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## Pupil productivity in elementary school mathematics as related to principal and teacher leadership style

Beverly Roane Forster

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PUPIL PRODUCTIVITY IN ELEMENTARY SCHOOL MATHEMATICS AS  
RELATED TO PRINCIPAL AND TEACHER LEADERSHIP STYLE

*The College of William and Mary in Virginia*

Ed.D. 1983

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PUPIL PRODUCTIVITY IN ELEMENTARY SCHOOL  
MATHEMATICS AS RELATED TO PRINCIPAL  
AND TEACHER LEADERSHIP STYLE

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A Dissertation  
Presented to  
The Faculty of the School of Education  
The College of William and Mary in Virginia

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In Partial Fulfillment  
Of the Requirements for the Degree  
Doctor of Education

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by  
Beverly Roane Forster

May 1983

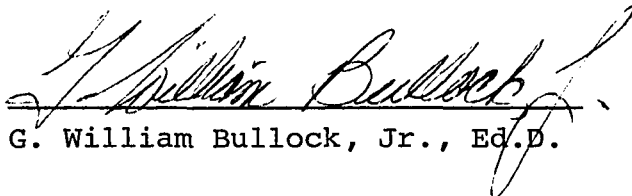
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by


Beverly Roane Forster

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## Chapter 1

### INTRODUCTION

Although the competency movement has gained nationwide political acceptance, the impetus is coming from the statehouses, not the schoolhouses.<sup>1</sup> This sociopolitical movement provides the technological scheme for what is termed "educational accountability"--an accountability born of economic and social problems which have recently plagued the schooling industry and may transform its future.<sup>2</sup> Drucker maintains that "the battle cry for the eighties and nineties will be the demand for performance and accountability from schools on all levels."<sup>3</sup> Lessinger believes this fundamental accountability or the "ability to deliver on promises" is owed to the public.<sup>4</sup> In fact,

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<sup>1</sup>Dorene D. Ross, "Competency Based Education: Understanding a Political Movement," The Educational Forum, XLVI, No. 4 (Summer, 1982), 483.

<sup>2</sup>Gene V. Glass, "The Many Faces of Educational Accountability," Phi Delta Kappan, LIII, No. 10 (June, 1972), 636.

<sup>3</sup>Peter F. Drucker, The Changing World of the Executive, (New York, New York: Truman Talley Books, 1982), p. 139.

<sup>4</sup>Leon M. Lessinger, Every Kid a Winner: Accountability in Education, (New York, New York: Simon and Schuster, 1970), p. 35.



Popham views a "public schooling truth-in-lending act" to be essential to the survival of public education.<sup>5</sup> Thus, school districts in the United States are being pressured by the public to be accountable for the educational achievement of pupils. By May, 1979, thirty-six states had taken either legislative or state board action to require some facet of an educational accountability program, and the remaining states had some similar form of activity under way.<sup>6</sup> The clamor for accountability continues. Currently, thirty-eight states have mandated such programs.<sup>7</sup> State legislators are sensitive to public opinions about education since money for education constitutes a large portion of individual state budgets. In addition, education legislation affects the entire electorate as each citizen is engaged in education and/or paying for education.<sup>8</sup>

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<sup>5</sup>W. James Popham, "The Case for Minimum Competency Testing," Phi Delta Kappan, LXIII, No. 2 (October, 1981), 91.

<sup>6</sup>Chris Pipho, "Competency Testing: A Response to Arthur Wise," Educational Leadership, LVI, No. 8 (May, 1979), 551.

<sup>7</sup>"Standardized Testing Fair, But Overused, Study Says," Education, USA, XXIV, No. 24 (February 8, 1982), 189.

<sup>8</sup>Henry M. Brickell and Regina H. Paul, Minimum Competencies and Transferable Skills: What Can Be Learned From the Two Movements, (Columbus, Ohio: The National Center for Research in Vocational Education, 1978), p. 10.

Accountability is an attempt to measure the productivity of a system, or its outputs, relative to the resources, or inputs, required by that system. With respect to education, the implication of accountability is that those assigned the task of educating children are to be held responsible in terms of the educational achievement of those children.<sup>9,10</sup> This responsibility has been a part of the educational scene for more than a century. In the 1840's, Boston public school officials instituted a common examination for members of the graduating class. The student performance was such that the Boston School Committee recommended changes which included more stringent requirements for teachers and greater accountability from the masters.<sup>11</sup> Public demand for accountability continued, and in the 1870's the New York legislature empowered the Regents to establish a system of examinations as a standard

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<sup>9</sup>James W. Becher, "Accountability: A New Form of Tease," Accountability: A State, a Process, or a Product?, ed. William J. Gephart (Bloomington, Indiana: Phi Delta Kappan, Inc., 1975), p. 6.

<sup>10</sup>Ernest R. House, "The Price of Productivity: Who Pays?" Accountability: A State, a Process, or a Product?, op. cit., p. 50.

<sup>11</sup>Jenne K. Britell, "Competence and Excellence: The Search For an Egalitarian Standard, The Demand For a Universal Guarantee," Minimum Competency Achievement Testing: Motives, Models, Measures, and Consequences, eds., Richard M. Jaeger and Carol Kehr Tittle (Berkley, California: McCutchan Publishing Corporation, 1980), pp. 28-29.

for elementary schools and high schools.<sup>12</sup> As early as the 1920's, nationally standardized tests in various subject areas were introduced. These provided a general tool to assess district-wide accountability. The use of nationally standardized tests has continued with information generally provided for broad groupings of students.<sup>13</sup> The decade of the seventies, however, saw a dramatic shift to the use of evidence based upon the achievement of stated instructional objectives for a particular student and/or group of students, using clearly identified procedures over a specified period of time.<sup>14,15</sup>

Whether examples of accountability programs such as those mandated in California, Oregon, Michigan, or Florida are failures or successes or whether legislatures are moving more carefully in adopting accountability

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<sup>12</sup>Ibid., p. 25.

<sup>13</sup>Ibid., pp. 30-31.

<sup>14</sup>Lesley H. Browder, Jr., "A Point of View," Emerging Patterns of Administrative Accountability, ed. Lesley H. Browder, Jr. (Berkeley, California: McCutchan Publishing Corporation, 1979), pp. 1-21.

<sup>15</sup>Leon M. Lessinger, "The Powerful Notion of Accountability in Education," Emerging Patterns of Administrative Accountability, op. cit., pp. 62-73.

legislation is currently beside the point.<sup>16,17,18,19,20, 21, 22, 23</sup> The preceding confirms the accountability orientation of the national education milieu. In the Commonwealth of Virginia, Section 2 of Article VIII of the Constitution of Virginia provides that "standards of quality for the several school divisions shall be determined and prescribed from time to time by the Board

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<sup>16</sup>Chris Pipho, "Minimum Competency Testing in 1978: A Look at State Standards," Phi Delta Kappan, LIX, No. 9 (May, 1978), 585-588.

<sup>17</sup>Ernest R. House, Wendell Rivers and Daniel L. Stufflebeam, "An Assessment of the Michigan Accountability System," Phi Delta Kappan, LV, No. 10 (June, 1974), 663-669.

<sup>18</sup>C. Phillip Kearney, David L. Donovan and Thomas H. Fisher, "In Defense of Michigan's Accountability Program," Phi Delta Kappan, LVI, No. 1 (September, 1974), 14-19.

<sup>19</sup>Gary D. Fenstermacher, "Educational Accountability: Features of the Concept," Theory Into Practice, XVIII, No. 5 (December, 1979), 330-335.

<sup>20</sup>Ron Brandt, "Conflicting Views on Competency Testing in Florida," Educational Leadership, XXXVI, No. 2 (November, 1978), 99-106.

<sup>21</sup>W. James Popham and Elaine Lindheim, "Implications of a Landmark Ruling on Florida's Minimum Competency Test," Phi Delta Kappan, LXIII, No. 1 (September, 1981), 18-20.

<sup>22</sup>Arthur Wise, "Why Minimum Competency Testing Will Not Improve Education," Educational Leadership, XXXVI, No. 8 (May, 1979), 546-549.

<sup>23</sup>Warren B. Newman, "Competency Testing: A Response to Arthur Wise," Educational Leadership, XXXVI, No. 8 (May, 1979), 549-551.

of Education, subject to revision only by the General Assembly."<sup>24</sup> This statute requires certain pupil achievement, particularly in mathematics and reading. The immediate focus of this statute, as interpreted by the State Board of Education of Virginia, was in grades K-6 (i.e., Basic Learning Skills, K-6).<sup>25</sup> This emphasis has continued and the Basic Learning Skills are in the process of being superseded by the Standards of Learning Program (K-12), which includes basic skills and knowledge to be expected of students at each strata.<sup>26</sup> Additionally, the Planning and Management Objectives adopted by the Virginia State Board of Education are intended to complement the standards and to provide direction within individual schools for principals and teachers in providing education for students in the state.<sup>27</sup> The Virginia State Board of Education on May 26, 1978, reworded certain accreditation

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<sup>24</sup>Standards of Quality and Objectives for Public Schools in Virginia, 1978-80. (Richmond, Virginia: Commonwealth of Virginia, Department of Education), p. 1 (Subsequent printing, 1980-82, 1982-84).

<sup>25</sup>Basic Learning Skills, Grades K-6, Minimum State-wide Educational Objectives Approved by the Board of Education, May 27, 1977 (Richmond, Virginia: Commonwealth of Virginia, Division of Elementary Education, Department of Education, July 1, 1977), pp. 1-2.

<sup>26</sup>Standards of Learning Objectives (Richmond, Virginia: Commonwealth of Virginia, Department of Education, August, 1981), p. 1.

<sup>27</sup>Standards of Quality and Objectives for Public Schools in Virginia, 1978-80, op. cit., pp. 7-10.

requirements of the Standards for Accrediting Secondary Schools in Virginia so that the principal will specifically certify that students, no later than the graduating class of 1981, shall have met both competency and credit requirements prior to the awarding of the diploma.<sup>28,29</sup> As with the mandated programs of several other states, one sees an expectation of coordinated effort--administrator and teacher with respect to student performance (K-12).<sup>30,31</sup> The import of this legislation and the Virginia State Department of Education regulations, promulgated to date, is the linking of students' educational performance to the performance or effectiveness of principals and teachers.

How is this coordinated effort--administrator, teacher and student--to be achieved? One answer commonly

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<sup>28</sup>W. E. Campbell, Superintendent of Public Instruction, "Proposed Revision in the Wording: Graduation Eligibility Requirements in Secondary Accreditation Standards" (Memo to Division Superintendents, May 2, 1978).

<sup>29</sup>Standards for Accrediting Schools in Virginia, Adopted by the Board of Education, July 1976, with Revisions July 1978, (Richmond, Virginia: Commonwealth of Virginia, Department of Education), pp. 13-18.

<sup>30</sup>Paul L. Tractenburg, "The Legal Implications of Statewide Pupil Performance Standards" (A background paper prepared for the Minimal Competency Workshop sponsored by the Education Commission of the States and the National Institute of Education, September, 1977), p. 7.

<sup>31</sup>K. B. Start, "Establishing Children's Learning as the Criterion for Teacher Effectiveness," Educational Research, XVI, No. 3 (June, 1974), 206-209.

offered by the general public and school administrators is effective leadership on the part of the principal.<sup>32,33,34,35</sup> To what extent does this recognize that effectiveness on the part of the principal may be as much related to the managerial situation as it is to the behaviors of the principal? This question suggests an investigation as to how leadership can or cannot influence student achievement, which in turn further suggests the study of leadership in an actual school situation. This approach could support a synthesis of theory, research, and practice.

### Leadership Theory

Beginning with Carlyle's "great man" belief, the quest for a predictable theory of leadership has spanned more than one hundred years.<sup>36</sup> One idea was that leaders

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<sup>32</sup>Stewart C. Purkey and Marshall S. Smith, "Too Soon to Cheer? Synthesis of Research on Effective Schools," Educational Leadership, XL, No. 3 (December, 1982), 66.

<sup>33</sup>Why Do Some Urban Schools Succeed? (Bloomington, Indiana: Phi Delta Kappa, 1980), pp. 132-135.

<sup>34</sup>Cindy Tursman, Good Schools: What Makes Them Work? (Arlington, Virginia: National School Public Relations Association, 1981), pp. 1-14.

<sup>35</sup>Daniel U. Levine, "Successful Approaches for Improving Academic Achievement in Inner-City Elementary Schools," Phi Delta Kappan, LXIII, No. 8 (April, 1982), 523-526.

<sup>36</sup>Ralph M. Stogdill, Handbook of Leadership (New York, New York: The Free Press, 1974), pp. 17-23.

exhibited some common traits that could be defined and classified. Another theory, postulated by environmentalists such as Bogartdus, in 1930, saw the leader emerging as a result of time, place, and situation.<sup>37</sup> By the 1940's, investigators such as Shartle, Hemphill, Stogdill, and others (Ohio State Leadership Studies) pursued the essentials of the trait theory while beginning a search for behaviors associated with effective leaders.<sup>38</sup> The complex nature of the leadership task and seemingly related behaviors did not yield a reliable basis for predicting an effective leader.<sup>39</sup> Both the trait theorists and behaviorists examined leader traits and leader behaviors independent of the situation in which the leader functioned.

Concurrent with the Ohio State Leadership Studies, Likert set forth a theory of leadership/effectiveness predicated upon systems of management extending along a continuum.<sup>40</sup> After reviewing the results of behavior studies into the 1970's, Stogdill concluded: "Group productivity does not vary consistently with directive and

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<sup>37</sup> Robert G. Owens, Organizational Behavior in Schools (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970), p. 120.

<sup>38</sup> Ralph M. Stogdill, op. cit., p. 128.

<sup>39</sup> Ibid., pp. 144-151, 155.

<sup>40</sup> Rensis Likert, The Human Organization (New York, New York: McGraw-Hill Book Company, 1967), pp. 13-46.



participative styles of leadership behavior."<sup>41</sup> Thus, effective leadership begins to emerge, not as a monolithic whole of either traits or behaviors, but as one which appears to vary as groups vary, as expectations for the groups vary, and as situations vary.<sup>42</sup> This emerging idea set the stage for the formulation of a contingency theory of leadership, which considered leadership as related to two series of variables--varying leader behavior and styles as well as varying situation and groups. No single "right" leadership style was hypothesized; it was contingent upon situational variables.<sup>43</sup> Investigations by Fiedler are viewed as major studies using situation as a main factor. Fiedler hypothesized that group effectiveness was dependent upon the relationship between the leadership style and a combination of three situational factors which contributed to the degree to which the group situation enabled the leader to exert influence.<sup>44</sup> The three major

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<sup>41</sup>Ralph M. Stogdill, op. cit., p. 392.

<sup>42</sup>Dorwin Cartwright and Alvin Zander, eds., Group Dynamics: Research and Theory (2nd Edition, Evanston, Illinois: Row, Peterson and Company, 1962), p. 492.

<sup>43</sup>Thomas J. Sergiovanni and Robert J. Starratt, Emerging Patterns of Supervision: Human Perspectives (New York, New York: McGraw-Hill Book Company, 1971), p. 200.

<sup>44</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness (New York, New York: McGraw-Hill Book Company, 1967), pp. 3-15.

situational variables considered by Fiedler were (1) leader-member relations, (2) task structure, and (3) position power of the leader.<sup>45</sup> Fiedler concluded that "the appropriateness of the leadership style of maximizing group performance is contingent upon the favorableness of the group-task situation."<sup>46</sup> In addition, Fiedler presumed that the leader and group members "have the necessary . . . resources, skills and abilities."<sup>47</sup> In terms of his hypothesis, "task-oriented leaders" would be expected to perform best in group situations that are either "very favorable to" or "very unfavorable to" the leader. "Relationship-oriented leaders" would be expected to perform best in group situations that are intermediate in favorableness.<sup>48</sup>

Fiedler's Contingency Theory of Leadership Effectiveness appears readily applicable to real-life organization goals for bottom-line productivity. A school environment influenced by an accountability notion is a case in point. An elementary school setting can be viewed as a bi-level management setting with the principal as a second-level manager, the teacher as a first-level manager, and the students as the work group providing the appropriate level of production. Fiedler suggested that the influence of the second-level manager is more likely to be due to his own

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<sup>45</sup>Ibid., p. 22.

<sup>47</sup>Ibid., p. 22.

<sup>46</sup>Ibid., p. 147.

<sup>48</sup>Ibid., p. 147.

leadership style than to his ability to select and replace subordinates.<sup>49</sup> Further, Fiedler postulated that "it is possible for the second-level manager to exert influence over and beyond that which is generally attributed to the first-level supervisor."<sup>50</sup> The consideration of first- and second-level manager's leadership style centers upon the degree of congruence between the leadership styles.

The legislative intent of much of the accountability legislation would suggest that when considering production in an educational setting, one is actually considering the leadership influence of the principal as a second-level manager. Consideration of the foregoing hypotheses of Fiedler suggests that the nature of the leadership style and level of production of the work group would be positively affected by the appropriate match of situation favorableness. Fiedler's hypotheses also suggest there may be a relationship between the leadership style of the principal as a second-level manager, the leadership style of the teacher as a first-level manager, and the production of the pupils as members of the work group. In addition, the utilization of Fiedler's theory presumes the leaders and group members have the necessary skills and abilities to perform their role as group member or leader in the particular organizational setting being studied.

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<sup>49</sup>Ibid., p. 237.

<sup>50</sup>Ibid., p. 239.

### The Problem

The purpose of this study was to determine if the following relationships, as predicted by Fiedler's Contingency Theory of Leadership Effectiveness, exist in an actual school setting:

1. the relationship between the leadership style of an elementary school principal, as second-level manager, and the mathematics achievement of the students,
2. the relationship between the degree of leadership style congruence of the elementary principal, as second-level manager, and the teacher, as first-level manager, and the mathematics achievement of the students.

Fiedler's Contingency Theory of Leadership Effectiveness presumes the necessary skills and abilities for the performance of required organizational duties. In short, in the actual school setting the teacher possesses necessary skills and abilities to perform his role in the educational setting.

### Empirical Hypotheses

The following hypotheses were tested:

1. Fourth, fifth, and sixth grade pupil achievement gains in mathematics for groups where the elementary school principal leadership style and situation favorableness are matched will be significantly greater than the corresponding pupil achievement where the elementary school principal leadership style and situation favorableness are not matched.

2. Fourth, fifth, and sixth grade pupil achievement gains in mathematics for groups where the elementary school principal leadership style and teacher leadership style are not congruent will be significantly higher than the corresponding pupil achievement where the elementary school principal leadership style and teacher leadership style are congruent.
3. Fourth, fifth, and sixth grade pupil achievement gains in mathematics for groups where the elementary school principal leadership style and situation favorableness are matched and where the elementary principal leadership style and teacher leadership style are not congruent will be significantly greater than the corresponding pupil achievement where these conditions are not satisfied.
4. Fourth, fifth, and sixth grade pupil achievement gains in mathematics where teacher beliefs about mathematics and mathematics instruction are informal and teacher competence in mathematics is high will be significantly greater than the corresponding pupil achievement where these conditions are not satisfied.

#### Definition of Terms

For purposes of this study, the following operational definitions were assumed:

1. Favorableness of situation was determined by:
  - a. leader-member relations as measured by the leader's rating of the group atmosphere in conjunction with the rating of the group atmosphere by the teachers in the school using Fiedler's scale of group atmosphere,<sup>51</sup>

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<sup>51</sup>Ibid., pp. 32, 269.

- b. task structure as measured by Hunt's scaling of Shaw's dimensions for the classification of tasks,<sup>52</sup>
  - c. leader position power as measured by Fiedler's Measure of Position Power Checklist.<sup>53</sup>
2. Leadership style was determined by the Least Preferred Co-worker Scale (LPC), where high LPC defined operationally a leadership style in which the leader seems to focus on the needs of and relationships with group members and low LPC defined operationally a leadership style in which the leader tends to focus on accomplishing the task.<sup>54</sup>
3. Matched groups for leadership style and situation favorableness were:
- a. situation favorableness in Octants 1-3 and 8 matched with low LPC ratings (See Figure 1),
  - b. situation favorableness in Octants 4-7 matched with high LPC ratings (See Figure 1).

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<sup>52</sup>Ibid., pp. 28, 282-291.

<sup>53</sup>Ibid., pp. 24, 281.

<sup>54</sup>Ibid., pp. 39-46.

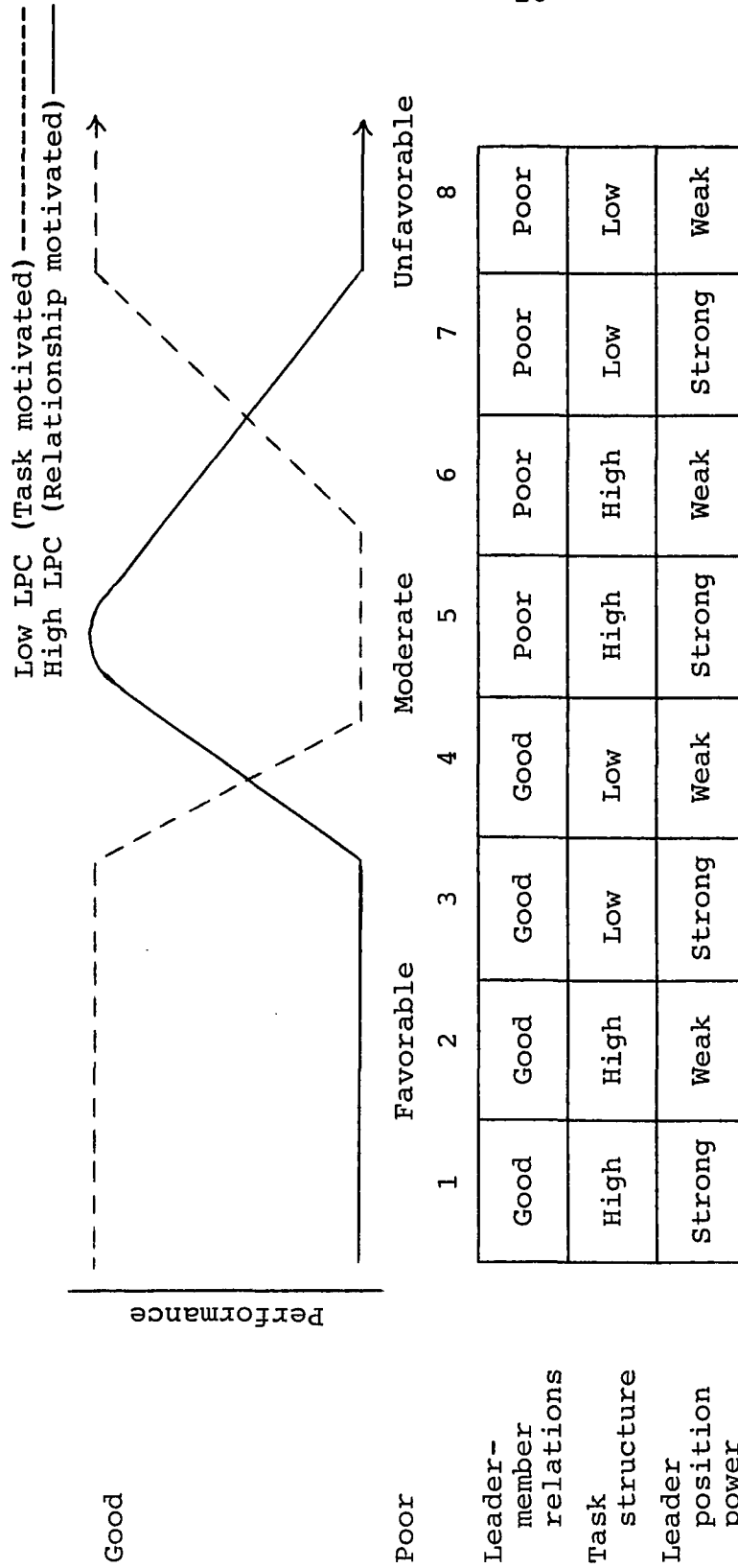


Figure 1

Schematic Representation of the Performance of Relationship and Task-Motivated Leaders in Different Situational Favorableness Conditions

<sup>a</sup>Fred E. Fiedler, "The Leadership Game: Matching the Man and the Situation," Organizational Dynamics, IV, No. 3 (Winter, 1976), 11.

4. Non-congruent groups for principal and teacher leadership style were:
  - a. that both principal and teacher did not have low LPC ratings,
  - b. that both principal and teacher did not have high LPC ratings.
5. Pupil achievement gain in mathematics grades four, five, and six was measured by Norfolk Public Schools Mathematics Monitor Tests administered in September and May of the school year. Monitor tests are criterion referenced tests keyed to specified objectives within the K-6 mathematics curriculum of Norfolk Public Schools.
6. Teacher attitude about mathematics and mathematics instruction was measured by Beliefs About Mathematics Scale (BAMS) and Beliefs About Mathematics Instruction Scale (BAMIS).<sup>55</sup>
7. Teacher competency/knowledge in mathematics was measured by the Beckmann-Beal Mathematical Competencies Test for Enlightened Citizens.<sup>56</sup>

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<sup>55</sup>C. Patrick Collier, "Prospective Elementary Teachers' Intensity and Ambivalence of Beliefs About Mathematics and Mathematics Instruction," Journal for Research in Mathematics Education, III, No. 3 (May, 1972), 156-158.

<sup>56</sup>Based on personal correspondence between Milton W. Beckmann, Professor of Secondary Education, University of Nebraska, and the writer, December, 1976.



### Limitations of the Study

Some specific conditions which place limitations upon any generalizations which can be made from this study are delineated in the following. Conclusions drawn from this study must take into account:

1. the demography of the inner-city school division in Virginia from which the sample was drawn,
2. measurement of pupil productivity by means of criterion referenced tests,
3. the restriction of the study to grades 4-6 in the content area of mathematics,
4. the restriction of teacher characteristics to a measure of competency/knowledge in mathematics and attitude toward mathematics and mathematics instruction,
5. the utilization of an analysis of data obtained from a non-controlled laboratory experimental situation, as life in the real world does not always conform to the theoretical controlled clinical atmosphere of a controlled laboratory setting.<sup>57,58</sup>

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<sup>57</sup>E. F. Lindquist, Design and Analysis of Experiments in Psychology and Education, (Boston: Houghton-Mifflin Company, 1953), pp. 317, 323, 328.

<sup>58</sup>Egon G. Guba, "Reaction to Suggestions for Leadership Research," Leadership: The Science and the Art Today, eds. Luvern L. Cunningham and William J. Gephart (Itasca, Illinois: Phi Delta Kappa, 1973), p. 258.

### Significance of the Study

The clamor for greater accountability in education in Virginia and other states is reflected in public and legislative insistence that principals and teachers accept responsibility and, perhaps, be judged as effective based on pupil performance with respect to certain instructional objectives, specifically in mathematics and reading in grades, K-6.<sup>59</sup>

As the National Advisory Committee on Mathematical Education (NACOME) noted, there is a vast body of research that has attempted to determine the identifiable teacher characteristics that bear a relationship to teacher effectiveness.<sup>60</sup> So too, there is a growing group of researchers challenging previous research and suggesting that differences among schools do make a difference in the performance of students.<sup>61</sup> This research also suggests that principals are a part of this difference.<sup>62</sup> There is

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<sup>59</sup>Basic Learning Skills, Grades K-6, op. cit., pp. 1-2.

<sup>60</sup>Conference Board of the Mathematical Sciences National Advisory Committee on Mathematical Education, Overview and Analysis of School Mathematics, Grades K-12, (Washington, D.C.: Conference Board of Mathematical Sciences, 1975), pp. 100-101.

<sup>61</sup>Stewart C. Purkey and Marshall S. Smith, op. cit., 64.

<sup>62</sup>James Sweeney, "Research Synthesis on Effective School Leadership," Educational Leadership, XXXIX, No. 5 (February, 1982), 346-352.

currently a theoretical base to support a strategy based on the relationship between leadership behavior of teacher and principal, favorableness and unfavorableness of the situation, and student productivity. This relationship should be examined in the actual school setting. Such a relationship has the potential to assist personnel departments in the initial placement or rotation of school personnel to optimize school effectiveness, to assist staff development departments to plan and implement appropriate in-service training of personnel, as well as suggesting a theoretical and empirical base for an accountability model. Any such evidence should be of value to both legislative intent and Virginia State Department of Education implementation, as well as local school board desires.

#### Plan for the Report

Beginning with an introductory chapter in which the problem and its limitations were discussed, the report of this study consists of five chapters. A report of pertinent related literature is the content of Chapter 2. In Chapter 3, the design of the study and procedure followed are outlined. Statistical analysis of the data is the subject of Chapter 4. The final chapter contains a discussion of the conclusions reached from the data analysis as well as recommendations considered suitable.

## Chapter 2

### REVIEW OF RELATED LITERATURE

Proposed definitions of leadership vary according to the theory of leadership espoused and embraced, that is, as a characteristic of an individual, as a property of a group, or as the behaviors which facilitate the attainment of a group goal.<sup>1</sup> While these possible definitions have not evolved one from the other, there does appear to be agreement that leadership and group performance are necessarily related to each other even though the measurement of group performance or productivity is not constant.<sup>2</sup>

Late nineteenth and early twentieth century considerations of leadership, as Carlyle in 1841, concentrated on "great man" theories. At the turn of the century, the first empirical data obtained were predicated upon suspected personality characteristics which would distinguish effective from ineffective leaders. This approach was a static, classificatory, investigative strategy which gave rise to

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<sup>1</sup>Ralph M. Stogdill, Handbook of Leadership (New York, New York: The Free Press, 1974), pp. 7-16.

<sup>2</sup>Dorwin Cartwright and Alvin Zander, eds., Group Dynamics: Research and Theory (2nd Edition, Evanston, Illinois: Row, Peterson and Company, 1962), pp. 488-489.

the "trait theories of leadership."<sup>3</sup> Concurrent with the trait theorists were the environmentalists, as Bogardus in 1930, who maintained that the leader emerged as a result of time, place, and circumstance. That is, leadership is a function of the situation. However, these two categories of theories were not integrated but were dichotomized.<sup>4</sup>

In the 1930's, Lewin, Lippitt, and White contributed the first major research which studied leadership as a process of interaction between leader and followers.<sup>5</sup> Concurrently, the trait theory, while continuing, began to evolve into a search for behaviors associated with effective leaders. The Ohio State Leadership Studies begun by Shartle in 1945 developed a list of 1800 descriptors of leadership behavior that were later reduced to 150 and separated into nine categories. Hemphill used these items to develop the first form of the Leader Behavior Description Questionnaire (LBDQ).<sup>6</sup> Following studies using the LBDQ instrument, these categories were then consolidated into two, "initiating structure" and "consideration." Unlike the discriminating

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<sup>3</sup>Ralph M. Stogdill, op. cit., p. 17.

<sup>4</sup>Robert G. Owens, Organizational Behavior in Schools (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970), p. 120.

<sup>5</sup>Ralph White and Ronald Lippitt, "Leader Behavior and Member Reaction in Three 'Social Climates,'" Group Dynamics: Research and Theory, eds. Dorwin Cartwright and Alvin Zander, op. cit., pp. 527-553.

<sup>6</sup>Ralph M. Stogdill, op. cit., p. 128.

characteristics the "trait theorists" sought, these two categories related to interaction between the leader and the group.

The LBDQ instrument was initially used in military and then in educational settings. Some studies indicated that leaders were rated as more effective when described as high on both factors of the LBDQ instrument. Other studies showed no correlation among the variables of consideration, structure, and performance.<sup>7</sup> As industrial sites became the location for studies, increased emphasis was placed on determining a relation between the structure and consideration variables and bottom-line performance results. Opposite and contradictory results were found.<sup>8</sup> Thus, many behavior theorists began to view the two factors, structure and consideration, as too simplistic. Around 1960, Halpin and Croft developed four factors to describe leader behaviors.<sup>9</sup> The LBDQ-Form XII was developed by Stogdill, and an analysis of the subscale correlations by Stogdill, Goode, and Day suggested that leader behavior is very complex.<sup>10</sup> Still, a reliable basis upon which to select or predict an effective leader was not available. It should also be noted that the preceding studies examined leader behavior independent of the situation in which the leader operated.

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<sup>7</sup>Ibid., pp. 129-133.

<sup>8</sup>Ibid., pp. 133-140.

<sup>9</sup>Ibid., p. 142.

<sup>10</sup>Ibid., pp. 144-151, 155.

While the Ohio State and other behavior research studies were being conducted, University of Michigan studies under the direction of Likert were moving toward a view of leadership behaviors as points on a continuum. Likert postulated four systems of management ranging along a continuum from (1) exploitive authoritative, (2) benovolent authoritative, (3) consultative to (4) participative.<sup>11</sup> Likert hypothesized that the effective leader should be high on the continuum, that is a system 3 or 4, even when the criteria of group output are applied.<sup>12</sup> Comparison of the results of behavior studies into the 1970's, however, forced Stogdill to confirm that participative and directive styles of leader behavior do not adequately predict group productivity.<sup>13</sup>

Leadership studies at Ohio State University, the University of Michigan, and elsewhere began to suggest that the two dimensions of initiating structure and consideration were not mutually exclusive but were mutually supportive. Researchers could no longer eliminate the variable of "situation" from leadership research design. This failure of behavior theorists to solve the leadership enigma

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<sup>11</sup>Thomas J. Sergiovanni and Robert J. Starratt, Emerging Patterns of Supervision: Human Perspectives (New York, New York: McGraw-Hill Book Company, 1971), pp. 105-125.

<sup>12</sup>Rensis Likert, The Human Organization (New York, New York: McGraw-Hill Book Company, 1967, pp. 13-46.

<sup>13</sup>Ralph M. Stogdill, op. cit., pp. 386-392.

preceded the research shift to the consideration of the factor of situation. The shift in research ushered in contingency studies which viewed effective leadership as dependent upon two series of variables: varying leader behavior and styles as well as varying situations and follower groups.<sup>14</sup>

The Contingency Model of  
Leadership Effectiveness

By the 1960's, some researchers, including Fiedler, had begun to include situational factors in their research.<sup>15</sup> Fiedler's contingency studies are usually viewed as the first major studies to use situation as a main factor. These studies used the original two factors of the Ohio State Studies, that is, "structure" as primarily task-oriented leadership style and "consideration" as primarily relationship-oriented leadership style. Neither type of leadership style, however, was theorized to be effective. Instead, Fiedler viewed "leader effectiveness in terms of the group performance on the group's primary assigned task" and asserted that the "effectiveness of a group is contingent upon the relationship between the leadership style and the degree to which the group situation enables the leader to

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<sup>14</sup>Thomas J. Sergiovanni and Robert J. Starratt, op. cit., p. 100.

<sup>15</sup>Fred E. Fiedler, "The Leader's Psychological Distance and Group Effectiveness," Dorwin Cartwright and Alvin Zander, eds., op. cit., pp. 586-605.



exert influence."<sup>16,17</sup> The three major situational factors upon which Fiedler hypothesized leadership effectiveness to be contingent were: (1) leader-member relations, (2) task structure, and (3) position power of the leader.<sup>18</sup> Fiedler, using his Contingency Model of Leadership Effectiveness, hypothesized that task-oriented leadership style would be most effective in group situations that are either "very favorable to" or "very unfavorable to" the leader and that relationship-oriented leadership style would be most effective in group situations of intermediate favorableness.<sup>19</sup> Rather than one "right" leadership style or one set of leader behaviors, the model suggested a leadership style contingent upon situational variables; that is, "the group's performance will be contingent upon the appropriate matching of leadership style and the degree of favorableness of the group situation for the leader."<sup>20</sup> The application of the model also presumes that the leader and group members "have the necessary . . . resources, skills and abilities."<sup>21</sup>

Two other major contingency-type theories have been hypothesized since the 1960's. These are the Path-Goal

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<sup>16</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness (New York, New York: McGraw-Hill Book Company, 1967), p. 9.

<sup>17</sup>Ibid., p. 15.

<sup>18</sup>Ibid., p. 22.

<sup>19</sup>Ibid., p. 147.

<sup>20</sup>Ibid., p. 151.

<sup>21</sup>Ibid., p. 22.

Theory by House and the Leader Decision Theory by Vroom and Yetton.<sup>22</sup> Vroom, however, did not consider how the leader behavior-situation match leads to group outcomes as did Fiedler and House.<sup>23</sup> Further, in contrast to Fiedler's treatment of leader effectiveness "in terms of group performance on the group's primary goal," House's Path-Goal Theory assumes effective leadership to be a function of follower needs and perceptions.<sup>24,25</sup> As a result, Fiedler's Contingency Theory appears more readily applicable to real-life organizational goals for measuring productivity.

Tests of the Contingency  
Theory of Leadership  
Effectiveness

Fiedler derived support for his theory by extracting data from real-life groups. He viewed the real-life organization as a very significant aspect of the environment within which the group operates.<sup>26</sup> Generally, the findings which tended to cast doubt upon the contingency theory were

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<sup>22</sup>Joseph E. Garcia, "Field Theory in Organizational Psychology: An Analysis of Theoretical Approaches in Leadership" (Paper presented at the Annual Meeting of Western Psychological Association, April, 1981), p. 5.

<sup>23</sup>Ibid., p. 11.

<sup>24</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness, op. cit., p. 9.

<sup>25</sup>Joseph E. Garcia, op. cit., p. 8.

<sup>26</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness, op. cit., p. 17.

extracted from studies conducted in laboratories and not under field conditions.<sup>27,28</sup> Some of the commonly noted critiques are by Ashour, Graen, et al., McMaHon, and Shiflett.<sup>29,30,31,32</sup> Since the inception of the contingency theory, supporting studies have also been conducted. Examples are available in research studies by Fiedler as well as others.<sup>33,34</sup> The question of whether the available

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<sup>27</sup>Fred E. Fiedler and Martin M. Chemers, Leadership and Effective Management (Glenview, Illinois: Scott, Foresman and Company, 1974), p. 83.

<sup>28</sup>Sudhir K. Saha, "Contingency Theories of Leadership: A Study," Human Relations, XXXII, No. 4 (April, 1979), 315.

<sup>29</sup>Ahmed Sakr Ashour, "The Contingency Model of Leadership Effectiveness: An Evaluation," Organizational Behavior and Human Performance, IX, No. 3 (June, 1973), 339-355.

<sup>30</sup>George Graen, James B. Orris and Kenneth M. Alvares, "Contingency Model of Leadership Effectiveness: Some Experimental Results," Journal of Applied Psychology, LI, No. 3 (June, 1971), 196-201.

<sup>31</sup>J. Timothy McMaHon, "The Contingency Theory: Logic and Method Revisited," Personnel Psychology, XXV, No. 4 (Winter, 1972), 697-710.

<sup>32</sup>Samuel C. Shiflett, "The Contingency Model of Leadership Effectiveness: Some Implications of Its Statistical and Methodological Properties," Behavioral Science, XVIII, No. 6 (November, 1973), 429-440.

<sup>33</sup>Fred E. Fiedler, "The Contingency Model: A Reply to Ashour," Organizational Behavior and Human Performance, IX, No. 3 (June, 1973), 356-368.

<sup>34</sup>Martin M. Chemers and George J. Shrzypek, "An Experimental Test of the Contingency Model of Leadership Effectiveness" (Available from ERIC, ED 057 381, 1971), pp. 1-16.

research is statistically significant in support of the theory has always recognized that the research reviewed usually does produce patterns of correlation consistent with the predictions of the theory.<sup>35</sup> In fact, Mitchell noted that limited sample size had often only allowed researchers to consider whether the correlations were in the predicted direction.<sup>36</sup>

Stogdill, after reviewing research related to interaction between leadership styles and task characteristics, concluded:

. . . group productivity tends to respond favorably to person-oriented leadership under conditions of medium structure and stress. Productivity tends to be enhanced by a work-oriented style of leadership under conditions of very low or very high structure and stress.<sup>37</sup>

While the preceding could be viewed as support for the contingency theory, more recent analyses provide more specific support. Strube and Garcia used meta-analytic techniques in the investigation of data obtained from 33 tests used originally to derive the theory and 127 subsequent tests of

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<sup>35</sup>Chester A. Schriesheim and Steven Kerr, "Theories and Measures of Leadership: A Critical Appraisal of Current and Future Directions," Leadership: The Cutting Edge, eds., James G. Hunt and Lars L. Larson, (Carbondale, Illinois: Southern Illinois University Press, 1977), p. 11.

<sup>36</sup>Terence R. Mitchell, Anthony Biglan, Gerald R. Oncken, and Fred E. Fiedler, "The Contingency Model: Criticism and Suggestions," Academy of Management Journal, XIII, No. 3 (September, 1970), 260.

<sup>37</sup>Ralph M. Stogdill, op. cit., p. 406.

the model.<sup>38</sup> These researchers noted that meta-analytic techniques, which allow a quantitative assessment of how well a set of results fits the predictions of a theory, confirmed the predictions of the contingency theory. Further, Strube and Garcia noted that this technique demonstrated statistical validity for the contingency theory.<sup>39</sup> Given this support for the health of the Contingency Theory of Leadership Effectiveness, a consideration of its application in the field of education is appropriate.

Contingency Theory of Leadership  
Effectiveness in Educational  
Settings

Campbell noted that in an applied field, as educational administration, there is the responsibility "to generate or organize knowledge that is applicable and to use or encourage the use of such knowledge."<sup>40</sup> Erickson, however, pointed out that "researchers in education have selectively adopted models of organizational inquiry,

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<sup>38</sup>Michael J. Strube and Joseph E. Garcia, "A Meta-Analytic Investigation of Fiedler's Contingency Model of Leadership Effectiveness," (Paper presented at the Annual Convention of the American Psychological Association, September, 1980), p. 6.

<sup>39</sup>Ibid., p. 12.

<sup>40</sup>Roald F. Campbell, "Educational Administration: A Personal View of Its Future," Educational Administration, eds. Luvern L. Cunningham, Walter G. Hack, and Raphael O. Nystrand (Berkeley, California: McCutchan Publishing Corporation, 1977), p. 124.

avoiding paradigms that require assessment of the achievement of goals.<sup>41</sup> Furthermore, he viewed models which link process and structure to student behavior and long-term accomplishment, that is, school productivity, as an essential ingredient in the making of an effective educational administrator.<sup>42</sup> Nevertheless, an ERIC search of the literature in 1979 identified no more than 10 of 242 "contingency" citations in education which were at all related to school organization or administration. The remaining were primarily related to teaching-learning issues in the field of special education.<sup>43</sup> There have been few additional citations since 1979.

The following citations are illustrative of the educational studies available in the literature which use contingency theory as a theoretical rationale. In 1968, McNamara investigated a group of secondary schools and a group of elementary schools in Alberta, Canada. The principals were categorized as to favorable or unfavorable situational conditions based on years experience in their

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<sup>41</sup>Donald A. Erickson, "An Overdue Paradigm Shift in Educational Administration, Or, How Can We Get That Idiot Off the Freeway?" Educational Administration, op. cit., p. 124.

<sup>42</sup>Ibid., p. 125.

<sup>43</sup>E. Mark Hanson, "School Management and Contingency Theory: An Emerging Perspective," Educational Administration Quarterly, XV, No. 2 (Spring, 1979), 99.

respective positions. The elementary principal's effectiveness was based on ratings by the superintendent and/or his staff, whereas the secondary principal's effectiveness was based on eleventh grade student test performance. This categorization of situation favorableness did not provide data in support of the contingency theory.<sup>44</sup> In reviewing this study, Fiedler, however, suggested categorizing elementary schools with six to twelve teachers as relatively simple organizations versus the more complex secondary setting as a factor in assessing situation favorableness. Based on the changed status of situation favorableness, a re-analysis of data obtained from McNamara's study tended to support the contingency theory.<sup>45</sup> The criterion of effectiveness used on the elementary school and the omission of the teacher effect, however, do not allow this study and its revised findings to satisfy the implications of current educational accountability requirements.

Studies by Hardy, et al, as well as by Cohen and Cherrington considered student groups in an educational setting--junior high and college. Hardy considered student groups with student leaders, whereas Cohen and Cherrington

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<sup>44</sup>Fred E. Fiedler, "The Effects of Leadership Training and Experience: A Contingency Model Interpretation," Administrative Science Quarterly, XVII, No. 4 (December, 1972), 457-459.

<sup>45</sup>Fred E. Fiedler and Martin M. Chemers, Leadership and Effective Management, op. cit., p. 131.

considered student teachers and included an additional situational factor, "teacher ability."<sup>46,47</sup> In both studies the data tended to support the predictions of Fiedler's Theory, but sample sizes were too small to obtain satisfactorily significant results.

Reavis considered a partial model of teacher effectiveness. Two teachers taught a unit to four of eight groups under conditions which were classified as moderately favorable or very unfavorable. The teachers were to teach using task-oriented style and using person-oriented style as designated by the researcher. The criterion for effectiveness was student gain scores on a test related to the lesson. Using analysis of variance the data were not statistically significant but were in the predicted direction.<sup>48</sup> One factor contributing to the lack of significance in the support of the contingency theory could have been the presumption by the researcher that the teachers could assume an assigned leadership style rather than the determination

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<sup>46</sup>Robert C. Hardy, Stanley Sack, and Frances Harpine, "An Experimental Test of the Contingency Model on Small Classroom Groups," The Journal of Psychology, LXXXV, (First half, September, 1973), 3-16.

<sup>47</sup>Louis Cohen and Derek Cherrington, "Leadership Effectiveness in an Educational Setting," Educational Research, XV (February, 1973), 154-157.

<sup>48</sup>Charles A. Reavis and Valerian J. Derlega, "Test of a Contingency Model of Teacher Effectiveness," Journal of Educational Research, LXIX, No. 6 (February, 1976), 221-222.



and use of their actual style. Such a presumption is not consistent with Fiedler's hypotheses.<sup>49,50</sup>

More recent studies involving Fiedler's theory in an educational setting are those in Lebanon by Theodory in 1981 and 1982. In his study which concentrated upon elementary school principals and pupil achievement in mathematics, Theodory did not find support for Fiedler's theory.<sup>51</sup> This lack was, in part, attributed to the possibility that the instrument (Least Preferred Co-worker Scale) used for determining leadership style may not be culture free. The possibility of culture bias was also a result of a study by Bennett.<sup>52</sup> In an ex post facto field study relating to secondary school effectiveness, Theodory found confirmation of the discriminatory value of the Least Preferred Co-worker (LPC) instrument.<sup>53</sup> Theodory did not find support for

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<sup>49</sup>Fred E. Fiedler, "The Leadership Game: Matching the Man and the Situation," op. cit., 7.

<sup>50</sup>Fred E. Fiedler, "Response to Sergiovanni," Educational Leadership, XXXVI, No. 6 (March, 1979), 394-396.

<sup>51</sup>George C. Theodory and Mafakhir Hadbai, "Retesting Fiedler's Contingency Theory in Islamic Schools," Journal of Psychology, CXI, (First half, May, 1982), 15-17.

<sup>52</sup>Mick Bennett, "Testing Management Theories Cross-culturally," Journal of Applied Psychology, LXII, No. 5 (October, 1977), 578-581.

<sup>53</sup>George C. Theodory, "The Effect of the Least Preferred Co-worker Measure on School Outcomes in Lebanon's Educational System," The Journal of Psychology, CVIII, (May, 1981), 3-6.

leadership style as measured by the LPC scale and the situational favorableness match. It should be noted that Theodory employed a version of the LPC scale and cutting values delineated by Fiedler, Chemers, and Mahar in a self-teaching book.<sup>54,55</sup> Shiflett determined that the "Leader-Match" scaling created a substantial bias toward being inappropriately categorized as a high LPC individual.<sup>56</sup> Such a bias would allow the LPC scale to discriminate and yet provide inaccurate data for the leadership style-situation favorableness match resulting in Theodory's no-support findings. Another factor which could have altered the analysis of the data obtained by Theodory could be the interaction of the leadership styles of the principal and the teacher. This interaction was not considered by Theodory.

#### Bi-Level Management Setting in Education

Studies by Keeler and Andrews in Canada in 1963 had suggested an effect on student performance by the leader

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<sup>54</sup>George C. Theodory, "The Mediating Role of Principals' Situational Favorableness on School Effectiveness in Lebanon" (Paper presented at the Annual Meeting of the American Educational Research Association in New York, March, 1982), pp. 1-17.

<sup>55</sup>Fred E. Fiedler, Martin M. Chemers, with Linda Mahar, Improving Leadership Effectiveness: The Leader Match Concept (New York, New York: John Wiley and Sons, Inc., 1976), pp. 9-12.

<sup>56</sup>Samuel Shiflett, "Is There a Problem With the LPC Score in Leader Match?" Personnel Psychology, XXXIV, No. 4 (Winter, 1981), 765-769.

behavior of principals.<sup>57</sup> These studies, however, did not appear to consider situational factors nor to provide any predictive power.<sup>58</sup> Furthermore, neither of these studies considered the teacher factor. Greenfield and Andrews found that teachers exhibiting a high degree of leader behavior tended to induce higher achievement in their pupils.<sup>59</sup> Leadership theories and preceding or subsequent studies related to these theories, however, have primarily dealt with single leadership roles. In the 1970's, some attention was directed toward the consideration of the influence of leadership styles of different levels of leaders and the subsequent effectiveness of the leaders.<sup>60</sup> As Szilagyi noted "the study of leadership from a congruence framework, where more than one leader can influence subordinate behavior, is much needed."<sup>61</sup> In addition, such a study more

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<sup>57</sup>Ralph M. Stogdill, "The Trait Approach to the Study of Educational Leadership," Leadership: The Science and the Art Today, op. cit., p. 95.

<sup>58</sup>Glen L. Immegart, "Suggestions for Leadership Research: Toward a Strategy for the Study of Leadership in Education," Leadership: The Science and the Art Today, op. cit., pp. 225-226.

<sup>59</sup>Ralph M. Stogdill, "The Trait Approach to the Study of Educational Leadership," op. cit., p. 95.

<sup>60</sup>Peter M. Storm, "Lateral and Hierarchical Leadership Style Congruences," Leadership: The Cutting Edge, op. cit., p. 138.

<sup>61</sup>Andrew D. Szilagyi, "Leadership Congruence: Issues and Directions," Leadership: The Cutting Edge, op. cit., p. 159.

accurately represents the environment within which many individuals must function.<sup>62</sup> This is certainly the case in an educational setting. With regard to current accountability schemes, responsibilities are being placed upon principals as second-level managers and teachers as first-level managers.

The available studies concentrating on the effect of similar or dissimilar leadership styles at several managerial levels do not chart a clear course. Nealey and Blood, in a study of different levels of supervision in the nursing service, found data to support dissimilar leadership styles. Specifically, high LPC second-level managers and low LPC first-level managers were positively related to effective group performance. Nealey and Blood, however, noted that the sample size decreased as the supervisory level increased. Sample size and the particular nature of the nursing service seriously limited the generalizability of the findings.<sup>63</sup> Further, situational favorableness was not included as a factor in the study. Hunt, in a laboratory setting, obtained data which suggested that knowledge of the leadership style of both levels of management predicted

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<sup>62</sup>Ibid.

<sup>63</sup>Stanley M. Nealey and Milton R. Blood, "Leadership Performance of Nursing Supervisors at Two Organizational Levels," Journal of Applied Psychology, LII, No. 5 (October, 1968), 414-422.

group performance better than knowledge of the single level of leadership style. In contrast to the field study by Nealey and Blood, the best performing groups had low LPC second-level managers and high LPC first-level managers.<sup>64</sup> Chemers and Fiedler suggested that the leadership style and situational demands be considered in order to provide predictions of organizational effectiveness.<sup>65</sup> Storm also suggested that leadership style congruence needs are dependent upon the structure of the organization, that is, complex versus non-complex configurations.<sup>66</sup> Storm's study, in which leadership style was operationally defined by the use of the LBDQ-Form XII as modified by Sergiovanni, did not find leadership style congruence and group performance to have a significant positive relationship.<sup>67</sup>

Since there is no firm theoretical rationale upon which leadership style congruence may predict group effectiveness, Szilagyi stated "contingency leadership approaches . . . are the best conceptualizations on which to base

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<sup>64</sup>J. G. Hunt, "Leadership-Style Effects at Two Managerial Levels in a Simulated Organization," Administrative Science Quarterly, XVI, No. 4 (December, 1971), pp. 476-485.

<sup>65</sup>Fred E. Fiedler and Martin M. Chemers, Leadership and Effective Management, op. cit., p. 115.

<sup>66</sup>Peter M. Storm, op. cit., p. 140.

<sup>67</sup>Ibid., p. 152.

future empirical research."<sup>68</sup> This conclusion leads to the notion that Fiedler's Contingency Theory of Leadership Effectiveness be extended to consider a relationship between the leadership style of the principal as a second-level manager, the leadership style of the teacher as first-level manager, and their relationship to the performance of the pupils. The utilization of this theoretical rationale would further presume consideration of the favorableness of the leadership situation as well as the expectation that leaders and group members have the necessary skills and abilities to perform their tasks in the particular organizational setting under study.

#### Principal as Related to Student Learning

The role of the elementary principal is not to accomplish educational goals single handedly, but to act as the catalyst for instructional improvement.<sup>69,70</sup> Even though contingency-type investigations in educational administration have only progressed to the "crawling stage,"

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<sup>68</sup>Andrew D. Szilagyi, op. cit., p. 163.

<sup>69</sup>Russell Gersten, Douglas Carnine, and Susan Green, "The Principal as Instructional Leader: A Second Look," Educational Leadership, XL, No. 3 (December, 1982), 47-49.

<sup>70</sup>Ray Cross, "Elementary School Principal Effectiveness," (Paper presented at the National Conference of Professors of Educational Administration, Edmonton, Canada, August, 1979), p. 29.

Cross stated that the findings justify a continuance of such investigations to determine a theoretical rationale upon which school systems can rely in the move toward effective schooling.<sup>71</sup>

The decade of the seventies, as a response to the Coleman Report, has seen the growth of studies suggesting that schools and what happens in schools do make a difference in student performance outcomes.<sup>72,73</sup> Marcus, et al, suggested that the improvement noted in mathematics achievement of students in elementary schools he studied may be affected by administrative leadership rather than any particular instructional technique intervention.<sup>74</sup> While the various school effectiveness studies demonstrated a certain similarity of conclusions, there does not yet appear to be a predictable recipe. The studies reviewed, however, all considered the "principal factor" as a key element in attaining school productivity and treated student outcomes

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<sup>71</sup>Ibid., p. 28.

<sup>72</sup>Michael Cohen, "Effective Schools: What the Research Says," Today's Education, (April-May, 1981), 58-60.

<sup>73</sup>Joan Shoemaker and Hugh W. Fraser, "What Principals Can Do: Some Implications from Studies of Effective Schooling," Phi Delta Kappan, LXIII, No. 3 (November, 1981), 178-182.

<sup>74</sup>Alfred C. Marcus, et al, "Administrative Leadership in a Sample of Successful Schools from the National Evaluation of the Emergency School Aid Act," (Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, California, April, 1976), p. 19.

as a criterion of effectiveness.<sup>75,76</sup> The case studies reviewed, as exemplified by a Phi Delta Kappa search, could not attribute causation--only correlation.<sup>77,78</sup>

The majority of the studies on school effectiveness have concentrated on urban settings and students from low socioeconomic status. Yet, neither teaching nor teachers were singled out as critical incidents, but they were instead only noted as positive factors.<sup>79</sup> Nevertheless, Sweeney stated that "teachers, students, instructional methods, and leadership are among the most volatile and interactive school variables" and suggested that the school output may be contingent upon the situation in which these factors interact.<sup>80</sup>

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<sup>75</sup>Joseph D'Amico, "Each Effective School May Be One of a Kind," Educational Leadership, XL, No. 3 (December, 1982), 61-62.

<sup>76</sup>Lloyd E. McCleary, "Toward a Reconstruction of the Principalship," The Executive Review, II, No. 3 (December, 1981), 1-4.

<sup>77</sup>Why Do Some Urban Schools Succeed?, op. cit., pp. 2-131.

<sup>78</sup>David L. Clarke, Linda S. Lotto, and Martha W. McCarthy, "Factors Associated with Success in Urban Elementary Schools," Phi Delta Kappan, LXI, No. 7 (March, 1980), 467-470.

<sup>79</sup>Why Do Some Urban Schools Succeed?, op. cit., p. 135.

<sup>80</sup>James Sweeney, "Research Synthesis on Effective School Leadership," Educational Leadership, XXXIX, No. 5 (February, 1982), 352.



Teacher as Related to  
Student Learning

There is no data base to predict relationships between teacher behavior and student learning.<sup>81,82,83</sup> In addition, teacher behaviors tend to vary with varying situations of grade, subject matter, and type of classroom organization.<sup>84,85</sup> Bloom believes it is the teaching, not the teacher, that is related to student learning.<sup>86</sup> Findings by Goodlad, however, suggested a "sameness of instruction--"minimal movement, minimal student-to-student or student-to-teacher interaction, and low, nonintimate affect."<sup>87</sup>

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<sup>81</sup>Nicholas Hobar, "Are Your Students Learning?" Electronic Education, II, No. 6 (February, 1983), 16.

<sup>82</sup>Conference Board of the Mathematical Sciences National Advisory Committee on Mathematical Education, Overview and Analysis of School Mathematics, Grades K-12, op. cit., pp. 100-101.

<sup>83</sup>E. G. Begle, Critical Variables in Mathematics Education: Findings From a Survey of Empirical Literature (Washington, D.C.: Mathematical Association of American and National Council of Teachers of Mathematics, 1979), pp. 156-157.

<sup>84</sup>Marjorie Powell, "Variability of Teacher Behaviors," Practical Applications of Research, I, No. 1 (September, 1978), 3-4.

<sup>85</sup>Charles W. Guditis, "Classroom Observation: How Good a Measure of Effective Teaching and Learning?" Curriculum Trends, (March, 1978), 1-4.

<sup>86</sup>Benjamin S. Bloom, Human Characteristics and School Learning (New York, New York: McGraw-Hill, 1976), pp. 110-111.

<sup>87</sup>John I. Goodlad, "A Study of Schooling: Some Findings and Hypotheses," Phi Delta Kappan, LXIV, No. 7 (March, 1983), 467.

The findings of Goodlad that in the "how and why of teaching, a school is a school is a school" suggested that characteristics other than instructional methods must be considered when investigating the teacher effect upon student learning.<sup>88</sup>

Research in mathematics instruction in the 1960's consistently showed that elementary teachers did not have the knowledge of mathematics considered essential for effective mathematics teaching.<sup>89,90</sup> Correlational studies, however, did not show a statistically significant relationship between teacher knowledge of mathematics and student learning outcomes. It was suggested that the knowledge was uniformly so low that it was insufficient to play a discriminatory role in student outcomes.<sup>91</sup>

In the late 1960's, one promising approach to the investigation of teacher effect on student learning was the consideration of teacher knowledge and teacher attitude

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<sup>88</sup>Ibid., 469.

<sup>89</sup>Arden K. Ruddell, Wilbur Dutton and John Reukzeh, "Background Math For Elementary Teachers," Instruction in Arithmetic: Twenty-fifth Yearbook of National Council of Teachers of Mathematics, (Washington, D.C.: National Council of Teachers of Mathematics, 1960), pp. 316-317.

<sup>90</sup>James Fey, "Classroom Teaching of Mathematics," Review of Educational Research, XXXIX, No. 4 (October, 1969), 539-540.

<sup>91</sup>Ibid., 540.

toward mathematics.<sup>92</sup> By the beginning of the decade of the seventies, a realization, similar to that in leadership effectiveness and principal effectiveness, was evident in the search for effective teaching. Researchers were beginning to view effective teaching as a complex interactive process which included the effect of teacher ability/knowledge and attitude, student factors, and subject-matter organization.<sup>93</sup> More recent studies considering teacher attitude as a factor suggested that teacher attitude may show a positive statistical relationship with student achievement in elementary mathematics when the relationship is at least two years in duration.<sup>94</sup> Concurrently, a study by Van de Walle suggested that consideration of teacher attitude toward mathematics and mathematics instruction showed promise. In his study involving grades three and six, a positive relationship with student achievement was found at grade three.<sup>95</sup> Schofield conducted a study in Australia using 250 prospective teachers. Sixty of these teachers were

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<sup>92</sup>Ibid.

<sup>93</sup>Ibid., 548.

<sup>94</sup>Robert B. Phillips, Jr., "Teacher Attitude as Related to Student Attitude and Achievement in Elementary School Mathematics," School Science and Mathematics, LXXIII, No. 6 (June, 1973), 501-507.

<sup>95</sup>John A. Van de Walle, "Attitudes and Perceptions of Elementary Mathematics Possessed by Third and Sixth Grade Teachers as Related to Student Attitude and Achievement in Mathematics," (Paper presented at Annual Meeting of the National Council of Teachers of Mathematics, Houston, Texas, April, 1973), pp. 1-31.

placed as teachers of grades four, five, or six the following year. A positive correlation was found between teacher achievement on a mathematics knowledge test and pupil achievement in mathematics, and a negative correlation was found with pupil attitude toward mathematics.<sup>96</sup> Other studies found no relationship between factors of teacher attitudes and knowledge of the subject matter.<sup>97,98,99</sup> None of these studies, however, considered these two factors interacting with leadership or situational factors.

The concern about elementary teacher mathematics knowledge continues. A 1973 study showed improvement in whole number computation from 1930 to 1973, but no improvement in work with decimals and percentage-type problems.<sup>100</sup>

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<sup>96</sup>Hilary L. Schofield, "Teacher Effects on Cognitive and Affective Pupil Outcomes in Elementary School Mathematics," Journal of Educational Psychology, LXXIII, No. 4 (August, 1981), 462-471.

<sup>97</sup>Demitrious Prekeges, "Relationship Between Selected Teacher Variables and Growth in Arithmetic in Grades Four, Five and Six," (Report funded by Office of Education, Washington, D.C., December, 1973, ED 050 023), pp. 1-76.

<sup>98</sup>Donald J. Veldman and Jere E. Brophy, "Measuring Teacher Effects on Pupil Achievement," Journal of Educational Psychology, LXVI, No. 3 (June, 1974), 319-324.

<sup>99</sup>Charles D. Gilbert and Dwight Cooper, "The Relationship Between Teacher/Student Attitudes and the Competency Levels of Sixth Grade Students," School Science and Mathematics, LXXVI, No. 6 (October, 1976), 469-476.

<sup>100</sup>Theodore A. Eisenberg, "An Analysis of Computational Errors Made by Teachers of Arithmetic: 1930, 1973," (Report funded by Office of Education, Washington, D.C., 1974, ED 096 160), pp. 1-8.

Teacher knowledge of mathematics, however, should be compared to an absolute scale and not a relative scale. When the findings were viewed in that light, no meaningful differences appeared between the performance in 1930 and 1973 nor later in 1979.<sup>101</sup> As Glennon stated "teachers cannot teach what they do not understand" nor make curriculum decisions about instructional emphases by virtue of the allocation of available instructional time without "a solid knowledge of the mathematics appropriate to the grade level(s) and ability levels of the students being taught."<sup>102</sup> It seems that the need to upgrade the mathematical knowledge of elementary teachers still exists.<sup>103,104</sup>

Additional information regarding variations of teaching styles and student learning styles seemed to suggest it may be the teacher leadership style and situation which may allow some teachers to be sufficiently flexible

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<sup>101</sup>Fred L. Pigge, Thomas C. Gibney, and John L. Ginther, "Today's Elementary School Teachers Are Better Prepared in Mathematics," Arithmetic Teacher, XXVI, No. 3 (March, 1979), 48-51.

<sup>102</sup>Vincent J. Glennon, "In Mathematics Education: Our Greatest Need," Phi Delta Kappan, LXI, No. 9 (May, 1980), 593-594.

<sup>103</sup>Leroy G. Callahan and Vincent J. Glennon, Elementary School Mathematics: A Guide to Current Research (Washington, D.C.: Association for Supervision and Curriculum Development, 1975), p. 102.

<sup>104</sup>John Chaffee, Jr., "Many Prospective Teachers Fail Colorado Test," Education Week, II, No. 23 (March 2, 1983), 9.

to coordinate the complexities of the teaching act given certain levels of preparation, that is, knowledge of subject matter and attitude towards teaching.<sup>105,106,107,108</sup>

### Summary

The search for a way to predict the circumstances surrounding what constitutes effective leadership has pursued more than one path. These paths become more complex with each step toward the era of contingency models. In the school setting this complexity involves not only the leader of the school, the principal, but the teachers as well with all the situational factors than can exist in any such group. The situational factors are further confounded by the knowledge and attitudes of teachers concerning subject matter.

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<sup>105</sup>Rita S. Dunn and Kenneth J. Dunn, "Learning Styles/Teaching Styles: Should They . . . Can They . . . Be Matched?" Educational Leadership, XXXVI, No. 4 (January, 1979), 238-244.

<sup>106</sup>David S. Silvernail, Teaching Styles as Related to Student Achievement (Washington, D.C.: National Education Association, 1979), pp. 5-30.

<sup>107</sup>William J. Gephart, Deborah B. Stroters, and Willard R. Duckett, "On Mixing and Matching of Teaching and Learning Styles," Practical Applications of Research, III, No. 2 (December, 1980), 1-4.

<sup>108</sup>Thomas L. Good, "Teacher Effectiveness in the Elementary School," Journal of Teacher Education, XXX, No. 2 (March-April, 1979), 54-55.

Public demands for demonstrable levels of pupil achievement are persistent. The expectations placed upon principals and teachers in this regard require extensive inquiry into the conditions which provide the optimum mix for producing student learning outcomes as consistent as possible.

Although no consistent pattern of significance has been derived for the utilization of Fiedler's Theory of Leadership Effectiveness, it appears to be the opinion of many investigators in the field that Fiedler's Model is worthy of continued investigation and/or utilization as a theoretical rationale for a field-based study.

The foregoing supports a consideration of the relationship of principal and teacher leadership style, in conjunction with situational factors, and elementary pupil achievement in mathematics.

## Chapter 3

### METHODOLOGY

This chapter presents a discussion of the present study. The chapter consists of the following sections: Selection of the Sample, Procedures for Data Collection, Instrumentation, Procedures for Data Analysis, and Summary.

#### Selection of the Sample

Participation in this study was solicited from the approximately thirty elementary schools of Norfolk Public Schools, Norfolk, Virginia, which included grades four, five, and six. Twenty-eight principals chose to participate. One principal was a first-year principal and not an appropriate participant. One principal chose not to participate. The number of principals involved provided a possible pool of 311 teachers and 8103 students in grades four, five, and six. Of the available teachers, 245 teachers participated. Thus, performance data for students were drawn from the 5373 students whom the participating teachers instructed from September to May of the 1978-79 school year. Data available from students whom the participating teachers instructed for only a portion of the school year were not included. The sample represented an urban school system in the Commonwealth of Virginia with an estimated 59-41



ratio of black-to-white student population of approximately 35,000 pupils.

### Procedures for Data Collection

To obtain information to apply the operational definition of principal leadership style and principal input toward the categorization of situational variables, each participating principal was provided a packet. The packet included the Least Preferred Co-worker Index, Scale of Group Atmosphere, Measure of Position Power Questionnaire, and a Job Task Structure Rating Form.<sup>1,2</sup> In addition, each principal was requested to indicate the number of years each had served as an elementary principal and the number of years service at the present school. The packets were distributed in April, and each principal was requested to complete the information. All packets were collected prior to the end of the 1978-79 school year.

To obtain teacher information, teacher packets were distributed during April and May. At the request of the principals involved in the study, the distribution of the teacher packets was made by the investigator or by the

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<sup>1</sup>Appendix A contains copies of the Least Preferred Co-worker Index, Scale of Group Atmosphere, and Measure of Position Power Questionnaire.

<sup>2</sup>Appendix B contains copies of Job Task Structure Rating Form.

principal of the individual school. The teacher packets included the Least Preferred Co-worker Index, Scale of Group Atmosphere, Measure of Position Power Questionnaire, Beliefs About Mathematics Scale, Beliefs About Mathematics Instruction Scale, and the Beckmann-Beal Mathematical Competencies Test for Enlightened Citizens, Form A.<sup>3,4</sup> Each teacher was requested to provide information concerning age, education, teaching experience, and grade presently teaching. The teachers were asked to complete the first three items (printed on green sheets) in the packet in ten minutes, the next two items (printed on yellow sheets) in ten minutes, and the last item in thirty minutes. Teacher participation was strictly voluntary, and teachers were assured that no teacher identification would be reported. Packets of participating teachers were collected prior to the end of the 1978-79 school year. A coding was used to permit specific teacher data to be related to appropriate student data. After the principal, teacher, and student data were prepared for statistical analysis, all principal, teacher, and student identification was destroyed.

To avoid any disturbance of the instructional routine, no student data were collected in addition to data

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<sup>3</sup>Appendix C contains copies of Beliefs About Mathematics Scale and Beliefs About Mathematics Instruction Scale.

<sup>4</sup>Appendix A, op. cit.

normally collected by the Norfolk Public Schools. The performance of students of the participating teachers was obtained from the administration of the Norfolk Public Schools Mathematics Monitor Tests. These tests were administered city wide in September, 1978, and May, 1979.

### Instrumentation

Least Preferred Co-worker Scale (LPC). This index was used to categorize leadership style. It is composed of 16 bipolar, semantic differential scales.<sup>5</sup> Respondents used these scales to describe their least preferred co-worker, that is, the person with whom they have had the most difficulty completing some task. Each item was scored from most to least favorable on an 8-point continuum. The sum of all individual scales provided a total LPC score. A high total score reflected a "relationship-orientation" while a low total score reflected a "task-orientation." The means and standard deviations were determined for the sample of principals and for the sample of teachers. High and low LPC classifications were made for those respondents whose LPC total scores fell in the top third or bottom third of the distribution, respectively.<sup>6</sup> This classification avoids

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<sup>5</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness (New York, New York: McGraw-Hill Book Company, 1967), pp. 39-44.

<sup>6</sup>Samuel Shiflett, "Is There a Problem With the LPC Score in Leader Match?" Personnel Psychology, XXXIV, No. 4 (Winter, 1981), 767.

the use of the contested LPC norms proposed by Fiedler, Chemers, and Mahar in 1976.<sup>7</sup> For this study, the teacher sample (n=251, m=71 and s.d.=10.56) and the principal sample (n=28, m=73 and s.d.=7.84) had cutting scores for high and low LPC classifications as follows: high LPC for the teacher sample was greater than 75, low LPC for the teacher sample was less than 67, high LPC for the principal sample was greater than 76, and low LPC for the principal sample was less than 70.

Much of the debate surrounding the Contingency Model pertains to characteristics of the LPC scale. The LPC score of a respondent has been interpreted as a measure of social distance, personal needs, cognitive complexity, and motivational hierarchies.<sup>8,9</sup> These various interpretations have not been found to be mutually exclusive.<sup>10</sup> The motivational hierarchy interpretation proposes that the LPC score reflects a hierarchy of motives. Successful task performance

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<sup>7</sup>Ibid., 765-769.

<sup>8</sup>Robert W. Rice, "Internal Analysis of the Least Preferred Co-worker (LPC) Scale," Educational and Psychological Measurement, XLI, No. 1 (Spring, 1981), 110.

<sup>9</sup>Martin G. Evans and Jerry Dermer, "What Does the Least Preferred Co-worker Scale Really Measure?: A Cognitive Interpretation," Journal of Applied Psychology, LVIX, No. 2 (April, 1974), 202.

<sup>10</sup>Robert P. Vecchio, "Alternatives to the Least Preferred Co-worker Construct," The Journal of Social Psychology, CXII (Second half, December, 1980), 264.

is thought to be the primary motive of persons with low LPC scores; their secondary motive is successful interpersonal relations. The opposite pattern of motives is thought to characterize persons with high LPC scores.<sup>11</sup> Fiedler noted that a third type of interpersonal style might be measured by medium position on the LPC scales.<sup>12</sup> This suggests the possibility that intermediate LPC individuals could have an effect on group performance.

Researchers have found that the LPC scale contains two types of items--those measuring non-task, interpersonal characteristics and those concerned with task-related attributes.<sup>13</sup> On the 16-item LPC scale, Fiedler reported split-half reliability coefficients ranging from 0.85 to 0.95.<sup>14</sup> The results of a study by Downey, Kirkeide, and Shiflett indicated that the LPC instrument does discriminate and is a more effective instrument in investigations which

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<sup>11</sup>Fred E. Fiedler, "The Effects of Leadership Training and Experience: A Contingency Model Interpretation," Administrative Science Quarterly, XVIII, No. 4 (December, 1972), 456.

<sup>12</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness, op. cit., p. 51.

<sup>13</sup>Chester A. Schriesheim, "Social Desirability and Leader Effectiveness," The Journal of Social Psychology, LVIII (June, 1979), 92-93.

<sup>14</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness, op. cit., p. 44.

do not require a particular interpretation of the LPC rating.<sup>15</sup>

The question of test-retest reliability for the LPC value appears to have resulted from replication studies which generalized real world conditions using an isolated segment of the population, that is, undergraduate student participants.<sup>16,17</sup> A study by Garland and O'Rielly retested 35 of 60 secondary principals within six weeks and obtained a Pearson product-moment correlation of 0.64.<sup>18</sup> Thus, the test-retest concern may not be a problem in an actual field situation where an ongoing task is being performed.

Group Atmosphere Scale (GA). This scale is designed to measure interpersonal or "leader-member" relations among the membership. The instrument consists of ten 8-point bipolar semantic differential scales.<sup>19</sup> The principal

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<sup>15</sup>Ronald G. Downey, Loreh Kirkeide, and Samuel C. Shiflett, "Dimensions and Dimension Relevance in LPC Selection and Evaluation," (Paper presented at the American Psychological Association Meeting, Toronto, Canada, 1978), pp. 8-9.

<sup>16</sup>Robert W. Rice, op. cit., 119.

<sup>17</sup>John E. Stinson and Lane Tracy, "Some Disturbing Characteristics of the LPC Score," Personnel Psychology, XXVII, No. 3 (Autumn, 1974), 480-482.

<sup>18</sup>Parnell Garland and Robert R. O'Rielly, "The Effect of Leader-Member Interaction on Organizational Effectiveness," Educational Administration Quarterly, XII, No. 3 (Fall, 1976), 20.

<sup>19</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness, op. cit., pp. 32, 269.

marked these scales to describe his work group. Each item was scored from most to least favorable, and the sum of the individual scales provided a total GA score. Each teacher was asked to describe the work group of teachers at his school. These individual teacher scores were averaged to obtain a mean GA score for each participating teacher group. The assessment of leader-member relations by both the leader and the group members is a more effective predictor for the leader-members relation facet of the situational variables.<sup>20</sup>

Fiedler reported that the split-half reliability of the GA scale is above 0.90.<sup>21</sup> Further, Chemers and Fiedler reported medians of approximately 65 for real-life groups.<sup>22</sup> Therefore, a total score of 60 to 80 was classified as good leader-member relations, 40 to less than 60 as moderate leader-member relations, and 10 to less than 40 as poor

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<sup>20</sup>Walter Hill, "The Validation and Extension of Fiedler's Theory of Leadership Effectiveness," Academy of Management Journal, XII, No. 1 (March, 1969), 48.

<sup>21</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness, op. cit., p. 163.

<sup>22</sup>Fred E. Fiedler and Martin M. Chemers, Leadership and Effective Management (Glenview, Illinois: Scott, Foresman and Company, 1974), pp. 65-66.

leader-member relations.<sup>23,24,25</sup> In this study, the mean and median of the principal sample were 68 and 70, respectively, and the mean and median of the means of the teacher samples were 63 and 64, respectively. The GA scores for each leader and the mean GA scores for his teacher group were both considered in the determination of leader-member relations as a situational variable.

Job Task Structure Rating Form. This instrument was employed to determine task structure. A task is scaled along four of Shaw's dimensions: goal clarity, decision verifiability, solutions specificity, and goal-path multiplicity.<sup>26,27</sup> An 11-point scale designed by Hunt was used to rate the tasks encompassed by the position of elementary

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<sup>23</sup>Ronald W. Johnson and Brenda J. Ryan, "A Test of the Contingency Model of Leadership Effectiveness," Journal of Applied Social Psychology, VI, No. 2 (April-June, 1976), 181.

<sup>24</sup>Robert C. Hardy, "Effect of Leadership Style on the Performance of Small Classroom Groups: A Test of the Contingency Model," Journal of Personality and Social Psychology, XIX, No. 3 (September, 1971), 370.

<sup>25</sup>Terence R. Mitchell, Anthony Biglan, Gerald R. Oncken, Fred E. Fiedler, "The Contingency Model: Criticism and Suggestions," Academy of Management Journal, XIII, No. 3 (September, 1970), 258.

<sup>26</sup>Fred E. Fiedler and Martin M. Chemers, op. cit., pp. 65-68.

<sup>27</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness, op. cit., p. 28.



principal.<sup>28</sup> A task is considered to be unstructured if goal clarity were low, if there were few ways to verify job decisions, if there were many ways the problems encountered could be solved, and if a multitude of correct decisions were possible.<sup>29</sup> A structured task has the opposite characteristics. Specifically, this means the following:

	Structured Task	Unstructured Task
Goal Clarity	7-11	1-5
Goal-Path Multiplicity	1-5	8-11
Decision Verifiability	8-11	1-5
Solution Specificity	7-11	1-5

Each principal participant rated a list of educationally related positions, including the position of elementary principal, on each of these dimensions.

Position Power Questionnaire. This 13-item questionnaire was employed to measure position power of the leader. The total score reflected the number of "yes" responses, that is from zero to 13.<sup>30</sup> Fiedler and Chemers stated, however, ". . . checklists are . . . rarely necessary to rate leadership positions in work contexts."<sup>31</sup> In addition, Fiedler suggested that in an elementary school

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<sup>28</sup>Ibid., pp. 28, 282-291.

<sup>29</sup>Walter Hill, op. cit., 40.

<sup>30</sup>Fred E. Fiedler, A Theory of Leadership Effectiveness, op. cit., pp. 23, 281.

<sup>31</sup>Fred E. Fiedler and Martin M. Chemers, op. cit., p. 69.

setting, with a relatively small faculty, the principal has relatively high position power.<sup>32</sup> In line with other studies reviewed, however, the dichotomizing position was placed at the median of the sample under study.<sup>33</sup> The median of the principal sample in this study was 11, and the median of mean teacher samples, as well as the median of the median teacher samples, was 10. Thus, 11 to 13 was classified as strong position power, and less than 10 was classified as weak position power.

Situational conditions. A combination of the measures of the three components, leader-member relations, task structure, and position power, was used to derive the situation favorableness for the environment of each principal. Leader-member relations, measured by Group Atmosphere Scale, was given the highest weight; task structure, measured by the Job Task Structure, was given an intermediate rank; and position power, measured by the Position Power Questionnaire, was given the lowest weight.<sup>34</sup>

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<sup>32</sup>Ibid., p. 133.

<sup>33</sup>Terence R. Mitchell, et al, op. cit., 257.

<sup>34</sup>Fred E. Fiedler and Martin M. Chemers, op. cit., pp. 64-69.

The situations described by these variables are as follows:<sup>35</sup>

Situation	Leader-Member Relations	Task Structure	Position Power
1	Good	Structured	High
2	Good	Structured	Low
3	Good	Unstructured	High
4	Good	Unstructured	Low
5	Poor	Structured	High
6	Poor	Structured	Low
7	Poor	Unstructured	High
8	Poor	Unstructured	Low

Situations 1, 2, 3, and 8 and situations 4, 5, 6, and 7 were treated as two groups for the consideration of situation favorableness in the utilization of the Contingency Model.

Beliefs About Mathematics Scale (BAMS). This scale is composed of 20 items marked on a 6-point continuum from "strongly disagree" to "strongly agree."<sup>36</sup> Ten of the items were scored positively or their actual scale value, and ten of the items were scored negatively or seven minus the scale value. The total of these values provided the BAMS score. Collier validated this scale as a measure of formal-informal dimension of attitude toward mathematics with 70 as the neutral point.<sup>37</sup> Collier, further,

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<sup>35</sup>Terence R. Mitchell, et al, op. cit., 254.

<sup>36</sup>C. Patrick Collier, "Prospective Elementary Teachers' Intensity and Ambivalence of Beliefs About Mathematics and Mathematics Instruction," Journal for Research in Mathematics Education, III, No. 3 (May, 1972), 155-157.

<sup>37</sup>Ibid.

categorized scores less than 70 as lying in a formal direction.<sup>38</sup> For purposes of this study, only scores greater than 70 or less than 70 were used. Collier reported a reliability coefficient of 0.80.<sup>39</sup>

Beliefs About Mathematics Instruction Scale (BAMIS).

This scale is composed of 20 items marked on a 6-point continuum from "strongly disagree" to "strongly agree." These items were presented to the responding teachers as items 21-40 of the Beliefs About Mathematics form. Collier validated the BAMIS scale as a measure of a formal-informal dimension to mathematics instruction.<sup>40</sup> The scoring and formal-informal placement were treated in the same manner as the BAMS scale.<sup>41</sup> Collier reported a reliability coefficient of 0.83.<sup>42</sup>

The Beckmann-Beal Mathematical Competencies Test

For Enlightened Citizens, Form A. This 48-item test was one of two forms developed by Beckmann and Beal to measure the 48 competencies suggested by the committee on Basic Mathematical Competencies in 1972.<sup>43</sup> The split-half correlation was determined to be 0.95, and norms were developed

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<sup>38</sup>Ibid., 159.

<sup>39</sup>Ibid., 157.

<sup>40</sup>Ibid., 155-158.

<sup>41</sup>Ibid.

<sup>42</sup>Ibid., 157.

<sup>43</sup>See Appendix D for a listing of the competencies.

for grades 7, 8, 9, and 12.<sup>44</sup> A panel of mathematics educators drawn from the Board of the National Council of Teachers of Mathematics reviewed the test to determine how well the test items conformed to the content of the competencies it purported to measure.<sup>45</sup> In addition, Cramer determined norms from a sample of prospective elementary teachers.<sup>46</sup> A test measuring basic competencies, however, should be used as an absolute, not a relative, scale. For this study, 90 to 100 percent or a raw score greater than 42 constituted the category of high competence, and raw scores of 41 and 42 were discarded.

Norfolk Public Schools Mathematics Monitor Tests.

These tests are a part of the Norfolk Public Schools' assessment program. The tests reflect the Norfolk Public Schools Mathematics Curriculum.<sup>47</sup> These evaluative instruments, in addition, were found in compliance with the criteria established by the State Department of Education, and approval was granted for their use in lieu of the Basic Skills

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<sup>44</sup>Based on personal correspondence between Milton W. Beckmann, Professor of Secondary Education, University of Nebraska, and the investigator, December, 1976.

<sup>45</sup>Ibid.

<sup>46</sup>Ibid.

<sup>47</sup>Correspondence between the Assistant Superintendent, Instructional Support Services, Norfolk Public Schools and the Assistant Superintendent of Planning and Evaluation, State Department of Education, Richmond, Virginia, July-October, 1981.

Tests in Mathematics.<sup>48</sup> Popham has also noted the value of using criterion referenced tests, as compared to norm referenced measures, for purposes of determining instructional improvement.<sup>49</sup> Reliability coefficients reported for these tests, Levels II and III, ranged from 0.85 to 0.87.<sup>50</sup>

An educational accountability model suggests that the purpose of education is to promote growth in the educational attainment of students; the model requires a means of evaluating effectiveness in promoting such a change. The development of an acceptable means of determining gain has been considered by various investigators. One investigator, Richards, developed a computer simulation model from which he concluded that "simple pretest-posttest difference is about as accurate . . . as other change estimates . . . , easier to compute . . . and holds even when students are assigned nonrandomly to school."<sup>51</sup> Further, "simple gain

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<sup>48</sup> Ibid.

<sup>49</sup> W. James Popham, "Well-Crafted Criterion-Referenced Tests," Educational Leadership, XXXVI, No. 2 (November, 1978), 93.

<sup>50</sup> Interview with the Coordinator of Testing, Norfolk Public Schools, September, 1981.

<sup>51</sup> James M. Richards, Jr., "A Simulation Study of the Use of Change Measures to Compare Educational Programs," American Educational Research Journal, XII, No. 3 (Summer, 1975), 300.

scores . . . are more meaningful to non-researchers."<sup>52</sup>

Linn and Slinde state that the conclusions reached by Richards "might be justified if the process under study is adequately modeled by the simulation."<sup>53</sup>

For purposes of this study, pre- and post-test scores on the monitor tests were used to determine a simple gain score for each student instructed by a participating teacher. A mean gain score for each teacher in the sample was calculated from the individual gain scores of the pupils who were instructed from the pre-test administration, September, to the post-test administration, May. This mean gain score was expressed as a percent of the total number of items on the test administered, that is, Level II or Level III.

#### Procedures for Data Analysis

The procedures for data collection yielded one group of principals whose LPC value and determined situational conditions matched as hypothesized by Fiedler's Contingency Theory. This group of principals was composed of two categories: (1) low LPC principal and favorable situational conditions and (2) high LPC principal and moderate

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<sup>52</sup>Ibid., 309.

<sup>53</sup>Robert L. Linn and Jeffrey A. Slinde, "The Determination of the Significance of Change Between Pre- and Posttesting Periods," Review of Educational Research, XXXVII, No. 1 (Winter, 1977), 133.

situational conditions. The remaining four groups were: (1) low LPC principal and moderate situational conditions, (2) high LPC principal and favorable situational conditions, (3) intermediate LPC principal and favorable situational conditions, and (4) intermediate LPC principal and moderate situational conditions. Using the mean gain scores for those students related to each principal in the sample as the dependent variable, an analysis of variance (ANOVA, 3x2, 2x2) was performed on each set of data using the Statistical Package for the Social Sciences (SPSS).<sup>54</sup> This procedure was performed to test empirical Hypothesis 1.

In order to test empirical Hypothesis 2, the data were sorted into groups which reflected the following principal and teacher characteristics: (1) low LPC principal and low LPC teacher, (2) low LPC principal and high LPC teacher, (3) low LPC principal and intermediate LPC teacher, (4) high LPC principal and low LPC teacher, (5) high LPC principal and high LPC teacher, (6) high LPC principal and intermediate LPC teacher, (7) intermediate LPC principal and low LPC teacher, (8) intermediate LPC principal and high LPC teacher, and (9) intermediate LPC principal and intermediate LPC teacher. Using the mean gain scores for

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<sup>54</sup>Thomas D. Cook and Donald T. Campbell, Quasi-Experimentation: Design and Analysis Issues for Field Settings (Chicago, Illinois: Rand McNally College Publishing Company, 1979), pp. 182-183.



those students related to each teacher as the dependent variable, an analysis of variance (ANOVA, 3x3, 2x2) was performed on each set of data using SPSS.<sup>55</sup>

The next step was to further sort the data into the following groups: (1) low LPC principal, favorable situational conditions, and low LPC teacher, (2) low LPC principal, favorable situational conditions, and high LPC teacher, (3) low LPC principal, favorable situational conditions, and intermediate LPC teacher, (4) high LPC principal, moderate situational conditions, and low LPC teacher, (5) high LPC principal, moderate situational conditions, and high LPC teacher, and (6) high LPC principal, moderate situational conditions, and intermediate LPC teacher. Using the student mean gains scores related to each teacher as the dependent variable, an analysis of variance (ANOVA, 2x3, 2x2) was performed on each set of data using SPSS.<sup>56</sup> This procedure was performed to test empirical Hypothesis 3.

To test empirical Hypothesis 4, the data were sorted into eight groups which reflected the following teacher characteristics: Beckmann-Beal raw score greater than 42 or less than 41 and the various combinations of formal and informal for the BAMS and BAMIS scales. Using the student mean gain scores related to each teacher as the

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<sup>55</sup>Ibid.

<sup>56</sup>Ibid.

dependent variable, an analysis of variance (ANOVA, 2x4) was performed on each set of data.<sup>57</sup>

The teacher characteristics of mathematics knowledge/competence and attitude toward mathematics and mathematics instruction were viewed as significant contributors to the predictive ability of the Contingency Model. Thus, these characteristics were treated as covariates (ANCOVA) using SPSS in an analysis for empirical Hypotheses 1, 2, and 3.<sup>58</sup>

#### Summary

In the application of Fiedler's Contingency Model to an educational problem, random assignment of principals to schools and experimental manipulations of teachers and students were not possible. This ex post facto field study, as have the majority of studies, viewed principals, teachers, and students where they were. The design and subsequent analysis of the data extracted was associational, not causative, in the consideration of situational variables, leadership styles--principal and teacher--and student learning as measured by pupil performance in a content area.

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<sup>57</sup> Ibid.

<sup>58</sup> Ibid.

## Chapter 4

### RESULTS

The following analyses by hypothesis were performed using the Statistical Package for the Social Sciences (SPSS). The ANOVA and related analyses were designed for use with data of unequal cell size. These data were obtained from a non-randomized, quasi-control, pre- and post-test design.

#### Analysis of Data and Findings

Hypothesis 1. Fourth, fifth, and sixth grade pupil achievement gains in mathematics for groups where the elementary school principal leadership style and situation favorableness were matched will be significantly greater than the corresponding pupil achievement where the elementary school principal leadership style and situation favorableness were not matched.

A two-way interaction, principal leadership style by situational conditions, significant at the 0.012 level suggests support for Hypothesis 1. (See Table 1 for the statistical findings of the 2x2 factorial design, principal leadership style by situational conditions.) This interaction, however, was generated primarily by the depressed

mean gain score for cell "c," described as high LPC principal leadership style and favorable situational conditions, instead of both cells "c" and "b" as required to satisfy this hypothesis. (See Table 2 for parameters for each cell in the 2x2 factorial design.) Cell "b," described as low LPC principal leadership style and moderate situational conditions, exhibited a somewhat depressed mean gain score. The additional consideration of the effect of the selected teacher characteristics (Beckmann-Beal raw score (COMP), Beliefs About Mathematics Scale (BAMS), and Beliefs About Mathematics Instruction Scale (BAMIS)) as covariates also demonstrated a two-way interaction between principal leadership style and situational conditions. This was significant at the 0.051 level. (See Table 3 for the statistical findings of the 2x2 factorial design with the inclusion of the covariates.) This significant interaction, generated following the inclusion of the covariates, appears to be derived primarily from the consideration of the teacher characteristic, BAMIS. An elevated value is found in cell "b," that is, the cell described as low LPC principal leadership style and moderate situational conditions. (See Tables 4, 5, and 6 for parameters for each cell in the 2x2 factorial design related to each of the covariates.) A slightly elevated value is found for each of the other teacher characteristics in cell "b." These occurrences

probably contribute to the finding of only a somewhat depressed mean gain score in cell "b" as previously noted.

The extension of the analysis to include intermediate LPC principal leadership style as well as high LPC and low LPC principal leadership style with favorable or moderate situational conditions did not shed additional light on Hypothesis 1. Again, an interaction significant at the 0.007 level was obtained. (See Table 7 for the statistical findings of the 3x2 factorial design.) The significant interaction appeared to be generated from the depressed mean gain score in cell "c" as was found in the 2x2 factorial design. The significant interaction, however, did not persist following the additional consideration of the selected teacher characteristics (COMP, BAMS, and BAMIS) as covariates. (See Table 8 for the statistical findings of the 3x2 factorial design with the inclusion of the covariates.)

Technically, since all aspects and expectations of Hypothesis 1 cannot be supported and/or met, Hypothesis 1 must be rejected to avoid the occurrence of a Type 2 error. The quasi-experimental design of the study demands rigorous support of any hypothesis prior to its acceptance.

Table 1

Analysis of Variance Mean Gain Score by Principal  
Leadership Style and Situational Conditions (2x2)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	491.904	2	245.952	3.723	0.026
Principal Leadership	393.390	1	393.390	5.956	0.016
Situational Conditions	258.307	1	258.307	3.911	0.050
Two-Way Interaction					
Leadership by Situation	427.147	1	427.147	6.467	0.012
Residual	10568.670	160	66.054		
Total	11487.721	163	70.477		

Table 2  
 Factorial Design Using Mean Gain Score as the  
 Dependent Variable (Hypothesis 1)

	Favorable Situational Conditions	Moderate Situational Conditions	
Low LPC Principal Leadership Style	"Matched" Cell "a" M=20.7734 s.d.=6.9016 N=70	"Not Matched" Cell "b" M=19.3041 s.d.=9.3726 N=17	M=20.4863 s.d.=7.4097 N=87
High LPC Principal Leadership Style	"Not Matched" Cell "c" M=15.0603 s.d.=6.5292 N=37	"Matched" Cell "d" M=20.9020 s.d.=10.5513 N=40	M=18.0949 s.d.=9.2711 N=77
	M=18.798 s.d.=7.276 N=107	M=20.425 s.d.=10.158 N=57	M=19.36 N=164

Table 3

Analysis of Variance With Covariates: Mean Gain Score by Principal  
Leadership Style and Situational Conditions (2x2)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Covariates	105.521	3	35.174	0.520	0.669
COMP	50.708	1	50.708	0.749	0.388
BAMS	11.839	1	11.839	0.175	0.676
BAMIS	2.615	1	2.615	0.039	0.844
Main Effects	141.150	2	70.625	1.043	0.355
Principal Leadership	127.535	1	127.535	1.884	0.172
Situational Conditions	60.869	1	60.869	3.899	0.345
Two-Way Interaction					
Leadership by Situation	262.149	1	262.149	3.873	0.051
Residual	9476.479	140	67.689		
Total	9985.398	146	68.393		



Table 4  
 Factorial Design Using Covariate COMP as the  
 Dependent Variable (Hypothesis 1)

	Favorable Situational Conditions	Moderate Situational Conditions	
Low LPC Principal Leadership Style	"Matched" Cell "a" M=39.2353 s.d.=5.6492 N=68	"Not Matched" Cell "b" M=40.7059 s.d.=6.7525 N=17	M=39.5294 s.d.=5.8728 N=85
High LPC Principal Leadership Style	"Not Matched" Cell "c" M=37.6071 s.d.=7.2844 N=28	"Matched" Cell "d" M=38.2162 s.d.=7.8886 N=37	M=37.9538 s.d.=7.5817 N=65
	M=38.760 s.d.=6.176 N=96	M=39.000 s.d.=7.576 N=54	

Table 5  
 Factorial Design Using Covariate BAMS as the  
 Dependent Variable (Hypothesis 1)

	Favorable Situational Conditions	Moderate Situational Conditions	
Low LPC Principal Leadership Style	"Matched" Cell "a" M=74.9275 s.d.=12.2382 N=69	"Not Matched" Cell "b" M=76.7059 s.d.=11.4987 N=17	M=75.2791 s.d.=12.0505 N=86
High LPC Principal Leadership Style	"Not Matched" Cell "c" M=73.6216 s.d.=9.6878 N=37	"Matched" Cell "d" M=71.7949 s.d.=8.7845 N=39	M=72.6842 s.d.=9.2191 N=76
	M=74.472 s.d.=11.383 N=106	M=73.286 s.d.=9.847 N=56	

Table 6

Factorial Design Using Covariate BAMIS as the  
Dependent Variable (Hypothesis 1)

	Favorable Situational Conditions	Moderate Situational Conditions	
Low LPC Principal Leadership Style	"Matched" Cell "a" M=74.4638 s.d.=12.8356 N=69	"Not Matched" Cell "b" M=85.1176 s.d.=15.5156 N=17	M=76.5698 s.d.=13.9761 N=86
High LPC Principal Leadership Style	"Not Matched" Cell "c" M=73.2162 s.d.=10.6982 N=37	"Matched" Cell "d" M=75.3846 s.d.=11.2311 N=39	M=74.3289 s.d.=10.9561 N=76
	M=74.028 s.d.=12.095 N=106	M=78.339 s.d.=13.326 N=56	

Table 7

Analysis of Variance Mean Gain Score by Principal Leadership  
Style and Situational Conditions (3x2)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	404.802	3	134.934	1.862	0.137
Principal Leadership	395.614	2	197.807	2.730	0.067
Situational Conditions	42.898	1	42.898	0.592	0.442
Two-Way Interaction					
Leadership by Situation	742.651	2	371.326	5.124	0.007
Residual	17318.166	239	72.461		
Total	18465.619	244	75.679		

Table 8

Analysis of Variance With Covariates: Mean Gain Score by Principal  
Leadership Style and Situational Conditions (3x2)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Covariates	282.269	3	94.090	1.278	0.283
COMP	103.402	1	103.402	1.405	0.237
BAMS	0.017	1	0.017	0.000	0.988
BAMIS	77.572	1	77.572	1.054	0.306
Main Effects	109.398	3	36.466	0.495	0.686
Principal Leadership	100.838	2	50.419	0.685	0.505
Situational Conditions	0.588	1	0.588	0.008	0.929
Two-Way Interaction					
Leadership by Situation	384.215	2	192.108	2.610	0.076
Residual	15825.479	215	73.607		
Total	16601.361	223	74.446		

Hypothesis 2. Fourth, fifth, and sixth grade pupil achievement gains in mathematics for groups where the elementary school principal leadership style and teacher leadership style were not congruent will be significantly higher than the corresponding pupil achievement where the elementary school principal leadership style and teacher leadership style were congruent.

A significant main effect for teacher leadership style was evident when high and low LPC leadership styles were considered, as well as when intermediate LPC leadership styles were included. (See Tables 9 and 10 for the statistical findings of the 2x2 factorial design and the 3x3 factorial design, respectively.) The main effect for teacher leadership style for both factorial designs, as well as a significant total main effect for the 3x3 factorial design, suggests a significantly elevated mean gain score associated with high LPC teacher leadership style. (See Tables 11 and 12 for parameters for each cell in the 2x2 and 3x3 factorial designs, respectively.) The significant main effect for teacher leadership style as well as the significant total main effect for the 3x3 factorial design remained when the teacher characteristics (COMP, BAMS, and BAMIS) were considered as covariates. (See Tables 13 and 14 for statistical findings of the 2x2 and 3x3 factorial designs with the inclusion of the covariates.) No particular teacher leadership style, however, was

consistently elevated for each of the teacher characteristics used as covariates. (See Tables 15, 16, and 17 for parameters for each cell in the 3x3 factorial design related to each of the covariates.) Nevertheless, no support was provided for congruence or non-congruence of principal and teacher leadership style. Hypothesis 2 must be rejected.

Table 9

Analysis of Variance Mean Gain Score by Principal Leadership  
Style and Teacher Leadership Style (2x2)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	406.970	2	203.485	2.742	0.070
Principal Leadership	72.496	1	72.496	0.977	0.326
Teacher Leadership	354.682	1	354.682	4.780	0.031
Two-Way Interaction					
Principal by Teacher Leadership Style	34.263	1	34.263	0.462	0.499
Residual	6603.673	89	74.199		
Total	7044.906	92	76.575		



Table 10

Analysis of Variance Mean Gain Score by Principal Leadership  
Style and Teacher Leadership Style (3x3)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	1003.997	4	250.999	3.411	0.010
Principal Leadership	372.563	2	186.281	2.532	0.082
Teacher Leadership	642.093	2	321.046	4.363	0.014
Two-Way Interaction					
Principal by Teacher Leadership Style	96.181	4	24.045	0.327	0.860
Residual	17365.441	236	73.582		
Total	18465.619	244	75.679		

Table 11

Factorial Design Using Mean Gain Score as the  
Dependent Variable (Hypothesis 2)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	
Low LPC Principal Leadership Style	"Congruent" Cell "a" M=19.0906 s.d.=7.1129 N=18	"Not Congruent" Cell "b" M=22.2406 s.d.=7.1894 N=35	M=21.171 s.d.=7.253 N=53
High LPC Principal Leadership Style	"Not Congruent" Cell "c" M=15.4300 s.d.=9.3433 N=11	"Congruent" Cell "d" M=21.2593 s.d.=10.5446 N=29	M=19.656 s.d.=10.448 N=40
	M=17.702 s.d.=8.072 N=29	M=21.796 s.d.=8.806 N=64	M=20.52 N=93

Table 12

Factorial Design Using Mean Gain Score as the  
Dependent Variable (Hypothesis 2)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	Intermediate LPC Teacher Leadership Style	
Low LPC Principal Leadership Style	Cell "a" M=19.0906 s.d.=7.1129 N=18	Cell "b" M=22.2406 s.d.=7.1894 N=35	Cell "g" M=19.4194 s.d.=7.6332 N=34	M=20.4863 s.d.=7.4097 N=87
High LPC Principal Leadership Style	Cell "c" M=15.4300 s.d.=9.3433 N=11	Cell "d" M=21.2593 s.d.=10.5446 N=29	Cell "h" M=16.4070 s.d.=7.5871 N=37	M=18.0949 s.d.=9.2711 N=77
Intermediate LPC Principal Leadership Style	Cell "e" M=20.4943 s.d.=6.2518 N=14	Cell "f" M=22.2771 s.d.=10.7894 N=28	Cell "i" M=20.0608 s.d.=9.0547 N=39	M=20.9019 s.d.=9.2531 N=81
	M=18.611 s.d.=7.569 N=43	M=21.942 s.d.=9.396 N=92	M=18.634 s.d.=8.236 N=110	M=19.87 N=245

Table 13

Analysis of Variance With Covariates: Mean Gain Score by Principal Leadership Style and Teacher Leadership Style (2x2)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Covariates	278.993	3	92.998	1.320	0.274
COMP	42.835	1	42.835	0.608	0.438
BAMS	168.057	1	168.057	2.385	0.127
BAMIS	147.202	1	147.202	2.089	0.153
Main Effects	299.115	2	149.557	2.122	0.127
Principal Leadership	0.596	1	0.596	0.008	0.927
Teacher Leadership	297.864	1	297.864	4.227	0.043
Two-Way Interaction					
Principal by Teacher Leadership Style	4.073	1	4.073	0.058	0.811
Residual	5284.970	75	70.466		
Total	5867.151	81	72.434		

Table 14

Analysis of Variance With Covariates: Mean Gain Score by Principal Leadership Style and Teacher Leadership Style (3x3)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Covariates	282.269	3	94.090	1.310	0.272
COMP	103.402	1	103.402	1.440	0.232
BAMS	0.017	1	0.017	0.000	0.988
BAMIS	77.572	1	77.572	1.080	0.300
Main Effects	954.169	4	238.542	3.322	0.012
Principal Leadership	102.931	2	51.465	0.717	0.490
Teacher Leadership	845.359	2	422.680	5.886	0.003
Two-Way Interaction					
Principal by Teacher Leadership Style	140.199	4	35.050	0.488	0.745
Residual	15224.724	212	71.815		
Total	16601.361	223	74.446		

Table 15

Factorial Design Using Covariate COMP as the  
Dependent Variable (Hypothesis 2)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	Intermediate LPC Teacher Leadership Style
Low LPC Principal Leadership Style	Cell "a" M=41.2222 s.d.=5.3198 N=18	Cell "b" M=38.0606 s.d.=6.5524 N=33	Cell "g" M=40.0588 s.d.=5.2509 N=34
High LPC Principal Leadership Style	Cell "c" M=34.4286 s.d.=8.9043 N=7	Cell "d" M=37.2917 s.d.=7.3098 N=24	Cell "h" M=39.1471 s.d.=7.4432 N=34
Intermediate LPC Principal Leadership Style	Cell "e" M=38.0000 s.d.=6.3875 N=11	Cell "f" M=39.1071 s.d.=6.2972 N=28	Cell "i" M=38.8718 s.d.=7.1163 N=39
	M=38.917 s.d.=6.784 N=36	M=38.188 s.d.=6.652 N=85	M=39.336 s.d.=6.652 N=107
			M=39.5294 s.d.=5.8728 N=85
			M=37.9538 s.d.=7.5817 N=65
			M=38.8333 s.d.=6.6575 N=78

Table 16

Factorial Design Using Covariate BAMS as the  
Dependent Variable (Hypothesis 2)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	Intermediate LPC Teacher Leadership Style	
Low LPC Principal Leadership Style	Cell "a" M=76.3889 s.d.=15.5304 N=18	Cell "b" M=74.5714 s.d.=11.5103 N=35	Cell "g" M=75.4242 s.d.=10.7501 N=33	M=75.2719 s.d.=12.0505 N=86
High LPC Principal Leadership Style	Cell "c" M=78.5455 s.d.=8.0045 N=11	Cell "d" M=71.0000 s.d.=8.9562 N=29	Cell "h" M=72.2500 s.d.=9.2902 N=36	M=72.6842 s.d.=9.2191 N=76
Intermediate LPC Principal Leadership Style	Cell "e" M=73.7857 s.d.=8.3498 N=14	Cell "f" M=75.4286 s.d.=8.0619 N=28	Cell "i" M=73.0253 s.d.=7.3097 N=38	M=74.0000 s.d.=7.7394 N=80
	M=76.093 s.d.=11.741 N=43	M=73.707 s.d.=9.849 N=92	M=73.505 s.d.=9.154 N=107	

Table 17

Factorial Design Using Covariate BAMIS as the  
Dependent Variable (Hypothesis 2)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	Intermediate LPC Teacher Leadership Style	
Low LPC Principal Leadership Style	Cell "a" M=78.8889 s.d.=17.5429 N=18	Cell "b" M=74.8286 s.d.=12.7521 N=35	Cell "g" M=77.1515 s.d.=13.2621 N=33	M=76.5698 s.d.=13.9761 N=86
High LPC Principal Leadership Style	Cell "c" M=69.9091 s.d.=8.7915 N=11	Cell "d" M=77.8276 s.d.=12.9892 N=29	Cell "h" M=72.8611 s.d.=9.0369 N=36	M=74.3289 s.d.=10.9561 N=76
Intermediate LPC Principal Leadership Style	Cell "e" M=72.7143 s.d.=9.0590 N=14	Cell "f" M=75.7143 s.d.=10.0843 N=28	Cell "i" M=78.5000 s.d.=11.1325 N=38	M=76.5125 s.d.=10.5350 N=80
	M=74.581 s.d.=13.535 N=43	M=76.043 s.d.=12.019 N=92	M=76.187 s.d.=11.370 N=107	



Hypothesis 3. Fourth, fifth, and sixth grade pupil achievement gains in mathematics for groups where the elementary school principal leadership style and situation favorableness were matched and where the elementary principal leadership style and teacher leadership style were not congruent will be significantly greater than the corresponding pupil achievement where these conditions were not satisfied.

The matched principal leadership style and situational conditions produced no main effect. Based upon the utilization of Fiedler's Contingency Theory, this was an expected finding. The main effect for teacher leadership style, which appeared to generate the significant total main effect in the 2x2 factorial design, however, was not in accord with expectations for Hypothesis 3. (See Table 18 for the statistical findings of the 2x2 factorial design.) This statistically significant effect was sustained when the selected teacher characteristics (COMP, BAMS, and BAMIS) were treated as covariates. (See Table 19 for the statistical findings of the 2x2 factorial design with the inclusion of the covariates.) The significant main effects were reflected in an elevated mean gain score for the high LPC teacher leadership style. (See Table 20 for parameters for each cell in the 2x2 factorial design.) The inclusion of the teacher characteristics as covariates, however, did not appear to produce a similar discernible

pattern. (See Tables 21, 22, and 23 for the parameters for each cell in the 2x2 factorial design related to each of the covariates.)

An extension of the data analysis to include intermediate LPC teacher leadership style produced a statistically significant interaction; principal leadership style and matched situational conditions interacted with teacher leadership style. This significant interaction obscures the significant main effect for teacher leadership style. (See Table 24 for the statistical findings of the 2x3 factorial design.) Again, as in the 2x2 design, the mean gain score for the high LPC teacher leadership style was elevated. In addition, the cell, described by intermediate LPC teacher leadership style and low LPC principal leadership style and favorable situational conditions, possessed a somewhat elevated mean gain score. This additional occurrence of an elevated mean gain score probably was the initiating factor for the significant interaction. (See Table 25 for the parameters in each cell in the 2x3 design.) The significant interaction persisted in the 2x3 factorial design when the covariates were considered. (See Table 26 for the statistical findings of the 3x2 factorial design with the inclusion of the covariates.) None of the covariates produced any pattern for teacher leadership. (See Tables 27, 28, and 29 for the parameters for each cell in the 2x3 factorial design related to each of the covariates.)

The support in the 2x2 design for high LPC teacher leadership style and the confounding interaction in the 2x3 factorial design do not support either congruence or non-congruence of principal and teacher leadership style. Hypothesis 3 must be rejected.

Table 18

Analysis of Variance Mean Gain Score by Principal Leadership Style Matched  
With Situational Conditions and Teacher Leadership Style (2x2)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	654.128	2	327.064	4.620	0.014
Principal Leadership and Matched Situation	217.980	1	217.980	3.079	0.084
Teacher Leadership	410.327	1	410.327	5.796	0.019
Two-Way Interaction					
Principal Matched With Situation by Teacher Leadership Style	125.229	1	125.229	1.769	0.189
Residual	4247.400	60	70.790		
Total	5026.757	63	79.790		

Table 19

Analysis of Variance With Covariates: Mean Gain Score by Principal Leadership Style Matched With Situational Conditions and Teacher Leadership Style (2x2)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Covariates	126.156	3	42.052	0.616	0.608
COMP	6.069	1	6.069	0.089	0.767
BAMS	33.074	1	33.074	0.485	0.489
BAMIS	109.681	1	109.681	1.607	0.210
Main Effects	613.708	2	306.854	4.496	0.016
Principal Leadership and Matched Situation	182.396	1	182.396	2.673	0.108
Teacher Leadership	361.073	1	361.073	5.291	0.025
Two-Way Interaction					
Principal Matched With Situation by Teacher Leadership Style	172.060	1	172.060	2.521	0.118
Residual	3616.882	53	68.243		
Total	4528.807	59	76.759		

Table 20  
 Factorial Design Using Mean Gain Score as the  
 Dependent Variable (Hypothesis 3)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	
Low LPC Principal Leadership Style and Favorable Situational Conditions	Cell "a" M=18.0885 s.d.=6.6705 N=13	Cell "b" M=22.0185 s.d.=7.1746 N=34	M=20.931 s.d.=7.190 N=47
	Cell "c" M=16.7125 s.d.=14.4824 N=4	Cell "d" M=28.0085 s.d.=10.7454 N=13	M=25.351 s.d.=12.260 N=17
High LPC Principal Leadership Style and Moderate Situational Conditions	M=17.765 s.d.=8.547 N=17	M=23.675 s.d.=8.625 N=47	M=22.11 N=64

Table 21

Factorial Design Using Covariate COMP as the Dependent Variable (Hypothesis 3)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style
Low LPC Principal Leadership Style and Favorable Situational Conditions	Cell "a" M=39.6154 s.d.=5.4702 N=13	Cell "b" M=38.3125 s.d.=6.4929 N=32
High LPC Principal Leadership Style and Moderate Situational Conditions	Cell "c" M=37.5000 s.d.=6.3640 N=2	Cell "d" M=37.0000 s.d.=6.0828 N=13
	M=39.333 s.d.=5.394 N=15	M=37.933 s.d.=6.337 N=45
		M=38.689 s.d.=6.182 N=45
		M=37.067 s.d.=5.885 N=15

Table 22  
 Factorial Design Using Covariate BAMS as the  
 Dependent Variable (Hypothesis 3)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	
Low LPC Principal Leadership Style and Favorable Situational Conditions	Cell "a" M=73.9231 s.d.=17.3083 N=13	Cell "b" M=74.7059 s.d.=11.6555 N=34	M=74.489 s.d.=13.256 N=47
High LPC Principal Leadership Style and Moderate Situational Conditions	Cell "c" M=78.7500 s.d.=5.5000 N=4	Cell "d" M=69.9231 s.d.=8.0048 N=13	M=72.000 s.d.=8.284 N=17
	M=75.059 s.d.=15.323 N=17	M=73.383 s.d.=10.902 N=47	



Table 23

Factorial Design Using Covariate BAMIS as the  
Dependent Variable (Hypothesis 3)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	
Low LPC Principal Leadership Style and Favorable Situational Conditions	Cell "a" M=73.3846 s.d.=17.0173 N=13	Cell "b" M=75.1471 s.d.=12.8018 N=34	M=74.660 s.d.=13.919 N=47
High LPC Principal Leadership Style and Moderate Situational Conditions	Cell "c" M=70.7500 s.d.=12.5797 N=4	Cell "d" M=78.1538 s.d.=15.6729 N=13	M=76.412 s.d.=14.979 N=17
	M=72.765 s.d.=15.754 N=17	M=75.979 s.d.=13.546 N=47	

Table 24

Analysis of Variance Mean Gain Score by Principal Leadership Style  
Matched With Situational Conditions and  
Teacher Leadership Style (2x3)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	704.779	3	234.926	3.756	0.013
Principal Leadership and Matched Situation	15.871	1	15.871	0.254	0.615
Teacher Leadership	704.359	2	352.179	5.631	0.005
Two-Way Interaction					
Principal Matched With Situation by Teacher Leadership Style	419.865	2	209.932	3.357	0.039
Residual	6504.213	104	62.541		
Total	7628.857	109	69.990		

Table 25

Factorial Design Using Mean Gain Score as the  
Dependent Variable (Hypothesis 3)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	Intermediate LPC Teacher Leadership Style	
Low LPC Principal Leadership Style and Favorable Situational Conditions	Cell "a" M=18.0885 s.d.=6.6705 N=13	Cell "b" M=22.0185 s.d.=7.1746 N=34	Cell "e" M=20.4504 s.d.=6.4142 N=23	M=20.7734 s.d.=6.9016 N=70
High LPC Principal Leadership Style and Moderate Situational Conditions	Cell "c" M=16.7125 s.d.=14.4824 N=4	Cell "d" M=28.0085 s.d.=10.7454 N=13	Cell "f" M=17.6139 s.d.=7.8384 N=23	M=20.9020 s.d.=10.5513 N=40
	M=17.765 s.d.=8.547 N=17	M=23.675 s.d.=8.625 N=47	M=19.032 s.d.=7.225 N=46	M=20.82 N=110

Table 26

Analysis of Variance With Covariates: Mean Gain Score by Principal Leadership Style Matched With Situational Conditions and Teacher Leadership Style (2x3)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Covariates	136.165	3	45.388	0.765	0.516
COMP	14.852	1	14.852	0.250	0.618
BAMS	43.824	1	43.824	0.739	0.392
BAMIS	10.021	1	10.021	0.169	0.682
Main Effects	853.681	3	284.560	4.798	0.004
Principal Leadership and Matched Situation	13.614	1	13.614	0.230	0.633
Teacher Leadership	853.614	2	426.807	7.197	0.001
Two-Way Interaction					
Principal Matched With Situation by Teacher Leadership Style	548.255	2	274.128	4.622	0.012
Residual	5515.557	93	59.307		
Total	7053.657	101	69.838		

Table 27

Factorial Design Using Covariate COMP as the  
Dependent Variable (Hypothesis 3)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	Intermediate LPC Teacher Leadership Style	
Low LPC Principal Leadership Style and Favorable Situational Conditions	Cell "a" M=39.6154 s.d.=5.4702 N=13	Cell "b" M=38.3125 s.d.=6.4929 N=32	Cell "e" M=40.3043 s.d.=4.3530 N=23	M=39.2353 s.d.=5.6492 N=68
High LPC Principal Leadership Style and Moderate Situational Conditions	Cell "c" M=37.5000 s.d.=6.3640 N=2	Cell "d" M=37.0000 s.d.=6.0828 N=13	Cell "f" M=39.0000 s.d.=9.0554 N=22	M=38.2162 s.d.=7.8886 N=37
	M=39.333 s.d.=5.394 N=15	M=37.933 s.d.=6.337 N=45	M=39.667 s.d.=7.003 N=45	

Table 28  
 Factorial Design Using Covariate BAMS as the  
 Dependent Variable (Hypothesis 3)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	Intermediate LPC Teacher Leadership Style	
Low LPC Principal Leadership Style and Favorable Situational Conditions	Cell "a" M=73.9231 s.d.=17.3083 N=13	Cell "b" M=74.7059 s.d.=11.6555 N=34	Cell "e" M=75.8636 s.d.=9.9345 N=22	M=74.9275 s.d.=12.2382 N=69
High LPC Principal Leadership Style and Moderate Situational Conditions	Cell "c" M=78.7500 s.d.=5.5000 N=4	Cell "d" M=69.9231 s.d.=8.0048 N=13	Cell "f" M=71.6364 s.d.=9.3429 N=22	M=71.7949 s.d.=8.7845 N=39
	M=75.059 s.d.=15.323 N=17	M=73.383 s.d.=10.902 N=47	M=73.750 s.d.=9.767 N=44	

Table 29

Factorial Design Using Covariate BAMIS as the  
Dependent Variable (Hypothesis 3)

	Low LPC Teacher Leadership Style	High LPC Teacher Leadership Style	Intermediate LPC Teacher Leadership Style	
Low LPC Principal Leadership Style and Favorable Situational Conditions	Cell "a" M=73.3846 s.d.=17.0173 N=13	Cell "b" M=75.1471 s.d.=12.8018 N=34	Cell "e" M=74.0455 s.d.=10.4311 N=22	M=74.4638 s.d.=12.8356 N=69
High LPC Principal Leadership Style and Moderate Situational Conditions	Cell "c" M=70.7500 s.d.=12.5797 N=4	Cell "d" M=78.1538 s.d.=15.6729 N=13	Cell "f" M=74.5909 s.d.=7.4684 N=22	M=75.3846 s.d.=11.2311 N=39
	M=72.765 s.d.=15.754 N=17	M=75.979 s.d.=13.546 N=47	M=74.318 s.d.=8.970 N=44	

Hypothesis 4. Fourth, fifth, and sixth grade pupil achievement gains in mathematics where teacher beliefs about mathematics and mathematics instruction were informal and teacher competence in mathematics was high will be significantly greater than the corresponding pupil achievement where these conditions were not satisfied.

A statistically significant main effect was found for the factor teacher beliefs about mathematics and mathematics instruction (BAMS/BAMIS). (See Table 30 for statistical findings of the 2x4 factorial design.) Further, an elevated mean gain score, as suggested in Hypothesis 4, was indicated where BAMS/BAMIS was informal/informal. (See Table 31 for parameters for each cell in the 2x4 factorial design.) The lack of support for a main effect for teacher competence/knowledge in mathematics suggests that the results of the Beckmann-Beal Competency Test for Enlightened Citizens did not partition the teacher population. This possibility, rather than an inadequacy of the instrument, is suggested because of the inability of the investigator to control the time used by the teachers to complete the competency instrument. Participation was voluntary, and teachers were requested to use only 30 minutes to complete the instrument. Teacher and principal comments, however, indicated the requested time allotment was not generally followed. Thus, the 73 teachers or 37 percent of the sample categorized as "high competency" may



not actually represent the category "high competency." Further, the extended completion time used by many teachers in the sample only resulted in a raw score sample mean of 39 which falls in the "not high competency" category. Nevertheless, sufficient statistical data is not present to accept Hypothesis 4 in its entirety. Hypothesis 4 must be rejected.

Table 30

Analysis of Variance Mean Gain Score by Teacher Competence  
and Teacher Attitude--Mathematics (2x4)

Sources of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance of F
Main Effects	868.917	4	217.229	2.999	0.020
COMP	112.901	1	112.901	1.599	0.214
BAMS/BAMIS	737.952	3	245.984	3.396	0.019
Two-Way Interaction					
COMP by BAMS/BAMIS	124.291	3	41.430	0.572	0.634
Residual	11880.037	164	72.439		
Total	12873.245	171	75.282		

Table 31

Factorial Design Using Mean Gain Score as the  
Dependent Variable (Hypothesis 4)

	Informal BAMS/ Informal BAMS	Formal BAMS/ Formal BAMS	Informal BAMS/ Formal BAMS	Formal BAMS/ Informal BAMS
High Teacher Competency	M=21.9385 s.d.=7.6918 N=46	M=23.4033 s.d.=12.4405 N=9	M=16.9145 s.d.=4.9065 N=11	M=16.0745 s.d.=7.8138 N=7
Not High Teacher Competency	M=20.3777 s.d.=8.4603 N=43	M=19.6496 s.d.=8.7930 N=25	M=13.3870 s.d.=7.1508 N=10	M=18.2400 s.d.=10.1252 N=21
	M=21.184 s.d.=8.064 N=89	M=20.357 s.d.=10.016 N=34	M=15.235 s.d.=6.189 N=21	M=17.699 s.d.=9.509 N=28
				M=20.7997 s.d.=8.2921 N=73
				M=19.0342 s.d.=8.9167 N=99

### Summary of Findings

There were four hypotheses postulated in this study. Hypotheses were based on Fiedler's Contingency Theory of Leadership with pupil achievement in mathematics as the dependent variable. Independent variables were principal leadership style, teacher leadership style, and situational conditions. Principals and teachers from 28 elementary schools containing grades four, five, and six were partitioned into groups predicated upon the needed manipulation of the independent variables for the analysis of each of the hypotheses. Additional analyses were made using selected teacher characteristics as covariates to pupil achievement. Those teacher characteristics were competency in mathematics (COMP), attitude toward mathematics (BAMS), and attitude toward mathematics instruction (BAMIS). The analyses were performed using the SPSS computer program for analysis of variance with unequal cell sizes.

All empirical hypotheses were statistically rejected even though significant findings were generated by the data analysis for each hypothesis.

Hypothesis 1 required that the interaction between the two factors, principal leadership style and situational conditions, be derived from both cells representing either the matched or the unmatched factors. This significant interaction was shown, but it was most likely emanating

from only one of the two required cells. Main effects were also present for both factors when only high and low LPC principal leadership styles were considered.

Hypothesis 2 analyzed the congruence of the two factors of principal leadership style and teacher leadership style. The data analyzed did not produce the required interaction. Instead, a main effect was found for teacher leadership style.

Hypothesis 3 examined only those principals with theoretically appropriately matched situational conditions and the presence or lack of congruence with teacher leadership styles. A significant interaction was found when all levels (high, low, and intermediate LPC) of teacher leadership style were analyzed. A significant main effect for teacher leadership style was also present. When only high and low LPC teacher leadership styles were analyzed, the significant main effect for teacher leadership style persisted. In contrast to Hypothesis 2, this main effect for teacher leadership style in Hypothesis 3 generated a significant total main effect.

Hypothesis 4 considered the three teacher attributes of attitude toward mathematics, attitude toward its instruction, and teacher competence/knowledge in mathematics. Comparisons were made with teacher competence in mathematics and all combinations of teacher attitude toward mathematics and teacher attitude toward the instruction of

mathematics. A significant main effect was found for both teacher attitude toward mathematics and its instruction.

Use of these teacher attributes as covariates in Hypothesis 1 eliminated the previously reported main effects. Significant findings for Hypothesis 2 were unaffected by the consideration of the covariates. The data reported in Hypothesis 3 was similarly unaffected.

Chapter 5 will discuss the implications of these findings.

## Chapter 5

### CONCLUSIONS AND RECOMMENDATIONS

The extraction of the sample used in this study from an ongoing educational setting should be viewed both as an asset and as a deficiency. The non-randomized nature of the sample, as well as the need for analysis processes to accommodate data with unequal cell sizes, represents the deficit side of the ledger. The immediate and relevant applicability of findings of this study are a result of the naturally occurring real-world facets of the study and represent the positive side of the ledger.

#### Conclusions

There appears to be a relationship between first- and second-level managers, teachers and principals, and the mathematics performance of fourth, fifth, and sixth grade students. The matching of principal leadership style and situational conditions hypothesized using Fiedler's Contingency Theory of Leadership Effectiveness as a theoretical rationale appears to be partially supported. This partial support is derived from the significant interaction between the principal, as second-level manager, and the situational conditions found in the data analysis for Hypothesis 1. Further, in the data analysis for Hypothesis 3, where only

those principals whose naturally occurring high or low LPC leadership style and the naturally occurring situational conditions matched as hypothesized by Fiedler were considered, the main effect for teacher leadership generated a significant total main effect. This finding suggests an even stronger teacher leadership relationship where the principal leadership and situational conditions were matched than was found in the data analysis for Hypothesis 2. Hypothesis 2 only considered the relationship of principal and teacher leadership style exclusive of situational conditions. This seemingly stronger main effect for teacher leadership style found in the data analysis for Hypothesis 3 could indicate that an appropriate matching of principal leadership style and situational conditions may allow the main effect of teacher leadership style to be magnified or, as Fiedler suggested, second-level managers may have an additional effect over and above that solicited by the first-level manager.

Significant findings from the data analyses for Hypotheses 2, 3, and 4 support the contention that teacher-related constructs such as teacher leadership style and attitude about the content and instruction in the content strongly relate to student achievement in mathematics. In addition, when the teacher attributes (COMP, BAMS, and BAMIS) were included as covariates in the data analysis for Hypothesis 1, the main effects were eliminated and only



the significant interaction remained between the factors of principal leadership style and situational conditions. The remaining significant interaction suggests that it is appropriate to consider the impact of some selected attributes of the first-level manager when considering the relationship of the leadership style of the second-level manager and the situational conditions. Further, it might well be that the inability of the investigator to control the measurement of the related teacher attributes such as "high competency" and "not high competency" could have reduced the discernible impact of another important attribute. The significant main effect for teacher attitude toward mathematics and its instruction when included as covariates, however, did not eliminate the significant findings of main effect or total main effects for teacher leadership style in the data analyses of Hypotheses 2 and 3. The persistence of the significant findings may suggest that these constructs are mutually exclusive since a teacher-related construct, teacher leadership style, was one of the factors in the data analyses for Hypotheses 2 and 3. It should be noted that the inability of the investigator to control properly the measurement of the other teacher attribute, COMP, might have eliminated its influence in the analysis. Even with the extended completion time used by many teachers, the mean raw score of the teacher sample fell in the "not high competency" category. Thus, a situation noted by earlier

investigators might still be present; that is, elementary school teacher competency in mathematics is so low that it is not adequate to influence appreciably student learning in mathematics or to dichotomize a teacher sample. If this is the situation, then a more closely controlled determination of the teacher attribute, COMP, might have had no effect in this study.

#### Implications for Future Investigations

The accountability scheme within which this study was initiated appears to be partially supported by the findings. It does appear that first- and second-level managers do influence the production of the work group, and that this is applicable in an educational setting involving principal, teacher, and student in the achievement of mathematics in grades four, five, and six. Nevertheless, the theoretical rationale upon which this investigation was predicated does not address a portion of the naturally occurring principal and teacher population, that is, those identified as intermediate LPC leadership style. Any extension in this study to include intermediate LPC leadership style was not fruitful. Since the era of budget constraints is still present, educational accountability, in the format presently espoused by legislative and lay expectations demanding more production for allocated resources, remains a part of the educational scene. An extension to include

all facets of leadership style, therefore, should be considered.

Further, the restrictions of this study to particular grade levels, content discipline, and demography of the sample population suggest obvious extensions for other investigators. It would also be advisable to determine an appropriately representative, randomized, controlled experiment to replicate the present study, with such a study remaining in the real work setting however difficult it might be. In addition, the inclusion of other teacher constructs and better control of the presently studied constructs would be appropriate.

#### Implications for Practice

Even though this study has numerous restrictions, and its findings address, at best, only a part of the principal and teacher population, this study suggests that leadership styles and situational conditions should be a consideration in forming rational administrative transfer policies. Currently, many school systems either have no policy or have a blanket policy directing that all principals be moved after a specified number of years in a given school. A similar blanket approach is generally applied to required in-service training for principals. The limited findings of this study would suggest that some analysis be made concerning the leadership style of the principal and

the level of the situational conditions prior to initiating such training.

APPENDIX A

Samples of Least Preferred Co-worker Index,  
Scale of Group Atmosphere, and Measure  
of Position Power Questionnaire

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These consist of pages:

P. 119-122

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P. 140-143

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APPENDIX B

Sample of Job Task Structure Rating Form

## RATING FORM: JOB TASK STRUCTURE

- I. Please rate according to the instructions in the following sections those jobs which are listed on the last page.
- II. You will note that there are four dimensions on which each job is to be rated. Each dimension is described on a separate sheet. Please rate all jobs on a given dimension before going to the next dimension. In other words, jobs are to be rated on each dimension independently of the way they are rated on other dimensions.
- III. (A) In order to help you in your rating, you will note that there is a graphic scale (ranging from 1 to 11) for each dimension with job titles arranged so as to cover most of the points on the scale. These are called "anchor jobs."  
(B) All anchor jobs, with the exception of two, have been evaluated by a panel of judges, and general agreement has been reached that the jobs belong where they are shown on the scale. These jobs were selected from among one hundred because of the high interjudge agreement.  
(C) A short description of each job on the scale is included on the same page. This is the same description that the judges used in rating the jobs.
- IV. When rating the selected jobs in your system, please keep the description of the anchor jobs in mind and rate your jobs in relation to these anchor jobs.
- V. Note that in many cases there are different anchor jobs as job dimensions change.
- VI. (A) In order to simplify your rating work, note the listing on the last page of your system's jobs to be rated. (Note that each job on this sheet is lettered and that will be the job letter.) Then it is suggested that you familiarize yourself with the dimension you are going to rate and the anchor job descriptions.  
(B) After doing this, place the letter corresponding to the job you are rating above the anchor job which most nearly corresponds to it for the dimension you are rating.  
(C) After you have done this for each job, check to see that you have placed them where you think they



## Rating Form (continued)

belong. This may mean you will rearrange some of your earlier placements. After you are satisfied that you have rated the jobs the way you want them in relation to each other and in relation to the anchor jobs, do the same thing for the next dimension. Please do not refer to job ratings on earlier dimensions when rating on later dimensions, however.

- VIII. Do not worry if you have not covered every number on the scale. It may be that you are dealing with a narrow range of jobs. Also, you will note that there are parts of some of the scales which have no anchor jobs, because none were found to fall consistently on those parts of the scale. If you believe some of your jobs should lie at these points, it is all right to place them there. Please make sure, however, you have placed your jobs above one of the eleven points on the scale and not in between these points.

## Dimension 1

Goal clarity. This is the degree to which the requirements of a job (the tasks or duties which typically make up the job) are clearly stated or known to people performing the job.

Read the job descriptions for Dimension 1. Then think of yourself as the person assigned the job and ask yourself how clear what you are to do is to you. Do not include how you are to do the job. That is another dimension.

To rank this dimension, assume that the lower the scale number, the lower the goal clarity (the less clear the goals of the job).

- |     |       |                             |
|-----|-------|-----------------------------|
| 1   | I.    | Idle millionaire            |
| 2   | II.   | Hobo                        |
| 3   |       |                             |
| 4   |       |                             |
| 5   | III.  | Train director              |
|     | IV.   | Private detective           |
|     | V.    | Receiving stores supervisor |
| 6   | VI.   | Educational director        |
| 7   | VII.  | Notary public               |
| 8   | VIII. | Canvas cover repair foreman |
| 9   | IX.   | Bench carpenter             |
| 10  | X.    | Chili maker                 |
| 11. | XI.   | Axle assembler              |

Place the letters of jobs corresponding in structure to the anchor jobs shown on the scale directly above those anchor jobs. If there is no anchor job above the number on the scale, you can still place your job there if desired.

## Job Descriptions for Dimension 1

- I. Idle millionaire.
- II. Hobo. Note: Since no job evaluated by the judges was found to extend beyond 5 on this dimension, these two "jobs" have been added in an effort to broaden the scale. It may well be that some of your jobs approach these two on this dimension. You may supply your own descriptions for these two jobs.
- III. Train director. Directs switching of railroad traffic entering or leaving yards to regulate movements of trains in conformity with traffic schedules and safety regulations. Signals switching directions to towerman by manipulating controls from central control room.
- IV. Private detective. Performs private police work to protect property by detecting thievery, shoplifting, or dishonesty among employees or patrons of a business establishment or other private organization.
- V. Receiving and stores supervisor. Supervises workers engaged in receiving and storing production materials in an industrial establishment. Note: While the above three are different jobs, they were given the same rating on this dimension.
- VI. Educational director. Plans, organizes and administers training programs designed to promote efficiency through instruction of new employees in firm's policies, systems and routines. Instructs foreman in vocational training methods.
- VII. Notary public. Administers oaths or affirmations where required, issues summonses for witnesses in cases before courts or other persons authorized to examine witnesses. Takes affidavits on request.
- VIII. Canvas cover repair foreman. Supervises a group of workers who repair tents, awnings, and canvas covers used to protect various objects, such as motors and instruments.
- IX. Bench carpenter (woodworking). Works at a bench in an industrial firm and fits and assembles prefabricated wooden sections; or cuts, shapes, fits and assembles wooden sections according to blueprints

## Job Descriptions for Dimension 1 (continued)

and sketches, performing general carpentry duties, such as sawing, planing, jointing, fitting, and nailing.

- X. Chili maker. Cooks specified amounts of ground meat, chili, spices, chopped onions, garlic, and beef tallow in a steam-jacketed kettle to make chili and ladles from kettle into cans. All ingredients weighed out by chili maker or according to his formula.
  
- XI. Axle assembler (auto manufacturing). Secures front- or rear-axle subassemblies to chassis springs on final assembly line. Bolts subassembly in place using wrenches and power-driven nut-tightening tools.

## Dimension 2

Goal-path multiplicity. This is the degree to which the problems encountered in the job can be solved by a variety of procedures (number of different paths to the goal--number of alternatives in performing the job--number of different ways the problems typically encountered in the job can be solved).

Read the job descriptions for Dimension 2. Then think of yourself as the person assigned the job, and remembering that you have already evaluated the job in terms of what is expected, now shift and think of how you are to do the job. How many ways are there to accomplish the goal? To what extent is planning necessary to decide how to do the job?

To rank this dimension, assume that the lower the scale number, the lower the goal-path multiplicity (the less paths there are to the goal).

- |    |       |                                 |
|----|-------|---------------------------------|
| 1  | I.    | Date puller                     |
| 2  | II.   | Off-line assembler              |
| 3  | III.  | Billing clerk                   |
| 4  | IV.   | Form builder                    |
| 5  | V.    | Drafting clerk                  |
| 6  | VI.   | Receiving and stores supervisor |
| 7  | VII.  | Dance hall inspector            |
|    | VIII. | Chief clerk                     |
| 8  | IX.   | Buyer                           |
| 9  | X.    | Broadcast director              |
| 10 | XI.   | Research engineer               |
| 11 |       |                                 |

Place letters of jobs corresponding in structure to anchor jobs shown on the scale directly above anchor jobs. If there are no anchor jobs above the number of the scale, you can still place your job there if desired.

## Job Descriptions for Dimension 2

- I. Date puller. Cuts open dates, removes the stones, and cuts the dates into pieces for use in making candy.
- II. Off-line assembler (auto manufacturing). Assembles units, such as windshields and lights, which are later placed on the automobile chassis as it passes over the assembly line. Uses screwdriver, power-driven nut tightener, and other hand tools.
- III. Billing clerk. Prepares statements, bills, and invoices, by hand or on a typewriter, to be sent to customers, showing an itemized account of the amount they owe. Obtains information from purchase orders, sales and charge slips or other records. Addresses envelopes and inserts bills preparatory to mailing. Checks billings with accounts receivable ledger.
- IV. Form builder (aircraft and auto manufacturing). Builds forms, fixtures, jigs, or templates of wood or metal for use as guides or standards by other workers in mass production of cars or planes. Studies blueprint of part for which fixture is to be built and lays out, cuts, and assembles component pieces of wood or metal. Checks and measures finished assembly against blueprint.
- V. Drafting clerk. Draws and letters organization charts, schedules, and graphs. Uses simple drafting instruments such as ruling pen, lettering pen, and straightedge to produce neat, legible charts and graphs.
- VI. Receiving and stores supervisor. See job description for Dimension 1.
- VII. Dance hall inspector. A member of the police force who inspects all dance halls for licenses and for conduct of patrons. Enforces regulations concerning such places and reports on the manner in which each is operated.
- VIII. Chief clerk. Coordinates the clerical work of an establishment, directing performance of such services as the keeping of personnel and time records, standardizing operating procedures for clerical work, and purchasing and keeping inventories of clerical supplies and equipment. Directs work of several

## Job Descriptions for Dimension 2 (continued)

subordinate office managers. Note: While the above two jobs are different, they were given the same rating on this dimension.

- IX. Buyer (retail or wholesale trade). Purchases merchandise within budgetary limitations in sufficient quantity and with sufficient appeal to sell rapidly. Assigns selling price to merchandise and initiates procedures such as price reductions to promote the sale of surplus or slow-moving items.
- X. Broadcast director. Supervises broadcasting of specific radio programs. Formulates general policies to be followed in preparing and broadcasting programs. Keeps expenditures for producing programs within budgetary limits and creates and develops program ideas.
- XI. Research engineer. Conducts engineering research concerned with processing a particular kind of commodity with a view to improving present products and discovering new products or to improving and discovering new machinery for production purposes. Examines literature on subject. Plans and executes experimental work to check theories advanced. Consults with other engineers to get their ideas. Prepares report of findings.

## Dimension 3

Decision verifiability. This is the degree to which the "correctness" of the solutions or decisions typically encountered in a job can generally be demonstrated by appeal to authority or authoritative source (e.g., the census of 1960), by logical procedures (e.g., mathematical demonstration), or by feedback (e.g., examination of consequences of decision, as in action tasks).

Read the job descriptions for Dimension 3. Then think of yourself as the person assigned the job and ask yourself to what extent it is possible for you or others evaluating your work to know whether the job has been done "correctly" or not. A time sequence is implied here. For some jobs it is never possible to know the correctness of the decision. For other jobs it is possible to know but only after a long period of time, say, one year or more. For others it is possible to know immediately or within a one-year period.

To rank this dimension, assume that the lower the scale number, the lower the decision verifiability (the less ways there are to verify job decisions).

- |    |                                   |
|----|-----------------------------------|
| 1  |                                   |
| 2  | I. Social welfare research worker |
| 3  |                                   |
| 4  | II. Design engineer               |
| 5  | III. Service director             |
| 6  | IV. Buyer                         |
| 7  | V. Cameraman                      |
| 8  | VI. Account analyst               |
| 9  | VII. Cabinet assembler            |
|    | VIII. File clerk                  |
| 10 | IX. Off-line assembler            |
| 11 | X. Nut and bolt sorter            |

Place letters of jobs corresponding in structure to anchor jobs shown on the scale directly above anchor jobs. If there is no anchor job above the number on the scale, you can still place your job there if desired.



## Job Descriptions for Dimension 3

- I. Social welfare research worker. Performs research to facilitate investigation and alleviation of social problems. Gathers facts by reference to selected literature and by consultation. Analyzes data, employing statistical computations and correlates information. Evaluates social projects or disposition of cases in light of findings. Estimates future needs for services and presents facts significant to formulation of future plans.
- II. Design engineer. Creates designs for machinery or equipment. Draws up construction details and determines production methods and standards of performance. Investigates practicability of designs in relation to limitations of manufacturing equipment and gives advice on construction, manufacture, materials, and processes. Experiments with existing machinery to improve design.
- III. Service director (retail trade). Supervises all operating and nonselling services of a large store, such as delivery, wrapping, storage, stock keeping, receiving, and alterations. Responsible for care of building and upkeep of equipment, such as elevators.
- IV. Buyer (retail or wholesale trade). See job description for Dimension 2.
- V. Cameraman (motion picture). Photographs anybody or anything of which motion pictures may be required with a motion-picture camera. Specializes in shots from unusual angles and dangerous heights or positions.
- VI. Account analyst (banking). Determines and prepares charges to be made against commercial accounts for various services performed by the bank. Prepares reports on status and value of individual accounts for bank officials.
- VII. Cabinet assembler (furniture). Assembles by hand the parts of the radio cabinet that have been cut and dressed in the machine department, fastening the joints together with glue or braces at the points of union, and holding them together with clamps.

## Job Descriptions for Dimension 3 (continued)

- VIII. File clerk. Keeps correspondence, cards, invoices, receipts, and other records arranged systematically according to subject matter in file cabinets or drawers. Reads information on incoming material and sorts and places it in proper position in filing cabinet. Locates and removes material from cabinet when requested. Note: The above two jobs are different, but they were given the same rating on this dimension.
- IX. Off-line assembler (auto manufacturing). See job description for Dimension 2.
- X. Nut and bolt sorter. Sorts nuts and bolts by hand according to size, length, and diameter. Discards defective pieces.

## Dimension 4

Solution specificity. This is the degree to which there is generally more than one "correct solution" involved in tasks which typically make up a job. Some tasks, e.g., arithmetic problems, have only one solution that is acceptable; others have two or more, e.g., a sorting task where items to be sorted have several dimensions; and still others have an almost infinite number of possible solutions, each of which may be equally as good as others. For example, consider human relations problems or many problems managers must make decisions about.

Read the job descriptions for Dimension 4. Then think of yourself as the person who must decide whether tasks typically falling within a given job have been performed correctly or not. Ask yourself how difficult it would be to decide the relative correctness of the task solution of two people who have been assigned a given task as a part of their job and have come up with quite different answers.

Where there are a number of solutions which might be equally acceptable, you are dealing with a job low in solution specificity.

To rank this dimension, assume that the lower the scale number, the lower the solution specificity (the more correct solutions there are).

- |    |       |                                |
|----|-------|--------------------------------|
| 1  | I.    | Social welfare research worker |
| 2  | II.   | Research engineer              |
| 3  | III.  | Dancer                         |
| 4  | IV.   | Broadcast news analyst         |
| 5  | V.    | Service manager                |
| 6  | VI.   | Warehouse manager              |
| 7  | VII.  | Cane cutter                    |
| 8  | VIII. | Electrical assembler           |
| 9  | IX.   | Candy-cutting machine girl     |
| 10 | X.    | Dairy maid                     |
| 11 | XI.   | Barrel drainer                 |

Place letters of jobs corresponding in structure to anchor jobs shown on the scale directly above anchor jobs.

## Job Descriptions for Dimension 4

- I. Social welfare research worker. See job description for Dimension 3.
- II. Research engineer. See job description for Dimension 2.
- III. Dancer. Performs dances alone, with a partner, or in a group.
- IV. Broadcast news analyst. Analyzes and interprets news from various sources. Prepares copy and broadcasts material over radio station or network.
- V. Service manager. Supervises activities of an institution that renders service to the public, such as a business-service, repair-service or personal-service establishment.
- VI. Warehouse manager. Manages one or more commercial or industrial warehouses to maintain stocks of material. Directs through intermediate supervisors checking of incoming and outgoing shipments. Keeps stock records and does other clerical tasks. Directs handling and disposition of materials through foremen and establishes and enforces operations procedures according to work requirements.
- VII. Cane Cutter. Cuts sugarcane in the fields during harvest season using a broad-bladed knife. Pulls off side leaves of several cane stalks with hook at end of knife and cuts the leaves from stalk with knife blade. Cuts through stalk at base of ripe section and places cut stalks in piles.
- VIII. Electrical assembler (refrigeration equipment). Installs electrical equipment in refrigerator display cases working from blueprints. Cuts pockets and bores holes in wooden framing of case with electric or hand tools to install wiring and light receptacles. Attaches wires to fixtures and fixtures to receptacles, using hand tools, and tests circuits of completed case for errors in wiring or hookup.
- IX. Candy-cutting machine girl. Takes cut candies from cutting machine by hand and arranges them on metal trays ready for wrappers and packers. Picks out imperfect pieces of candy and drops them into a

## Job Descriptions for Dimension 4 (continued)

container. When conveyors are used, arranges pieces on conveyor belt as they come from the cutting knives.

- X. Dairy maid. Performs lighter types of work on a dairy farm. Milks cows. Separates cream by hand in pans or by machine with a cream separator. Churns butter with a hand churn.
- XI. Barrel drainer. Empties water from barrel that has been inspected or weighed by rolling barrel onto a stand and pulling bung from hole by hand.

LISTING OF JOBS

- A - Dietician
- B - Custodian
- C - Librarian
- D - Teacher
- E - Guidance Counselor
- F - Elementary School Assistant Principal
- G - Secondary School Assistant Principal (APA)
- H - Secondary School Assistant Principal (API)
- I - Subject Area Coordinator
- J - Elementary School Principal
- K - Junior High Principal
- L - Senior High Principal

APPENDIX C

Samples of Beliefs About Mathematics Scale  
and Beliefs About Mathematics  
Instruction Scale

APPENDIX D

The 48 Competencies and the Questions Which  
Test Them (Beckmann-Beal Mathematical  
Competencies Test for Enlightened  
Citizens, Form A)



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## Abstract

### PUPIL PRODUCTIVITY IN ELEMENTARY SCHOOL MATHEMATICS AS RELATED TO PRINCIPAL AND TEACHER LEADERSHIP STYLE

Beverly Roane Forster, Ed.D.

The College of William and Mary in Virginia, May 1983

Chairman: Professor Robert Maidment

The purpose of this study was to investigate: (1) the relationship between the leadership style of an elementary school principal, as second-level manager, and the mathematics achievement of the students, and (2) the relationship between the degree of leadership style congruence of the elementary principal, as second-level manager, and the teacher, as first-level manager, and the mathematics achievement of students. Fiedler's Contingency Theory of Leadership Effectiveness provided the conceptual framework for the study.

Measurements were recorded for a sample population of 28 principals, 245 teachers, and 5373 students of grades four, five, and six drawn from an urban district in southeastern Virginia with a student population of approximately 35,000. Principal measurements were recorded for the Least Preferred Co-worker Index (LPC), Scale of Group Atmosphere (GA), Measure of Position Power Questionnaire (PPQ), and a Job Task Structure Rating Form. Teacher measurements were recorded for LPC, GA, PPQ, Beliefs About Mathematics Scale, Beliefs About Mathematics Instruction Scale, and the Beckmann-Beal Mathematical Competencies Test for Enlightened Citizens. Student measurements were recorded for pre- and post-testing of the Norfolk Public Schools Mathematics Monitor Tests.

Four hypotheses were tested for statistically significant ( $p \leq 0.05$ ) findings: (1) pupil gains in mathematics would be greater where principal leadership style and situation favorableness were matched, (2) pupil gains in mathematics would be greater where principal leadership style and teacher leadership style were congruent, (3) pupil gains in mathematics would be greater where principal leadership style and situation favorableness were matched and where principal and teacher leadership style were congruent, and (4) pupil gains in mathematics would be greater where teacher beliefs about mathematics and its instruction were informal and teacher competence in mathematics was high.

An analysis of variance for unequal cell sizes resulted in the rejection of each of the hypotheses. Significant findings, however, were found using student achievement as the dependent variable for the interaction between principal leadership style and situational conditions, for teacher leadership style, and for teacher attitude toward mathematics and its instruction.

It was concluded that there appeared to be a relationship between first- and second-level managers, teachers and principals, and the mathematics performance of fourth, fifth, and sixth grade students. The matching of principal leadership style and situational conditions as postulated by Fiedler appeared to be partially supported. Further, certain teacher-related constructs did strongly relate to student achievement in mathematics.

Future investigators should consider an extension of this study to other grade levels, content disciplines, types of student populations, and all facets of leadership style. Practitioners should consider leadership style and situational conditions in formulating administrative transfer policies and in initiating principal in-service training.