992) defines concurrent validity as “evidence of a relationship between scales and conceptually related outcomes--for example, Reading scale to English performance, Numeric scale to math performance” (p. 40). Divergent validity “refers to evidence that scales do not predict outcomes that are conceptually unrelated--for example, reading should not predict math performance, Numeric should not predict English performance” (p. 40). Davis simultaneously obtained evidence of both in his study. He found that the English course performance of college students was significantly related to Reading scale preferences (concurrent validity), and performance in math was significantly related to Numeric scale preferences (discriminant validity).

Correlational evidence of relationships between the Learning Styles Inventory scales and related learning outcomes was provided by Raines (1978). He found that higher-achieving community college math students more closely matched the instructor’s instructional style as opposed to the lower-achieving students.

**Reliability.** Brainard and Ommen (1976, in Canfield, 1977) conducted numerous standardization and reliability studies using the Canfield Learning Styles Inventory at a community college in Missouri in 1976. They administered the Learning Styles Inventory to over 3,000 community college students. A sample of 1,397 students was used to study internal consistency. “The correlations they compiled were coefficients that were

corrected for the fact that the reliability of a larger scale was being estimated from a reduced number of items” (Canfield, 1992, p. 36). The values ranged from a low of .87 to a high of .965. For the Instructor scale, the median correlation was .87, and for the Organization scale, the median correlation was .88, both within the Conditions for Learning category. For the Direct Experience scale within the Mode of Learning category, the median correlation was .88. The high correlation for the A-Expectation and D-Expectation scales was in the Expectation for Course Grade category, each with median correlations of .965.

Split-half reliability scores reveal the consistency of rank preferences when a “given quality is assessed by different sets of items drawn from different sections of the Learning Styles Inventory--for example, whether the mean rank of Peer on Items 6, 16, and 26 matches that for Items 1, 11, and 21” (Canfield, 1992, p. 36). The split-half reliability scores obtained for each scale were higher than those for the analyses of individual items. The high was .99, and the low was .96.

The normative sample for Form A of the Canfield Learning Styles Inventory was obtained in midwestern locations. The sample involved 2,544 community college students (1,180 women and 1,364 men). The reading level of the inventory was obtained by using the Fry method. This method uses the mean number of sentences and syllables. There were an average of 8.7 sentences and 146 syllables per hundred words of text. The estimated reading level of the inventory is mid-seventh grade instructional level.

For this research study, students completed the Canfield Learning Styles Inventory which is composed of 30 items. The average time for completion of the inventory was approximately 30 minutes. Each of the 30 items has 4 corresponding choices. Students ranked these choices in the order that best described their preferences or reactions. Each item was ranked on a scale of 1 to 4: 1 = most preferred choice, 2 = second preferred choice, 3 = third preferred choice, and 4 = least preferred choice. Ranking of the four responses on each item equates to six paired comparison items in which the student chooses one item from each pair. For example: Peer, Organization, Goal Setting, and Competition each are ranked on a total of 6 items within the inventory (1, 6, 11, 16, 21, 26).

The Learning Styles Inventory was hand-scored and double checked by the researcher. To score the Learning Styles Inventory, raw scores were obtained by adding the numerical values assigned to each item. Six item values for each scale are arranged in horizontal rows. Thus, the sum of the numbers for items 1a, 6a, 11a, 16a, 21a, and 26a produce a raw score for the Peer Scale. (The Peer scale corresponds to 1a, Organization Scale corresponds to items for 1b, etc.).

A ranking process was used to obtain the raw scores. Thus, the lower the score, the stronger the preference. According to the Profile Form, the lowest possible score is 6, and the highest possible score is 24. Therefore, the strongest preference for a scale would be denoted by the lowest possible score of 6. The least preferred scale would be denoted by the highest possible score which is 24.

Once raw scores were obtained, they were converted to a standardized profile form. This form shows two types of graphic displays:

1. Raw scores, which provide a criterion referenced profile. This projects how students ranked the items in relation to each other.
2. Percentile scores, which provide a norm referenced profile. This shows the students preferences in relation to a group.

After completing the standardized profile form on each student to obtain their t-scores and percentile scores, a Learner Typology for each student was developed. The X value of the Learner Typology was derived by using t-scores obtained for six scales: Organization, Qualitative, Reading, Direct Experience, Inanimate, and Iconic. The Y value of the Learner Typology was derived by using t-scores obtained for four scales: Peer, Instructor, Goal Setting, and Independence. These scores were calculated within an equation to obtain two summary scores X and Y.

The Learner Typology summarizes the results of the Learning Styles Inventory into one of nine distinct categories (Canfield, 1992):

1. **Social** - prefers extensive opportunities to interact with peers and instructors; has no strong preference for either applied or conceptual approaches; instruction involving small groups and teamwork will create the closest match.
2. **Independent** - prefers to work alone toward individual goals; has no strong preference for either applied or conceptual approaches; instructional techniques such as analysis of case studies or self-selected and self-paced programs will create the closest match.
3. **Applied** - prefers to work in activities directly related to real-world experience; has no strong preference for either social or independent approaches; instruction involving practicums, site visits, and team labs will create the closest match.
4. **Conceptual** - prefers to work with highly organized language-oriented materials; has no preference for either social or independent approaches; instruction involving lectures and reading will create the closest match.
5. **Social/Applied** - prefers to have opportunities to interact with students and instructors in activities closely approximating real-world experiences; instruction involving role playing, group problem solving, and supervised practicums will create the closest match.
6. **Social/Conceptual** - prefers to have opportunities to interact with students and instructors using highly organized language-oriented materials; instruction involving a balance of lecture and discussion will create the closest match.
7. **Independent/Applied** - prefers to work alone toward individual goals in activities closely approximating real-world experience; instruction involving individual labs of unsupervised technical practicums will create the closest match.
8. **Independent/Conceptual** - prefers to work alone toward individual goals with highly organized language-oriented materials; instruction

allowing for independent reading, literature searches, and reviews will create the closest match.

9. **Neutral Preference** - tends to have no clear areas of strong preference; may find adequate match in any other type, but may also find it difficult at times to become entirely involved. (Canfield, 1992, p. 7)

### Canfield Instructional Styles Inventory

The Canfield Instructional Styles Inventory (ISI) is designed to identify the conditions under which instructors in educational settings teach best. It provides a comprehensive profile of techniques instructors do and do not like to use when presenting material to students. It is a 25-item self-report that assesses preferences for 21 different aspects of the teaching-learning experience.

The Canfield Instructional Styles Inventory is divided into four major categories: Conditions for Instruction, Areas of Interest, Modes of Instruction, and Influence. These major categories are then differentiated into 21 distinct scales. These scales include eight preferred Conditions for Instruction (Peer, Organization, Goal Setting, Competition, Instructor, Detail, Independence, Authority); four preferred Areas of Interest (Numeric, Qualitative, Inanimate, People); four preferred Modes of Instruction (Lecturing, Readings, Iconic, Direct Experience); and five Influence (A, B, C, D, and Total Influence) as shown in Appendix B.

Validity. The Canfield Instructional Styles Inventory and the Canfield Learning Styles Inventory are matched together on an item-by-item basis, and both instruments were administered to the same group of subjects. Thus, the studies used to validate the learning styles inventory can be used to validate the instructional styles inventory. According to Bradley (1985),

The reviewer is left with a positive impression of the test's potential usefulness because of its thoroughness of coverage. Few competing assessment devices can match the ease of administration and scoring on the one hand and the detail of the profiled results on the other (p. 695).

Reliability. Reliability studies were conducted to assess internal consistency and test-retest reliability of the Instructional Styles Inventory. Internal consistency examines whether items in a scale produce the same kinds of results as those for the scale as a whole. It shows "whether people tend to change their characteristic response in the time it takes to go from item to item or from one section of the task to another" (Canfield, 1992, p. 22). Internal consistency was demonstrated using a sample of 200 instructors (100 males and 100 females). Using a four-cell table, and combining item ranks 1 and 2 into one category and item ranks 3 and 4 into another category, total scores were divided into the upper and lower halves as close to the 50-50 distribution split as permitted on a given scale. To determine the association between item ranks and the total score ranks on each scale, phi coefficients were computed. The results were then obtained by averaging the five item values for each scale. The values ranged from a low of approximately .6 for Organization and Authority to a high of approximately .8 for the Areas of Interest scales and Direct Experience. A phi coefficient of .74 was the median value. "This measure of association ranking yields less sensitive estimates than do more traditional item analysis

statistics such as Pearson correlations or coefficient alpha. In view of this, the results tend to show adequate internal consistency for the scales of the Instructional Styles Inventory” (Canfield, 1988, p. 22).

To obtain test-retest reliability estimates, a class of 62 students were tested twice with an interval of seven days between testing (with no discussion of the instrument or its contents in between the two administrations). The results of the Pearson correlations between the two ranged from a low of approximately .8 for Instructor to highs in the .9s for all of the Areas of Interest scales, Organization, Authority, Direct Experience, and two of the Influence scales. There was a strong test-retest result with a median value of .89 (Canfield & Canfield, 1988).

For the purposes of this study, instructors completed the Canfield Instructional Styles Inventory which is composed of 25 items. The average time for completion of the inventory was approximately 25 minutes. Each of the 25 items has four corresponding choices. Instructors ranked these choices in the order that best described their preferences or reactions. Each item was ranked on a scale of 1 to 4: 1 = most preferred choice, 2 = second preferred choice, 3 = third preferred choice, and 4 = least preferred choice. Ranking of the four responses on each item equates to five paired comparison items in which the instructor chooses one item from each pair. For example: Peer, Organization, Goal Setting, and Competition each are ranked on a total of 5 items within the inventory (Items 1, 6, 11, 16, 21).

The Instructional Styles Inventory was hand-scored by the researcher. To score the Instructional Styles Inventory, raw scores were obtained by adding the numerical values assigned to each item. Five values for each scale are arranged in horizontal rows. Thus, the sum of the numbers for items 1a, 6a, 11a, 16, and 21a, produce a raw score for the Peer Scale.

A ranking process was used to obtain the raw scores. Thus, the lower the score, the stronger the preference. According to the Profile Form, the lowest possible score is five, and the highest possible score is 20. Therefore, the strongest preference for a scale would be denoted by the lowest possible score 5. The least preferred scale would be denoted by the highest possible score 20.

Once raw scores were obtained, they were converted to a standardized profile form. This form shows two types of graphic displays:

1. Raw scores, which provide a criterion referenced profile. This projects how instructors ranked the items in relation to each other.
2. Percentile scores, which provide a norm referenced profile. This shows the instructors preferences in relation to a group.

After completing the standardized profile form on each instructor to obtain the instructor’s t-scores and percentile score, an Instructor Typology for each instructor was constructed. The X value of the Instructor Typology was derived by using t-scores obtained for six scales: Organization, Qualitative, Reading, Direct Experience, Inanimate, and Iconic. The Y value of the Instructor Typology was derived by using t-scores obtained for four scales: Peer, Instructor, Goal Setting, and Independence. These scores were calculated within an equation to obtain two summary scores X and Y.

The Instructor Typology summarizes the results of the Instructional Styles Inventory into one of nine distinct categories (Canfield, 1988):

1. **Social** - likes to allow opportunities for students to interact with each other and for instructors to interact with students. Less likely to use learning methods that require solitary and self-directed activity. No strong preference for Applied or Conceptual approaches and learning materials. Emphasizes group discussion and teamwork in creating instructional plans.
2. **Independent** - prefers to set up opportunities for students to work alone toward individual goals. Tends to be less interested in allowing for social interaction than is the average instructor. No strong preference for Applied or Conceptual approaches and materials. Instructional techniques such as the analysis of case studies or the development of self-paced or programmed instruction closely match the interests of these instructors.
3. **Applied** - feels that students should work on activities that have a clear relation to everyday, real-world experiences. Likely to feel frustrated with a heavy reliance on lectures, preparatory reading, and the extensive use of language as a medium of information exchange. No clear preference for Social or Independent approaches or materials. Instruction involving practicums, site visits, and team labs will likely be emphasized in these instructors' curriculum plans.
4. **Conceptual** - likes to work with highly organized language-oriented materials. Likely to be less satisfied with instruction that focuses on inducing learning from everyday, real-world experience. No clear preference for Social or Independent materials and approaches. Instructional methods emphasizing lecture and reading formats will prove most satisfying for instructors with these preferences.
5. **Neutral Preference** - no strong preferences. May find it easy to shift and tailor instructional approach to suit the needs of a given set of students or a particular piece of curriculum. On the other hand, lacking strong preferences may also reflect some degree of detachment, making it difficult at times to be an enthusiastic advocate who can motivate students.
6. **Social/Applied** - enjoys creating opportunities for students and instructors to interact in activities closely related to real-world experiences. Likely to feel less comfortable with solitary or self-directed activity involving a reading or language component. Instruction involving role playing, group problem solving, and supervised practicums will likely be emphasized in these instructors' educational plans.
7. **Social/Conceptual** - likes to create opportunities for student interaction and prefers to deal with language oriented materials. May feel frustrated if expected to assign and supervise solitary self-directed

tasks involving concrete applications to real-world settings. Prefers to plan lessons involving a balance of lecture and discussion formats.

8. **Independent/Applied** - prefers that students work alone toward individual goals using materials closely related to real-world experience. Will likely find less satisfaction working with socially interactive situations involving a great deal of lecturing, reading, or other language-intensive activities. Instruction involving individual labs or less supervised technical practicums will most closely match these instructors' preferences.
9. **Independent/Conceptual** - prefers to create opportunities for students to work alone toward individual goals using organized language-oriented materials. Tends to feel frustrated if required to spend a large proportion of time managing learning activities that are socially interactive and closely tied to real-world experiences. An emphasis on independent reading, literature searches, and reviews is likely to match the preferences of these instructors. (Canfield, 1988, p. 6)

#### Data Collection Procedures

Business instructors at the two community colleges were contacted by telephone. The researcher presented the topic to the instructors, explained the purposes of the study, and asked for approval to use the keyboarding, word processing, machine transcription, desktop publishing, and introduction to computer classes to collect data for the research. Application for human subjects clearance was made and approved by the Sponsored Programs Department at Virginia Tech.

A pilot study was conducted that involved five students and one instructor from a community college. The results from the pilot study indicated no changes in the directions or procedures were needed.

The researcher met with business instructors and their students the fifth week of the five-week first summer class session. The purpose of the study was explained to each class, i.e., to identify the teaching styles of business instructors and the learning styles of their students in specific content areas, to determine if there was a match between the two, and to determine if there were relationships between student success and style match and between student evaluations of instructors and style match. A brief explanation of the instruments to be used was given. Instructors were informed that the Canfield Instructional Styles Inventory was designed to be used by instructors in the educational setting to identify the conditions under which they teach best. It provides a comprehensive profile of the techniques instructors do and do not like to use when presenting material to students.

Students were informed that the Canfield Learning Styles Inventory was a self-report questionnaire that allowed them to describe the features of their educational experiences they preferred the most. Both the instructors and the students were informed that the nature of the inventory was descriptive as opposed to evaluative and that the inventory would take approximately 30 minutes to complete. They were told that some items may sound familiar, but that each item was different and should be examined

carefully. They were encouraged to ensure that all questions had been answered to alleviate the problem of incomplete and inaccurate results.

The Canfield Instructional Styles Inventory was administered to the instructors. Instructions for completing the Instructional Styles Inventory were given as shown in Appendix C. The Canfield Learning Styles Inventory was administered to the students. Instructions for completing the Learning Styles Inventory were given as shown in Appendix D. Both the Instructional and Learning styles inventories were administered at the same time. The instructor evaluation form as shown in Appendix E was distributed to the students. They were told that their identity would remain anonymous and were asked to provide an overall evaluation of the instructor. The researcher collected the inventories and evaluation forms and checked them to ensure they were completed accurately.

The form provided the instructors to record the students course grade, final exam score, and GPA (as of Spring 1997) appears in Appendix F. This form was given to the instructors prior to class time so that identification numbers could be assigned to each form. The instructors used the last four digits of each student's social security number to identify each student ensuring that their identity remained anonymous to the researcher.

#### Statistical Treatment

Descriptive statistics were employed to answer the first two questions. Questions three, four, five, and six required statistical analysis. In addition, the procedures for scoring the instruments were explained.

#### **Research Question One: What are the teaching style profiles, including typologies, of the business instructors as measured by the Canfield Instructional Styles Inventory?**

To answer this question, the Canfield Instructional Styles Inventory was completed by the instructors. Each question was answered by choosing 1 for the most-preferred selection and 4 for the least-preferred selection. These scores were totaled for each scale to obtain the raw scores. Group means (representative of the raw scores for the group of business instructors in the study) were calculated for each scale. The lowest raw score represented the most preferred scale. The highest raw score represented the least preferred scale within the category. These scores were converted to a standardized profile form. This form allowed each scale to be linked to a normed percentile as well as t-scores. The percentile was used to compare the normed reference group to the group of participants in the study. The Canfield Instructional Styles Inventory was administered to 801 instructors from several Midwestern community colleges to obtain the primary normed reference group (Ladd, 1993).

The instructor typologies were obtained by correlating information from 10 different Instructional Styles Inventory scales. The Instructor Typology classifies instructors into nine categories. The percentage of business instructors in each of the categories within the Instructor Typology were calculated. Dividing the number of participants who preferred a category by the total number of participants yielded the actual percentage.

**Research Question Two: What are the learning style profiles, including typologies, of the students in business classes as measured by the Canfield Learning Styles Inventory?**

To answer this question, the Canfield Learning Styles Inventory was completed by the students. Each question was answered by choosing 1 for the most-preferred selection and 4 for the least-preferred selection. These scores were totaled for each scale to obtain the raw scores. Group means and standard deviations (representative of the raw scores for the group of students in the study) were calculated for each scale. The lowest raw score represented the most preferred scale. The highest raw score represented the least preferred scale within the category. These scores were converted to a standardized profile form. This form allowed each scale to be linked to a normed percentile as well as t-scores. The percentile was used to compare the normed reference group to the group of participants in the study. The Canfield Learning Styles Inventory was administered to 2,544 community college students from the Midwestern United States to obtain the normed reference group.

Learner typologies were obtained by correlating information from 10 different Learning Styles Inventory scales. The Learner Typology classifies students into nine categories. The percentage of students in each of these categories of the learner typology was calculated. The highest percentage as well as the lowest percentages were related to the group as a whole. Dividing the number of participants who preferred a category by the total number of participants yielded the actual percentage.

**Research Question Three: What is the percentage of match of teaching styles and learning styles across classes of business instructors?**

To answer this question, instructors' teaching styles and students' learning styles were identified. The number of students who matched the instructor's teaching style was determined. This number was divided by the total class size and multiplied by 100 to obtain the percent of match.

**Research Question Four: What is the relationship between students' success as indicated by course grades and a match between their learning styles and the instructors' teaching style?**

For this question, students were blocked into two groups as shown in Table 2: high achievers, grade point average (GPA) of 2.5 to 4.0, and low achievers, GPA of 1.0 to 2.4, using a 4.0 grading scale. The two categories were divided relative to match of learning style to teaching style with those matching designated as "1" and the non-matches designated by "0." The two independent variables were the two GPA categories and match or non-match of learning style and teaching style. The dependent variable was

Table 2.  
 Analysis of Variance Comparisons for Research Questions 4, 5, and 6

	Match = 1 Learning Style to Teaching Style	Non-Match = 0 Learning Style to Teaching Style
Research Question 4		
High GPA <sup>a</sup> = 2	Course Grade <sup>b</sup>	Course Grade
Low GPA = 1	Course Grade	Course Grade
Research Question 5		
High GPA = 2	Final Exam Score <sup>c</sup>	Final Exam Score
Low GPA = 1	Final Exam Score	Final Exam Score
Research Question 6		
High GPA = 2	Instructor Evaluation <sup>d</sup>	Instructor Evaluation
Low GPA = 1	Instructor Evaluation	Instructor Evaluation

<sup>a</sup>High GPA = 2.5 to 4.0 on a 4.0 scale  
 Low GPA = 1.0 to 2.4

<sup>b</sup>Course Grade: A = 5, B = 4, C = 3, D = 2, F = 1

<sup>c</sup>Final Exam Score: A = 12, A- = 11, B+ = 10, B = 9, B- = 8, C+ = 7, C = 6, C- = 5,  
 D+ = 4, D = 3, D- = 2, F = 1

<sup>d</sup>Instructor Evaluation: Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1

course grade. A comparison of students' course grade, the ordinal variable across match and non-match, was made using analysis of variance to determine if there was a significant difference between those students who matched their instructors and those students who did not match. The course grade conversion was A = 5, B = 4, C = 3, D = 2, and F = 1. This conversion provided quasi-interval data which was used for the analysis of variance.

**Research Question Five: What is the relationship between students' success as indicated by final exam scores and a match between their learning styles and the instructors' teaching style?**

For this question, students were blocked into two groups: high achievers, GPA of 2.5 to 4.0 on a 4.0 scale, and low achievers, GPA of 1.0 to 2.4. Each of these were divided relative to match or non-match of teaching style. The two independent variables were the two GPA categories and match or non-match of learning style and teaching style. The dependent variable was final exam scores. A comparison of the mean final exam scores across match and non-match was made using analysis of variance. The final exam score conversion was A = 12, A- = 11, B+ = 10, B = 9, B- = 8, C+ = 7, C = 6, C- = 5, D+ = 4, D = 3, D- = 2, F = 1. This conversion provided quasi-interval data to be used for the analysis of variance.

**Research Question Six: What is the relationship between students evaluations of their instructors and a match between teaching style and learning style?**

For this question, students were blocked into two groups: high achievers, GPA of 2.5 to 4.0 on a 4.0 scale, and low achievers, GPA of 1.0 to 2.4. Each of these are divided relative to match or non-match of learning style to teaching style. The two independent variables were the two GPA categories and match or non-match of learning style and teaching style. The dependent variable was rating of instructors. A comparison of the instructors ratings across match and non-match was made using analysis of variance. The instructor evaluation conversion was excellent = 5, very good = 4, good = 3, fair = 2, and poor = 1. This conversion provided quasi-interval data used for the analysis of variance.

### Summary

This chapter described the methodological procedures for the study. It includes the population and sample, the instrumentation used, the data collection procedures, and the statistical analysis procedures.

The population included instructors and their students from two community colleges in Southwest Virginia. The Canfield Learning Styles Inventory and the Canfield Instructional Styles Inventory were used to determine the students' learning styles and the instructors' teaching styles. Analysis of variance was used to determine the relationship between learning style and teaching style match and student success as indicated by course grades and final exam scores and between style match and instructor evaluations.