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An application of computer technology to educational administration.

Robert Theodroe Linstone
University of Massachusetts Amherst

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AN APPLICATION
OF
COMPUTER TECHNOLOGY
TO
EDUCATIONAL ADMINISTRATION

A Proposal
for
A Dissertation
Presented to
the Faculty of the Graduate School of Education
University of Massachusetts

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

Robert T. Linstone
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Without these men and women, and my understanding family and close friends, this task would never have been completed and probably never begun.

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APPLICATION
OF
COMPUTER TECHNOLOGY
TO
EDUCATIONAL ADMINISTRATION

A Dissertation

By

Robert T. Linstone

Approved as to style and content by:

Ray Budde
(Chairman of Committee)

(Head of Department)

W. E. Griffiths
(Member)

E. Paul Anderson, Jr.
(Member)

Ovid F. Parody
(Member)

September 1969
(Month) (Year)

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CHAPTER I

BACKGROUND OF THE PROBLEM

The need for quality educational leadership has never been more critical. The school administrator has been faced in the past with the myriad problems of steadily increasing school budgets, inadequate tax revenues, shortage of trained personnel and lack of adequate housing for expanding school populations.

These problems still exist, but the administrator's situation is being alleviated or worsened because he doesn't understand, by the appearance of electronic devices, computers, which will record and process educational data through the use of punched cards or magnetic tape.

The scope of the information available as a result of the ability of the computer to be programmed for statistical analysis of data is of considerable assistance at a time when the size and complexity of school administration is reaching crisis proportions.

Following World War II, electronic data processing (EDP) began to revolutionize the entire field of accounting in business, industry and government. Education also began to apply EDP to its accounting procedures but the lack of available financial resources made it difficult for educators to compete with other facets of the economy for the hardware and trained personnel needed.

Today, school districts are increasingly using EDP singly or in regional or national assocations, as its value to education has become more apparent and methods to reduce its impact on the budget are being explored.

Much of the EDP employed by individual districts is done in conjunction with banks or other businesses that already have computer access and statistical analysis available. Schools buy this time and service as needed, using the technology the vendor offers. Bare[1] estimates that some 22% of the nation's schools are involved in some form of EDP in conjunction with a non-school enterprise. Associations that are educational in nature offer similar services, such as NEEDS (New England Educational Data System) associated with Harvard University, and organizations such as General Learning, Inc., representing private business enterprises offering EDP services.

School administrators have not yet used the computer in many really sophisticated applications to administrative

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[1] C. E. Bare, "Automated Data Processing in Education," Education Forum, 1966, (30:442)

purposes. Until recently graded reporting,attendance accounting and test scoring and analysis have been among the most frequent administrative uses of EDP.

The New England School Development Council[2] feels that in addition to increased use in the areas of educational research and administrative function, the computer is an important instructional device.

The focus of the use of computers for instructional purposes is Computer Assisted Instruction (CAI), a computer system built to perform at the level of instruction desired. CAI programs have been initiated principally in the East Palo Alto, California school system, by Stanford University.

Wherever CAI is being used, computerized education is augmenting traditionally textbook oriented instruction.[3]

Although teachers consider computers a threat to traditional teaching situations, Dr. Patrick Suppes[4] suggests a clear relationship between the introduction of

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[2] "Challenge and Change, NESDEC's Job," New England School Development Council, (Cambridge, Massachusetts: Spring, 1968).

[3] "Computer to 'Teach' at 15 City Schools in February," The New York Times, Wednesday, June 21, 1967.

[4] Patrick Suppes, "Computer-based Instruction," Electronic Age, Summer, 1967.

books and the introduction of computers as instructional devices. When the textbook was introduced it was regarded with suspicion and was generally considered too expensive, and as a threat to the role of the teacher.

In recent years the scheduling of classes and the varied tasks closely associated with it have increasingly become the province of the computer and are considered by some to be the most important reasons for schools to begin EDP.[5] With the application of computer techniques the system provides class lists, teacher schedules, simulation of anticipated master schedules and enrollment projections.

The evolution of EDP in education can be seen from the relatively simple application to accounting procedures when educators first considered the computer, to some EDP goals for administrators today.

> "Since 1955 three major stages in the application of computer technology to education have been evident. The installation of the university computing center for the solution of mathematical and scientific problems came first. The second stage was the use of electronic data processing systems in accounting, record-keeping, and logistical control activities; this amounts to the automation of information and the data processing systems. The third stage, now in operation with on-line teletypes and cathode-ray tubes (CRT) display equipment for supporting educators and learners in a wide range of intellectual processes. It is this third

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[5] Don D. Bushnell, and D. W. Allen, (ed.) The Computer in American Education, Anderson, G.E., Educational Data Processing in Local School Districts,(New York: John Wiley and Sons, 1967), Chap. 17, p. 211.

generation application that spells a revolution in American education primarily because the development of time-shared systems promises to have a major impact on instructional and administrative processes.[5]

With the advent of a sophisticated time-shared computer usage, it is increasingly important for the administrator to be able to interpret the data collected accurately. In most school districts six of its operations supply data with which the administration should be in clear communication. These six divisions are:

1. Curriculum
2. Instruction
3. Planning and research
4. Personnel
5. Business
6. Publication and information

In addition to the need for the administration to be in communication with the divisions, the subdivisions must be in communication with each other. Diagramatically it presents a confusing communication pattern. (figure 1)

It is not surprising when McCarty states:

"Administrators who are the advisors of Boards of

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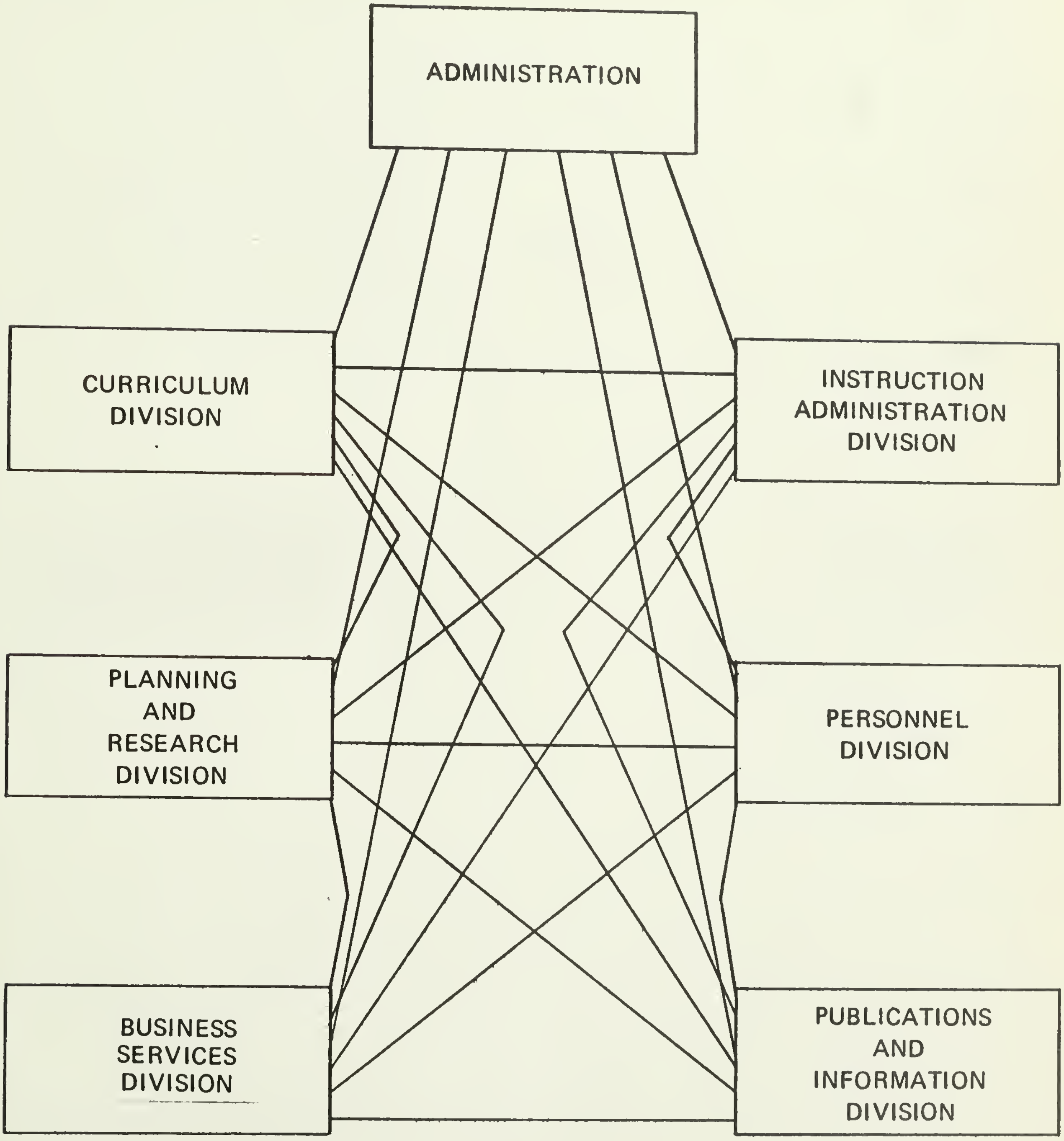
[6] Don D. Bushnell, Application of Computer Technology of the Improvement of Learning, a report prepared for the National Commission on Automation, Technology, and Economic Progress, (Washington, D.C.: February, 1966).

FIGURE 1
TYPICAL

SCHOOL COMMUNICATION PATTERN



education often disregard or misinterpret data collected. Political expediency and/or emotional reactions frequently play an important role in the decision-making process."[7]

What is being implemented in school districts throughout the nation is a system which will shorten and simplify the lines of communication. (Figure 2). This will enable documents to be circulated much more efficiently, decisions made known to each of the divisions involved and decentralization of budget and operational responsibilities. This data can be stored in memory by EDP and then made available for analysis by the administration.

The introduction of effective EDP may serve to make the goals of educators specifiable and well understood by the profession by statistically analyzing the data already available and presenting it to them in a concise manner to be acted upon.

Another aspect of effective EDP is to assist the administrator in answering thought-provoking questions. The decision itself must come from the administrator, but he may rely on EDP for direction. Thus, to avail himself of this electronic assistance, the administrator must be able

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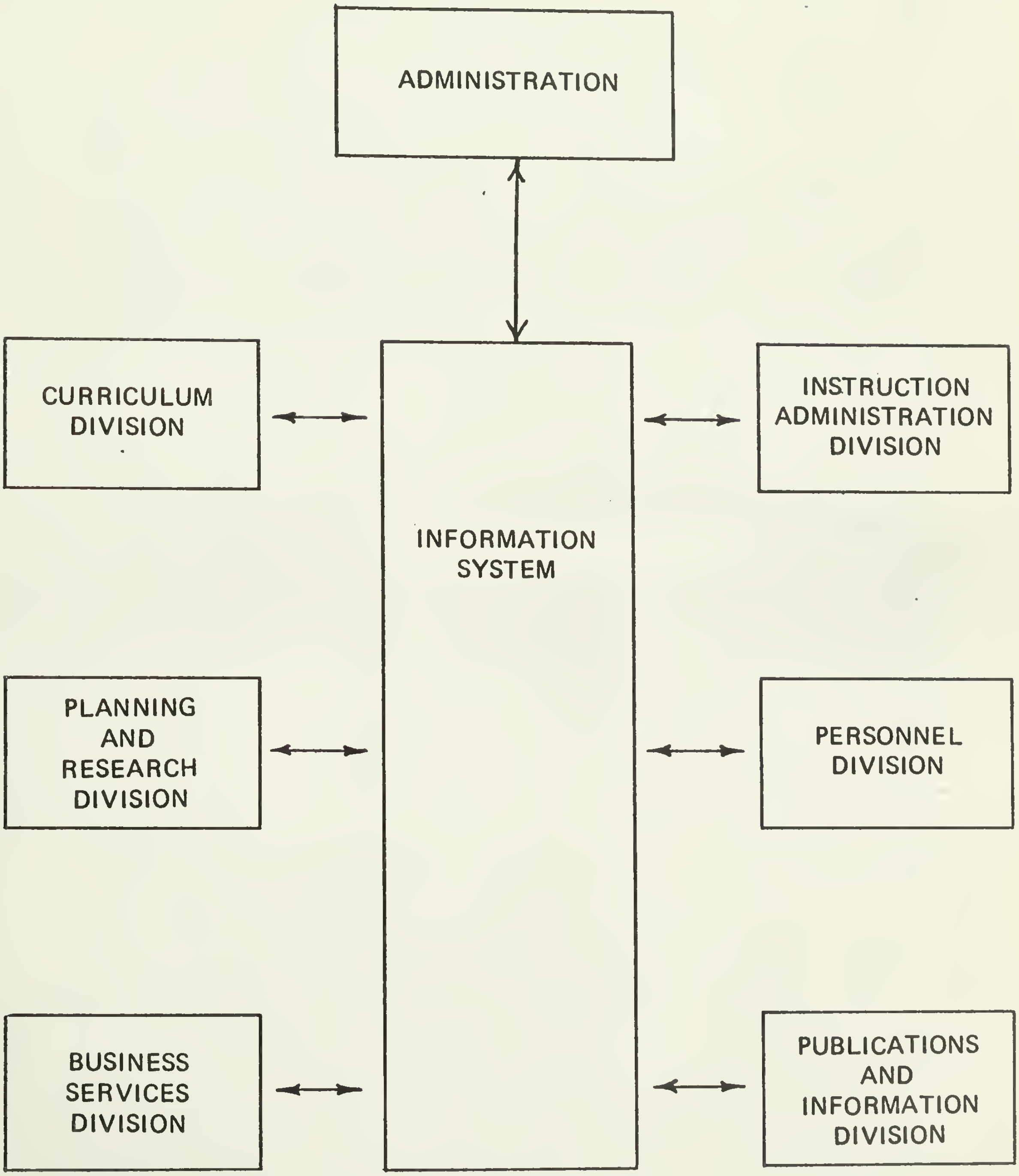
[7] Donald J. McCarty, Myths and Reality in School Board Research, paper prepared for presentation at Annual Conference of American Educational Research Association, (Chicago: February, 1966), p. 14.

FIGURE 2

ELECTRONIC DATA PROCESSING

PATTERN



to "communicate" with the machine through the technical personnel. Familiarizing himself with applications of the computer will enable him to keep the educational decisions in his own hands, with the machine and the technical personnel as a supplement to his work, rather than the control.

> "It is generally true that the less direct experience people have had with any machine the more they tend toward both fear and unreasonable admiration. Laymen have heard about computers but have had absolutely no direct experience with them."[8]

> "Too many educators panic or close their minds when they hear the word'computer.' They (the educators) have learned enough about them so that they realize the computer can help us all work on complex problems without loss of control."[9]

The educator's aim is not to replace the computer technician nor to become an expert programmer in order to translate information into data the machine can utilize. An educational leader hopes to learn to understand and utilize the computer for what it is; a machine that offers

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[8] Charles Slack, The Truth About Computerized Instruction, (Saddle Brook, New Jersey: Educational News Service, Oct. 15, 1967.)

[9] Douglas R. Dopp, "The Rank Order Instrument," Connecticut State Department of Education, Office of Departmental Planning, (Hartford, Connecticut: 1969).

tremendous opportunities and latitude for improvement in education.

STATEMENT OF THE PROBLEM

Up to this point few articles by users of computers for educational decision-making are in the literature; the theoreticians are in command, and they attest to the lack of educators that are trained in computer assisted statistical analysis.[10]

School administrators are faced with a formidable task to interpret and to use even the most routine information in connection with their decision-making responsibilities.

Vast amounts of data exist in the cumulative records, files, ledgers, accounts, registers, census reports, studies, professional books and publications of every school district.

The computer can provide a rapid information system as the foundation for the continuing program of upgrading the administration of the schools. The computer can be

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[10] Ralph W. Gerard, Computers in Education, (New York: McGraw-Hill Book Company, 1967), p. 221.

use as a basis for decision-making:

1. To research curriculum development and use it.
2. To provide information for all research projects in these areas.
3. To control growth of administrative and clerical costs in order to provide a greater share of funds for instructional use.
4. To meet both internal and external informational needs of the district.
5. To produce in a meaningful and timely manner all operating and comparative information needed.
6. To facilitate ordering and availability of supplies and equipment.
7. To provide complete and current budgetary information to administration and operating divisions.
8. To reduce clerical load of teachers, and thereby make more instruction time available for teachers.[11]

This study involves the acclimatization of the administrator to the previously unfamiliar field of computer technology and the steps in his acquiring the ability to interpret the statistical analyses to be used as a guide to an educational decision.

The study also deals with the efforts of one traditionally trained administrator to evaluate two curriculum

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[11] A. G. Oettinger, and Sema Marks, "Educational Technology: New Myths and Old Realities, "Harvard Educational Review, Vol. 38, No. 4, Fall, 1968, p. 705.

tracts by using a computer to analyze and compare data available on children in two learning situations.

IMPORTANCE OF THE STUDY

The impact of the computer upon the administrator cannot be overemphasized in its importance to the reforms that Anderson feels must come to education if we are to capitalize upon what the computer promises in the Computer in American Education.[12]

Anderson suggests that the administrator must understand the computer and its function in order to be able to utilize this tool for analysis of data.

The educational administrator is increasingly able to be compared to his counterpart in industry and business in three major areas, namely:

1. Availability of funds to train young administrators in aspects of computer-based decision-making.
2. Exposure to computer hardware and software upon which the corporate structure places great emphasis.
3. Adequate facilities available in the college or university level directly involving educational administrators in computer-based decision-making exercises.

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[12] D. D. Bushnell, and D. W. Allen, (eds), The Computer in American Education, Anderson, Robert Hl, "Sustaining individualized Instruction Through Flexible Administration," (New York: John Wiley and Sons, 1967), Chap. 3, p. 26.

The administrators of public agencies and corporate bureaucracies have recognized the need to determine the practicality of their decisions by the use of the computer. As evidenced in the background of this study, this trend is beginning to be felt in the education field.[13] The school boards are attemtping to apply to their administrators the same criteria that they feel appropriate for the business organizations with which they deal--namely, is the investment worth the results obtained?

OBJECTIVES

The objectives of this study are to:

1. Provide one traditionally trained administrator with the knowledge and experiences which will enable him to understand basic statistical techniques with the assistance of the computer.

2. Provide an opportunity for the administrator to demonstrate this competence using a practical problem involving a nongraded school and a graded school.

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[13] David J. Worth, "Simulation in the Preparation of Educational Administrators," New England School Development Council, (Cambridge: Spring, 1967).

CHAPTER II

REVIEW OF THE LITERATURE

This chapter is divided into two sections. The first is The Computer in Education; the second is devoted to a review of the literature relating to graded and nongraded organization.

THE COMPUTER IN EDUCATION

The literature relating to the computer and educational administration is not, at the time of this writing, voluminous. Probably the most inclusive book to date is the work edited by Bushnell and Allen.[1]

Five themes constitute the core of the work:

1. Individualized instruction and social goals.
2. Computers in instruction and research.
3. Teaching the computer sciences.
4. Information processing for educational systems.
5. Operations analysis.

The first part of the book deals with the rapid change in the social setting for education and in the tasks the

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[1] D. D. Bushnell, and Dwight W. Allen, (eds), The Computer in American Education, (New York: John Wiley and Sons, 1967).

public will demand of the computer in education.

The application of computers to the instructional tasks of individualizing education is viewed from the perspective of the failure of education to cope with this challenge in the past.

The computer based systems approach is outlined in detail with considerable emphasis on the complex problems associated with the building of this method.

The cry for reform in organization and administration is heard. The point is made that in order to capitalize on the computer such reform is a must.

Educators might heed the admonitions of yesteryear, "The world is full of apparatus--but the teacher, in times past, has been too slothful, or too dogmatical, even to point to it."[2] This student might add, and probably too overworked to find time to learn the process.

Miles[3] points to the computer as one of the reasons that the diffusion rates of educational innovation are significantly different in the 1960's as compared to the 1930's.

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[2] American Institute of Instructors, August, 1830, p. 344.

[3] Matthew B. Miles, (ed), Innovation in Education, (New York: Columbia University Press, 1964), p. 7.

His premise is that practically no significant educational innovations were products of the thirty's, while the computer has been the instsrument that is offering the opportunity to advance and extend knowledge during the sixties. Using techniques of computer technology, it can be ascertained what implications statistical analysis has for the administrator.

The use of the computer as the instrument for curriculum change is viewed as vital in making curricular offerings flexible, comprehensive and sequential. Without educational data processing as the means whereby exhaustive data can be digested and evaluated, significant curricular revision becomes an almost impossible task.

Bushnell and Allen[4] caution that the use of the computer should be structured upon an ethical base which will result in ultimate benefit to mankind.

This caution is voiced by Kong[5] who states that education should become a continuous self-actualization process. The computer can expose the child to the total environment,

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[4] Ibid.

[5] S. L. Kong, "Education in the Cybernetic Age: A Model," Phi Delta Kappan; (No. 2): October, 1967, pp.71-74.

so that the student may respond to any of it at will. This means that the school, as presently structured, and many of our existing theories of learning, will become obsolete. The technology and the economic feasibility of computer use, Kong claims, are within our reach. What is lacking is the comprehension of what is emerging, and how to use this knowledge beneficially.

Anderson[6] states that research indicates considerably less effort has gone into maximum utilization of present developments than has been expended upon the development of new systems, new products and new applications. He feels that the specialist in data processing should be the technician that executes the command of the educator. The educator is a man highly trained in his field, and he should not leave educational decision-making up to individuals who are unskilled in the educational field.

The caution Anderson underlines is that the "Systems Approach" should have the data processing system serving the educational system and not the reverse.

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[6] G. Ernest Anderson, Jr., "These are the Trends to Watch in Data Processing," Nation's Schools, Vol. 78, No.4, October, 1966, pp. 101-104.

The primary function of the computer is the management of information.[7] To perform this function, the computer programmer must know precisely what he is to do. To direct the programmer is the role of the dducational administrator. It follows that the educator must have a bsic understanding of the process of programming and the interpretation of the analysis of the information.

Anderson[8] states that administrators do not have computer experience in their backgrounds, as their training predates the computer. He argues that a good data processing organization that receives poor administrative support may not be an effecive organization. Data processing is something these administrators must make decisions about, however, and its use can affect their decision=making processes in almost all areas.

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[7] G. Ernest Anderson, Jr., "No One is Sure Where New Data Are Taking Education," Nation's Schools, Vol. 77, No.2, February, 1966, p. 90.

[8] G. Ernest Anderson, Jr., "People Shortages Hamper EDP Programs in Schools," Nation's Schools, Vol. 79, No. 2, February, 1967, p. 98.

Allen and DeLay[9] point out three areas which leave the busywork to the computers:

1. Free teachers from the scheduling burden yet increase their opportunities to make vital educational scheduling decisions.
2. Keep track automatically of a large number of facts about the availability of teachers, students and classrooms and combinations of these factors that far exceed the capacities of the most astute educator.
3. Satisfy a higher percentage of student scheduling requirements by accomodating more student and teacher preferences.

The computer has reached the stage of development at which the technical considerations have improved dramatically. Technicians refer to sophisticated computers as "third generation." Abt[10] outlines an efficient model of computer application to EDP.

The great majority of those who will have the responsibility of utilizing the computer are not "third generation" educators in experience or knowledgeability with the

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[9] Dwight W. Allen, and Donald DeLay, "Computer Gives Schools Scheduling Freedom", Nation's Schools, Vol. 77, No. 3, March, 1966, p. 125.

[10] C. C. Abt, Design for an Education System Cost-Effectiveness Model, Paper read at the Meeting on Systems Analysis and Education Planning of the Organization for Economic Cooperation and Development, (Paris: January 25-27, 1967).

machine.[11]

Many school superintendents don't think they want to take the time to understand data processing and what it might mean for their schools.[12] The attitude on the part of many is that someone else will be hired to program the machine, which is, of course, true, but what shall the administrator ask them to program?

One of the tasks that the computer can effectively perform, is to serve the classroom in upgrading instruction.[13] The programmer does not know the needs in this complicated category, and should not program without sound educational guidance. If decisions are to be made using the computer for instant information, then the educator must know what can be done with the results of this retrievable information. The need is to change from a record-keeping system to a record-using system.[14]

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[11] H. A. Simon, The Shape of Automation: For Men and Management, (New York: Harper and Row, 1965).

[12] Dwight W. Allen, and Donald DeLay, Loc. Cit.

[13] Donald R. McDonald, "What Can Computers Do For You?" School Management, September, 1966, p. 134.

[14] Ibid., p. 135.

The computer should not be thought of as capable of making quantitative judgments rather than qualitative judgments, for significant research tends to refute this view. Essays have been graded by computer which produced judgments that were practically indistinguishable from those of high school English teachers.[15] This has been only the beginning of such computer measurement. The important thing is that these experiments have proven the feasibility of this qualitative computer judgment.

Computer technology may be applied in a qualitative manner as well in situations in which the educator wishes to seek implication for change or more complete and detailed descriptions from the analysis of the data. This study utilizes graded versus nongraded schools to demonstrate this point.

GRADED AND NONGRADED ORGANIZATION

At this time the literature does not comfortably demonstrate significant differences between the graded and the nongraded structures. Goodlad and Anderson[16] state cate-

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[15] Ellis B. Page, "The Imminence of Grading Essays by Computer," Phi Delta Kappan, January, 1966, p. 241.

[16] John I. Goodlad, and Robert H. Anderson, The Nongraded Elementary School, (New York: Harcourt, Brace and Company, 1963 rev.), p. 59.

gorically that the values underlying the nongraded plan cannot be equated with values inherent in grading. They do, however, list characteristics that are initially built into each program and thus differentiate one from the other.

Graded Structure	Nongraded Structure
A year of progress in subject matter seen as roughtly comparable with a child's year in school.	A year of school life may mean much more or much less than a year of progress in subject matter.
Each successive year of progress seen as comparable to each past year and each year to come.	Progress seen as irregular; a child may progress much more rapidly in one year and quite slowly in another.
A child's progress seen as unified; advancing in rather regular fashion in all areas of development; probably working close to grade level in most subject areas.	A child's progress seen as not unified; he spurts ahead in one area of progress and lags behind in others; may be working at three or four levels in as many subjects.
Specific bodies of content seen as appropriate for successive grade levels and so labeled; subject matter packaged grade-by-grade.	Bodies of content seen as appropriate over a wide span of years; learnings viewed vertically or longitudinally rather than horizontally.
Adequacy of progress determined by comparing child's attainment to coverage deemed appropriate to the grade.	Adequacy of progress determined by comparing child's attainment to his ability and both to long-term view of ultimate accomplishment desired.

Inadequate progress made up by repeating the work of a given grade; grade failure the ultimate penalty for slow progress.	Slow progress provided for by permitting longer time to do given blocks of work; no repetitions but recognition of basic differences in learning rate.
Rapid progress provided for through enrichment; encouragement of horizontal expansion rather than vertical advancement in work, attempt to avoid moving to domain of teacher above.	Rapid progress provided for both vertically and horizontally; bright children encouraged to move ahead regardless of the grade level or the work; no fear of encroaching on work of next teacher.
Rather inflexible grade-to-grade movement of pupils, usually at end of year.	Flexible pupil movement; pupil may shift to another class at almost any time; some trend toward controlling shifts on a quarter or semester basis.

Bockrath,[17] in 1957, in her doctoral dissertation, compared the 1953 fourth grade reading scores when the schools were graded with the 1956 fourth grade reading scores, at which time the school had been nongraded for three years. The results indicated a median increase of five months for the fourth grade students in 1956 over the reading performance of fourth grade pupils in

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[17] Sister M. Bernarda Bockrath, C.P.P.S., *An Evaluation of the Ungraded Primary as an Organizational Device for Improving Learning in Saint Louis Archiocesan Schools*, Doctoral Dissertation, (St. Louis University, 1957).

1953. The results also indicated a higher percentage of children in 1956 were over-achieving and a lower percentage were under-achieving as compared to 1953. A questionnaire issued to primary teachers indicated that the program was favored by them over the graded plan.

The reasons given by these primary teachers indicated that the individualization of the reading program in the nongraded approach was the deciding factor. The flexibility of curricular offerings and frequent evaluation were also cited as positive features of the program.

However, in 1961[18] the achievement of one hundred twenty-two intermediate grade students who had been taught in a nongraded primary program were compared with one hundred twenty-two students who had been taught in a graded primary program. Of the two matched groups, the students from the graded primary classrooms were found to be significantly superior in achievement in all areas, vocabulary, reading comprehension, language, work study skills and arithmetic, to the students from the nongraded primary classrooms.

The two studies cited, while similar in design, utilized schools that were designated as "nongraded" but differed

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[18] Robert F. Carbone, "A Comparison of Graded and Nongraded Elementary Schools," Elementary School Journal, November, 1961, p. 86.

in curriculum, location, size, teacher and community expectations, and were using different interpretations of what nongraded schools should be.

These variables might well account for the opposite findings of the two studies.

It would appear that among leaders of the nongraded movement, as well, definitions vary greatly. Goodlad and Anderson[19] view nongradedness primarily as an organizational change. A 1966[20] work, however, demands both a new organizational pattern and a corresponding revolution in curriculum. Indeed, in 1967[21] Dufay stated that nongrading is a philosophy of education that affects all facets of education including pupil organization, curriculum materials, school atmosphere, etc., not just an administrative device to group children.

There is a very definite movement away from the early

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[19] John I. Goodlad, and Robert H. Anderson, The Nongraded Elementary School, (New York: Harcourt, Brace and Company, 1963 rev.).

[20] Frank B. Brown, The Appropriate Placement School: A Sophisticated Nongraded Curriculum, (West Nyack, New York: Parker Publishing Co.), p. 3.

[21] Frank R. Dufay, "When Nongrading Fails," School Management, (11:110-13), February, 1967.

version of the nongraded school as primarily an organizational change, to an almost total revision in approach and in philosophy of how to make this change effective.

The administrator is faced with a perplexing problem when considering the ungraded organization, as there are as many studies which show positive findings as there are those that snow negative findings.[22]

In addition to mixed reports within the literature, he is asked to make critical judgments with archaic information-handling techniques. If the nongraded flexible school organizational pattern is adopted, he finds a more complex administrative structure.[23] With this increase in mobility of children, flexibility of curricular offerings and frequent evaluation of students in academic, social and emotional areas, the organizational distance becomes longer between the decision-maker and the actions and events for which he is responsible. The use of the computer with edu-

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[22] John I. Goodlad, Address to the Department of Elementary School Principals, National Education Association Annual Convention, (Detroit, Michigan: 1962).

[23] David W. Beggs, III, and Edward G. Buffie, Nongraded Schools in Action, Bold New Venture, (Indiana University Press, 1967).

cationak data processing should shorten the organizational distance,[24] not only in the more complex nongraded school, but in the graded school as well.

It would appear that additional research is needed to obtain the dimensions of each specific situation in order to provide substance for critical educational decisions.

The growing mass of data that can be useful to educators will eventually lead to a systems approach to instruction. Great ideas exist and are ready to be poured into the schools.[25]

Information is being made available to administrators for the comparison and evaluation of progsrams of all types. This "Second Industrial Revolution"[26] of the role of EDP (Educational Data Processing) in such evaluation points to more factual and comprehensive implementation of significant

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[24] Ned Chapin, An Introduction to Automatic Computers, 2nd, Edition, (Princeton, N.J.: D. Van Nostrand Co., 1963).

[25] Conference on Educational Systems for the Seventies, untitled pamphlet, United States Office of Education, (New Orleans: March, 1968).

[26] Edmund C. Berkely, and Lawrence Wainwright, Computers: Their Operation and Applications, (New York: Reinhold Publishing Corp., 1956).

programs for future adoption.[27] Much research is yet to be done before comprehensive innovative programs can be validly evaluated. We can expect that efficient and comprehensive use of educational data will result in:

1. A more comprehensive in-depth view of student and school data.
2. A comparison of two sets of educational data, yours vs. general, employing statistical techniques, difficult to apply without the use of the computer.
3. An awareness by the administrator of what the results of this data analysis tell him.
4. Decisions made by the administrator based on this comprehensive information.

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[27] Joseph W. Halliwell, "A Comparison of Pupil Achievement in Graded and Nongraded Primary Classrooms," The Journal of Experimental Education, Vol. XXXII, Fall, 1963.

CHAPTER III

DESIGN AND METHODOLOGY

The first objective of this study will be to document an educational administrator's experiences in retooling his skills in order to utilize current educational data processing techniques, using specific, selected, basic statistical methods.

As a demonstration of these techniques a problem involving two schools, one graded and one nongraded, will be explored.

The design and methodology of this chapter will be divided into four categories:

1. Description of schools and school districts.
2. Instruments employed.
3. Assumptions.
4. Statistical procedures utilizing the computer.

DESCRIPTION OF SCHOOLS AND SCHOOL DISTRICTS

The experimental school will be a nongraded school as identified by Saylor and Alexander[1] in Avon, Connecticut.

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[1] J. Galen Saylor, and William N. Alexander, Curriculum Planning for Modern Schools, (New York: Holt, Rinehart and Winston, Inc., 1967)

The stated philosophy of the experimental school[2] is as follows:

> The Nongraded program is designed to recognize the individual differences of children. The plan provides a learning situation to meet those individual differences. In the nongraded program rigid grade lines are eliminated, enabling the child to acquire academic and social skills at his own rate of speed. The philosophy of the nongraded program is based upon the following principles:
>
> 1. Each child is an individual with his own rate and pattern of growth and should be evaluated as such.
> 2. Children should be taught at the level at which they are, regardless of age or length of time that has been spent in school.
> 3. A feeling of success is essential for normal growth.
> 4. The child progresses from level to level with a feeling of achievement because levels are paced to him.
> 5. A pupil whose achievement approximates his abilities has made satisfactory progress.
> 6. A child should not be forced to "mark time" until some of his peers reach his level of academic achievement or maturity; not be required to learn material beyond his range of ability.
> 7. No child should be forced to repeat material that serves no useful purpose.

Avon, Connecticut schools with their nongraded classes

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[2] "Educational Progress," Avon Elementary Schools, (Canton, Connecticut, Bouchard Press, 1963).

will be considered the experimental sample. For purposes of contrast, another sample from a graded school organization, from a Connecticut public school district, will be referred to as the G public school system.

All students in each school who are in their fifth year of elementary schooling will be used.

SAMPLE VARIABILITY

As 1960 was the last comprehensive study made of the two communities, this author feels it should beused as the basis for comparison.

1. Population in Avon was 5,237 persons,[3] and in community G, 10,138 persons.[4]
    a. Avon's population breakdown is as follows: 2,606 males and 2,667 females. Of this, 5,225 are white, 15 negro, and 3 classified as other.[5]
    b. Community G's population breakdown is as follows: 5,144 males and4,994 females. Of this

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[3] "Town of Avon," Avon Development Commission, March, 1966, p. 2.

[4] "Community Monographs," Community Development Commission, (Hartford, Connecticut), p.2.

[5] U. S. Department of Commerce, Bureau of Census, (Washington, D.C.), United States Census of Population, 1960: General Population Characteristics, 1960.

10,045 are white, 88 negro, and 5 classified as other.

It can be seen that G's population is approximately twice that of Avon. The ratio of males and females in both communities is about one to one. Less than 1% of each community is negro and/or other.

2. Median family income for Avon was $8,364, and community G, $8,132.[7]

A study made by the Connecticut Development Commission in 1965 in the area of retail sales would tend to substantiate the continued existence of this ratio. Avon's per capita retail sales at this time was $1,879, and community G;s per capita retail sales were $1,052, well below that of Avon.[8] This was due to a lack of a shopping center in community G, while a shopping parkade was located in Avon.

3. Avon's government uses the Selectmen-Town Meeting

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[6] Ibid.

[7] "Connecticut Market Data Book," Connecticut Development Commission, (Hartford, Connecticut, 1964), p. 58.

[8] "Connecticut Estimated Retail Sales and Per Capita Retail Sales," (mimeographed), (Hartford, Connecticut, 1965), p.3.

approach,[9] which is the same as that of community G.[10]

4. Pupil population in 1960 is again indicative of the two-to-one relationship shown in the total population.
    a. The pupil population was 1,239 pupils in Avon.[11]
    b. The pupil population was 2,609 pupils in community G.[12]
5. The school systems have developed according to their relative populations.
    a. There are three elementary schools and one junior-senior high school in Avon.[13]
    b. There are six elementary schools and one junior high school and one senior high school in community G.[14]

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[9] Op. Cit., "Town of Avon," p. 2.

[10] Op Cit., "Community Monographs," p. 3.

[11] "Age Grade Report," Superintendent of Schools, (Avon, Connecticut: September, 1960) , p.2.

[12] "Enrollment Data," Superintendent of Schools, (Avon, Connecticut: September, 1960) p.1.

[13] Op. Cit., "Town of Avon"

[14] Op. Cit., "Community Monographs."

The above variables are significant in that the relationship of the communities to each other can be ascertained. In general, one can say that although a two-to-one ratio exists in the area of population, the median family income tends to equalize the economic factor. Also, the percentage of whites to non-whites points to a similar social growth. Therefore it may be concluded that there is no superficial reason other than size to consider the communities different.

INSTRUMENTS EMPLOYED

Data was gathered from all children in each school who are in their fifth year of schooling. Those children who are unavailable for testing, or whose cumulative folders contain little or no pertinent information will be dropped from the study.

Information to be obtained from each student will be:

Name (assigned code number)
Age
Sex
Race
Years in present school
Father's occupation

In addition to obtaining the data from the children's cumulative folders all students in both schools will be tested with the Metropolitan Readiness Test[15] during the early part of their post-kindergarten year.

Six tests are included in the Metropolitan Readiness Tests, as follows:

Test 1: Word meaning, a 16-item picture vocabulary test. The pupil selects from three pictures the one that illustrates the word the examiner names.

Test 2: Listening, a 16-item test of ability to comprehend phrases and sentences instead of individual words. The pupil selects from three pictures the one which portrays a situation or event the examiner describes briefly.

Test 3: Matching, a 14-item test of visual perception involving the recognition of similarities. The pupil marks one of three pictures which matches a given picture.

Test 4: Alphabet , a 16-item test of ability to recognize lower-case letters of the alphabet. The pupil chooses a letter named from among four alternatives.

Test 5: Numbers, a 26-item test of number knowledge.

Test 6: Copying, a 14-item test which measures a combination of visual perception and motor control.

The total score will be converted into a percentile rank and compared to a representative group of beginning first grade pupils in overall readiness.

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[15] Gertrude H. Hildreth, and Nellie L. Griffiths, "Metropolitan Readiness Tests, Form R," (New York: Harcourt, Brace and World, Inc., 1949).

The students in both schools will also have been tested by their classroom teachers in the fifth year of schooling on one of three group Intelligence Quotient tests. No attempt will be made to equate these I.Q. tests.[16, 17, 18] The scores were used interchangeably for analysis.

The students in both schools will be administered the Science Research Associates Achievement Series[19] which was nationally standardized in the fall of 1963 for grades 2-9.

The grades 4-9 Multilevel Edition was used. Grades 4-9 Multilevel Edition is designed for use by students from the end of fourth grade through the ninth grade. This edition combines three batteries of graduated difficulty into a single format. Each battery tests students in the areas

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[16] "Otis Quick-Scoring Mental Ability Test, Alpha Short Form," (New York: Harcourt, Brace and World, Inc.), (administered equivalent grade three).

[17] "California Short Form Test of Mental Maturity, Level II, S-Form," 1963, (administered quivalent grade five).

[18] "Lorge-Thorndyke Intelligence Test, Level II," (Boston, Mass.: Houghton Mifflin Company, 1962), (administered equivalent grade three, Level III administered equivalent grade five).

[19] "SRA Achievement Series," 1963 ed., (Chicago, Ill.: Science Research Associates).

of reading, arithmetic, language arts, science, social studies, and work-study skills.

In order to assess the creativity of students in each school the Torrance Tests of Creative Thinking[20] was administered by Dr. Jerry Lavitt.[21] Verbal and figural batteries will both be used. Scores for four areas of creativity will be obtained for each child. They are Total Originality, Total Elaboration, Total Fluency and Total Flexibility.

> Total Originality represents the subject's ability to produce ideas that are away from the obvious, commonplace, banal, or established.
>
> Total Elaboration reflects the subject's ability to develop, embroider, embellish, carry out, or otherwise elaborate ideas.
>
> Total Fluency reflects the test taker's ability to produce a large number of ideas with words.
>
> Total Flexibility represents a person's ability to produce a variety of kinds of ideas, to shift from one approach to another, or to use a variety of strategies.

In order to identify factors of personality and social adjustment the California Test of Personality[22] will be administered to all students by Dr. Jerry Lavitt.

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[20] "The Torrance Tests of Creative Thinking,' 1968 rev. (Princeton, N.J.: Personnel Press, Inc.).

[21] Jerry Lavitt, Ed.D., Director of Pupil Personnel Services, Avon, Conn., ((A Comparative Evaluation of the Peabody Picture Vocabulary Test as a Measure of Ability for Children of Different Reading Proficiency Levels, disseration, University of Oklahoma: July, 1967)).

[22] "California Test of Personality," 1953 ed., (Monterey, California: California Test Bureau).

The test (more properly called an inventory) is a teaching-learning or developmental instrument. Its purpose is to provide the data for aiding individuals to maintain or develop a normal balance between personal and social development. Individual reactions to items are obtained, not primarily for the usefulness of total or section scores, but to detect the areas and specific types of tentendies to think, feel, and act which reveal individual adjustments.

Data for the following categories will be obtained, as well as scores for Total Adjustment, Personal Adjustment, and Social Adjustment.

Self-Reliance: Can do things independently of others; is self-dependent; candirect -his own activities. The self-reliant person tends to be emotionally stable and responsible for his behavior.

Sense of Personal Worth: Feels he is well regarded by others; feels that others have faith in his future success; feels capable and reasonably attractive.

Sense of Personal Freedom: Believes he has a reasonable share in the determination of his conduct and the course of his life; feels free to choose his own friends;

feels relatively independent financially.

Feeling of Belonging: Enjoys the love of his family, the well wishes of good friends, and a cordial relationship with others. Tends to get along well with his teachers or employer, and his peers; feels proud of his home, school, and place of business.

Withdrawing Tendencies: Substitutes the joys of a fantasy world for actual successes in real life. Sensitive, lonely, and given to self-concern. Normal adjustment is characterized by reasonable freedom from these tendencies.

Nervous Symptoms: Suffers from one or more of a variety of physical symptoms, such as loss of appetite, frequent eyestrain, inability to sleep, and a tendency to be chronically tired. Such physical expressions often reflect emotional conflicts.

Social Standards: Understands the rights of others; appreciates the necessity of subordinating certain desires to the needs of the group. He knows right from wrong.

Social Skills: Shows a liking for people; inconveniences himself to be of assistance to others; diplomatic in dealing with friends and strangers. Subordinates his egoistic tendencies in favor of interest in the problems and activities of his associates.

Anti-Social Tendencies: Given to bullying, frequent quarreling, disobedience, and destructiveness of property. Gets his satisfaction in ways that are damaging and unfair to others.

Family Relations: Feels that he is loved and is well treated at home; has a sense of security and self-respect in connection with his family life. Implies neither too strict nor too lenient parental control.

School Relations: Feels that his teachers like him; enjoys being with other students; finds school work adapted to his level of interest and maturity. Believes he is making a contribution to the activities of the school.

Community Relations: Mingles happily with his neighbors; takes pride in community improvements; is tolerant in dealing with both strangers and foreigners. Respects laws and regulations pertaining to the general welfare.

These tests have been chosen on the basis of extensive use and evaluation by many sources through the years.[23]

ASSUMPTIONS

These five assumptions will be made:

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[23] Oscar Krisen Buros, (ed.), (Highland Park, New Jersey), "Sixth Mental Measurements Yearbook," Gryphon Press, 1965.

1. That the time between Kindergarten and equivalent grade five will be sufficiently long for this comparison.

2. That the approval and support of the Superintendents, Principals, and Teachers will insure satisfactory pupil cooperation. Each pupil will be informed:

    a. That he will be part of a research project being conducted by a member of the Graduate School of Education of the University of Massachusetts.

    b. That the results of this survey will be for research purposes <u>only</u>.

    c. That we will appreciate cooperation on his part. (Every effort will be made to provide a normal testing situation.)

    d. That any question that he may have will be answered by the examiner upon completion of the survey.

    e. That he will not place his name on the numbered survey materials. (His identification will be made by using his teacher's seating plan and matching this with numbered materials, and later matching this with other background data for correlation.)

3. That the students in each sample are representatives of the schools involved as all students in the class will be tested with the exceptions itemized in Chapter II.

4. That the data obtained relative to each student in each organizational pattern can be explored, using statistical methods available at the University of Massachusetts Computer Research Center.

5. That the testing will indicate cumulative effect of the entire school exposure.

STATISTICAL COMPUTER PROCEDURES

The computer will be programmed to provide a printout of coded data and eight statistical procedures:

Printout of data.

1. Analysis of data in order to determine missing variables.
2. Correlation matrices.
3. F-test, to test equality of variances of populations.
4. t-test of equality of means.
5. Chi square, to indicate relationship between variables.
6. Stepwise multiple regression.
7. Factor analysis of data.
8. Analysis of variance.

These statistical measures were selected as basic instruments to illustrate this users acquisition of reasonable familiarity with the analysis of the data. Dr. G. Ernest Anderson, a member of this dissertation committee, served as the consultant for their selection.

Chapter IV will present the sequence of events involved in the administrator's learning process, and the interpretation of the data analysis.

CHAPTER IV

FINDINGS AND INTERPRETATION OF DATA

In order to demonstrate the experience and knowledge acquired during the course of this study, a sequence of events leading to the treatment of the data comprises the first part of this chapter.

SEQUENCE OF EVENTS

The requirements for the doctoral degree at the University of Massachusetts include familiarization with two "tool" areas to be chosen from the fields of statistics, computer science or foreign language. In this instance, computer programming was one of the tools chosen, foreign language the other.

During the summer of 1968, a Computer Science course was undertaken and in July the Computer Programming examination passed.

The content of the course was divided into three general areas:

1. Description of computer function
2. Computer language
3. Simple programming

The computer (referred to as 'hardware') consists of five components functionally distinct:

1. Storage
2. Control
3. Logic and arithmetic
4. Input
5. Output

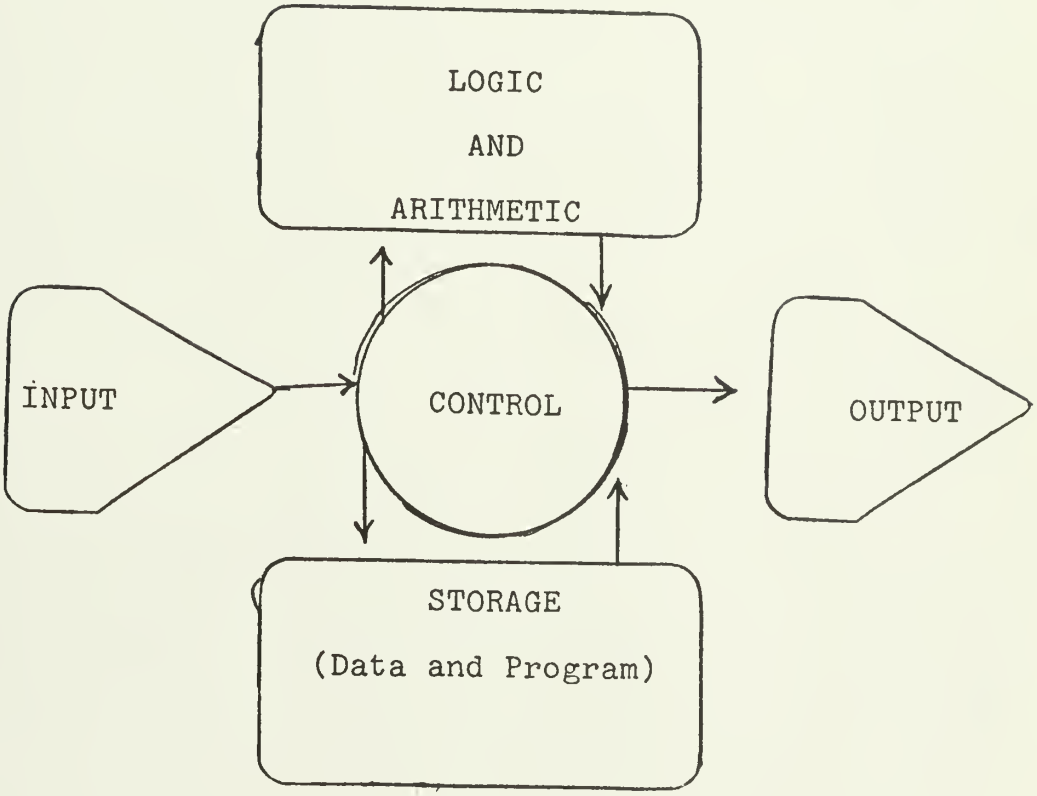
The storage component (referred to as "memory") may be thought of as an array of mailboxes, each with its own number or address. Each box holds a single piece of data, coded into a set of electromagnetic impulses. The storage segment usually contains all or a portion of both the program and the data to be processed. The control section is a collection of relay circuits and an electronic timer. The logic and arithmetic segment, usually called the central processing unit, (CPU) can transmit data from one part of storage to another and also set or reset relay switches of the control section while operating as a high speed adding machine with copying capabilities.

Input devices convert data from an external source into the storage segment. Output operates in a similar fashion, converting stored data to punched cards, cathode ray tubes, magnetic tape or print-out on paper. (Figure 3).

Reasonable mastery of the"language" is necessary

FIGURE 3

COMPUTER COMPONENTS



in order to communicate with the computer. FORTRAN (an acronym for "Formula Translation") is one of these language codes for a computer code systems. It is a set of numerical and alphabetical symbols which have assigned meaning for which the computer has been programmed. (Computer programs are referred to as "software").

Computer programs utilize this "language" by means of a set of commands in logical sequence that tell the machine what to do, e.g. add, compare, branch and print.

An administrator might ask these questions and a programmer must translate the logic of these jobs into an educational data processing (EDP) system.

In which month was the absentee rate highest?

In which schools?

What was the average duration of the absence?

What was the percentage of absence by sex?

How does this compare with last year, etc.?

The answers to these and similar questions would become almost immediately available rather than to be forced to wait the extended period that laborious hand computation would require.

The Computer Science course at the University of Massachusetts is not designed to be a comprehensive study of EDP, but rather is an introduction and overview of a complex technology practically unknown prior to 1946. Similarly, it is not to be considered a course of study the result of which is the training of a computer programmer. It does acquaint the student with the rudimentary techniques involved in this occupation.

During the fall of 1968, arrangements were made to audit a course in Operations Analysis for the purpose of obtaining a broader view of the systems approach in education. Basically, the systems concept is one of planned development. It relies heavily on computer technology to simulate and assess alternatives. It is heavily dependent on research evidence as a basis for policy decisions.

> "If the systems approach[1] in schools is to serve educational purposes, professionals in the field must assume the initiative in choosing objectives and providing the necessary strong leadership. The system must come from the best that scholars and technological experts can plan, they must be fully tested for validity by the most objective educational researchers, and those responsible must be accountable for the quality of learning produced. Systems approaches in education, in fact, should belong to proper educational agencies just as the military systems developments belong to the Department of Defense. The educational industries are needed and valued partners. They should expect a fair profit for their efforts just as teachers should receive fair reimbursement. Business and industry, however, should be contracting rather than controlling agencies. It is imperative that the materials produced be those wanted and needed by the teachers

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[1] Lindley J. Stiles, "The Systems Approach in Education," The Journal of Educational Research, Vol.60, No.5, inside cover, January, 1967.

who will use them, and that the systems belong to the schools themselves."

During the 1968-69 academic year a great many hours were spent at the University of Massachusetts Research Computer Center. On February 7, 1969, a Computing Research Grant for this thesis was approved by the Research Center Director.

OBTAINING AND INTERPRETING THE DATA

Educational Data Processing (EDP) is based upon the collection, treatment, storage and retrieval of data.

During September of 1968, student data collection was initiated.

From the outset of this endeavor, difficulties were encountered.

Throughout the period in which student data was collected, inaccuracy in the recording of information was frequently discovered when attempts to retrieve the data were made. When the inaccuraicies were discovered, and correct data could be obtained, the corrections were entered; in the event the correct data was unobtainable, the data was deleted from the study.

In some instances practically no information had been entered by the child's teachers. In seven cases, the entire school experience of five and one-half years should little or no attention to the recording of information such as I.Q., standardized testing results, health information or family background. These children were not included in the study.

It is worthy of note that in the cumulative folders of almost all children in both schools, pertinent data was frequently not recorded, although a great deal of extraneous "paper" was to be found. In the case of the thirty-three variables used in this study with the 203 children included, 356 responses were not recorded out of a possible 6,699. Information considered "standard" in the cumulative folders of children, i.e., age, father's occupation, etc., were omitted by clerks and/or teachers in 19.3% of the 203 cases and had to be obtained in a different manner. Items such as arithmetic papers without any identifiable signs, drawings of various types without notation as to reason for its preservation, permission slips with no name or signature, and a great many samplings with no date, class or teacher identification were found.

It would appear that this chore, considered by many teachers to be non-professional in nature, did not receive the attention it deserved in the schools involved.

Traditionally the teacher has been the vehicle by which information regarding students has been recorded and stored in some form of data storage device. Although among non-professional personnel in schools, secretarial and clerical employees, exhibited the greatest relative growth in numbers of any non-professional group,[2] the teacher is still the recorder of data in most schools.

A factor that was not anticipated in conducting this research was the need to recheck twice each batch of data recorded by the clerks for minor recording errors in the transmittal of data to cards for students in each school. This proved to be a time-consuming task that spanned a three-week time block in November, 1968. A great portion of this time was spent in verifying data.

During the course of this study several instances in which external pressure has changed procedures were experienced. In one instance, although permission was obtained to conduct the study in the schools, one parent felt that testing of any sort was an invasion of privacy

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[2] David H. Carlisle, "The Growth in the Number of Non-Teaching Personnel in California School Districts," The Journal of Educational Research, Vol. 62, No. 2, October, 1968.

and forced the withdrawal of his child's test data from the study by administrative directive.

Another instance of external pressure forcing procedural change was the rescheduling of a testing session on the protest of a parent who held religious convictions regarding the date the testing was scheduled to be held.

Educational decisions should remain within the province of educators, and is strongly endorsed by Almond[3] when he analyzes the development of political systems in developing areas. While in theory educational decisions make logical sense, a great deal of pressure from external sources often overrides the educator's judgment.

During the course of this study the human error was easily the greatest problem incurred. In the recording of information of a cumulative and developmental nature this was particularly apparent. This phenomenon merits mention as educators attach a great deal of importance to accurate record keeping and have devised rather sophisticated forms and procedures[4] to improve this task when it

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[3] Gabrial Almond, "The Developmental Approach to Political Systems," World Politics, Vol. 17, No. 2, January, 1965, p. 126.

[4] G. M. Blair, R. S. Jones, and R. H. Simpson, Educational Psychology, (New York: The MacMillan Co., 1969).

is to be done by hand. It would appear that computerized EDP would significantly reduce this margin of error.[5]

DATA INPUT

In order to achieve the second objective of this study, this student utilized two schools, one graded and one non-graded, compiled data of all children in the fifth year of school at those schools, and statistically analyzed the data by computer at the research computer center.

In all, 203 students were used in the study; one hundred seventeen in the experimental school and eighty-six in the control school. With the exception of several students who were dropped from the study due to lack of recorded information, these were all the available students in each school.

The information for the entire sampling of two hundred three students was key punched on computer data cards, one card per student. These cards are capable of holding 80 characters of data coded alphanumerically. In this study 73 spaces were used as follows:

Space 1 School

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[5] "Better Processing of Educational Data," <u>The American School Board Journal,</u> 143:40+ (September, 1961).

Spaces 2 - 4	Student's code number
Spaces 5 - 10	Date of birth
Space 11	Sex
Spaces 12 - 13	Metropolitan Total Readiness, Percentile Rank
Spaces 14 - 16	Intelligence Quotient, Otis Quick-Scoring
Space 17	Years in present school
Spaces 18 - 20	Father's occupation as coded - See appendix for explanation
Spaces 21 - 22	Years of education of father
Space 23	Race
Space 24 - 25	Blank
Spaces 26 - 27	Science Research Associates, Percentile Rank Grammatical Usage
Spaces 28 - 29	Blank
Spaces 30 - 31	Science Research Associates, Percentile Rank Arithmetic Reasoning
Spaces 32 - 33	Science Research Associates, Percentile Rank Arithmetic Concepts
Spaces 34 - 35	Science Research Associates, Percentile Rank Arithmetic Computation
Spaces 36 - 37	Science Research Associates, Percentile Rank Reading Comprehension
Spaces 38 - 39	Science Research Associates, Percentile Rank Reading Vocabulary
Spaces 40 - 41	Blank
Spaces 42 - 43	California Test of Personality, Percentile Rank, Self-Reliance

Spaces 44 - 45	California Test of Personality, Percentile Rank, Personal Worth
Spaces 46 - 47	California Test of Personality, Percentile Rank, Personal Freedom
Spaces 48 - 49	California Test of Personality, Percentile Rank, Sense of Belonging
Spaces 50 - 51	California Test of Personality, Percentile Rank, Feeling of Withdrawing
Spaces 52 - 53	California Test of Personality, Percentile Rank, Nervous Symptoms
Spaces 54 - 55	California Test of Personality Percentile Rank, Social Standards
Spaces 56 - 57	California Test of Personality, Percentile Rank, Social Skills
Spaces 58 - 59	California Test of Personality, Percentile Rank, Anti-social Tendencies
Spaces 60 - 61	California Test of Personality, Percentile Rank, Family Relations
Spaces 62 - 63	California Test of Personality, Percentile Rank, School Relations
Spaces 64 - 65	California Test of Personality, Percentile Rank, Community Relations
Spaces 66 - 67	California Test of Personality, Percentile Rank, Total Adjustment
Spaces 68 - 69	California Test of Personality, Percentile Rank, Personal Adjustment
Spaces 70 - 71	California Test of Personality, Percentile Rank, Social Adjustment
Spaces 72 - 73	Torrance Test of Creativity, Booklet A, Raw Score, Total Originality

Spaces 74 - 75	Torrance Test of Creativity, Booklet A, Raw Score, Total Elaboration
Spaces 76 - 77	Torrance Test of Creativity, Booklet A, Raw Score, Total Fluency
Spaces 78 - 79	Torrance Test of Creativity, Booklet A, Raw Score, Total Flexibility

In all cases when percentile rank is indicated, national norms are used.

A reproduction of the University of Massachusetts coding sheet with item entries may be found in the appendix as well as a data code interpretation.

ANALYSIS OF DATA FOR MISSING VARIABLES

A simple program was written to list the 32 variables by number, and to indicate which variables were missing from the data of the 203 cases. The program then counted the number of times that particular variable was missing from the data and printed out the sum for each variable. Table 1 is a reproduction of this print-out.

CORRELATION MATRICES

The statistical term correlation refers to a relationship between two variables. There is no clear-cut distinction between two kinds of scores as to which is the independent or predictor variable. Both variables are left com-

TABLE 1

ANALYSIS OF DATA FOR MISSING VARIABLES

Variable		Number Times Missing	
1	-	0	
2	-	0	
3	-	0	
4	-	1	
5	-	0	
6	-	6	
7	-	1	
8	-	3	
9	-	1	
10	-	2	
11	-	1	
12	-	2	
13	-	0	
14	-	13	
15	-	13	
16	-	14	
17	-	13	
18	-	15	
19	-	14	
20	-	14	
21	-	13	
22	-	15	
23	-	13	
24	-	13	
25	-	14	
26	-	13	
27	-	13	
28	-	13	
29	-	13	
30	-	13	
31	-	13	
32	-	13	
		272	Total number students with one or more variables missing.

completely free to take on any value for any observed individual. A sample of N individuals is obtained and each individual observed represents the occurrence of a joint X,Y event. The basic question is, can Y be predicted from X or X predicted from Y using a linear rule?,

A matrix is an array of mathematical elements that might be thought of as a rectangular series of mailboxes, each with its own number and location.

Table 2 is a reproduction of the print-out of the computer when programmed to determine statistically the correlations between the thirty-two variables used in this run within the control school.

The variables are located in two places, along the top of the page following the code word VAR from 1 to 10 in Table 2, 11 to 20 continuing Table 2, 21 to 30 in Table 2 continuing and 31 and 32 in continuance of Table 2. In each of these tables the variables are also listed in ascending order at the left margin of each page. Directly below the code word VAR is the letter M and below that, SD. The M stands for the Arithmetic Mean or simple arithmetic average. Above each column of correlations and parallel with the letter M the mean is given. In the case of variable 1 (sex), the mean is 1.594.

TABLE 2

CORRELATION MATRIX. CONTROL SCHOOL

CORRELATION MATRIX, CONTROL SCHOOL 3-13-69 N= ~~86~~ 69 PAGE 1

VAR	SEX 1	METRO 2 Readiness	3 IQ	Years 4 School	Fathers 5 occ.	YEARS 6 of Ed	Pct white 7 RACE	8 GRAM	9 ARITH Reasoning	10 Arith. Concepts
M	1.594	86.638	117.638	4.203	35.812	14.435 of Father	1.000	58.826	59.661	64.754
SD	0.491	16.864	11.464	1.440	23.374	2.882	0.000	28.943	32.019	27.062
1	1.000	-0.259	-0.240	-0.007	0.072	-0.111	0.000	-0.010	-0.385	-0.401
2	-0.259	1.000	0.579	0.057	0.045	0.145	0.000	0.347	0.387	0.434
3	-0.240	0.579	1.000	0.175	-0.060	0.088	0.000	0.284	0.484	0.451
4	-0.007	0.057	0.175	1.000	0.240	-0.056	0.000	0.022	-0.036	-0.067
5	0.072	0.045	-0.060	0.240	1.000	-0.300	0.000	0.211	0.006	0.024
6	-0.111	0.145	0.088	-0.056	-0.300	1.000	0.000	0.093	0.055	0.029
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	-0.010	0.347	0.284	0.022	0.211	0.093	0.000	1.000	0.573	0.547
9	-0.385	0.387	0.484	-0.036	0.006	0.055	0.000	0.573	1.000	0.851
10	-0.401	0.434	0.451	-0.067	0.024	0.029	0.000	0.547	0.851	1.000
11	-0.226	0.209	0.315	0.023	-0.060	0.027	0.000	0.397	0.514	0.489
12	-0.274	0.486	0.504	-0.022	0.024	0.190	0.000	0.672	0.607	0.650
13	-0.301	0.538	0.590	-0.064	0.048	0.226	0.000	0.637	0.635	0.687
14	0.097	0.058	0.132	0.013	0.179	-0.115	0.000	0.132	0.132	0.243
15	-0.035	0.010	0.113	0.075	-0.042	-0.021	0.000	-0.093	-0.137	-0.058
16	-0.039	0.051	0.131	0.165	0.015	0.053	0.000	-0.097	0.102	0.056
17	-0.064	0.031	0.047	0.092	-0.109	0.015	0.000	-0.018	0.018	0.025
18	-0.172	0.214	0.134	0.203	-0.003	0.134	0.000	-0.090	0.028	0.098
19	-0.006	0.146	0.175	0.062	-0.082	0.192	0.000	-0.011	0.001	0.129
20	0.194	0.032	0.106	-0.218	-0.204	-0.142	0.000	-0.057	-0.060	-0.017
21	0.165	0.024	0.048	0.092	0.016	-0.095	0.000	-0.035	-0.074	-0.102
22	0.047	0.087	-0.011	-0.054	-0.022	-0.051	0.000	-0.101	0.100	0.149
23	-0.102	0.088	0.096	-0.058	-0.031	-0.068	0.000	-0.144	-0.054	0.046
24	0.031	-0.050	-0.057	-0.027	-0.106	-0.009	0.000	-0.109	-0.063	-0.017
25	0.072	0.075	0.026	-0.044	-0.004	0.117	0.000	0.078	-0.042	0.011
26	0.045	0.092	0.120	0.008	-0.070	-0.003	0.000	-0.103	-0.030	0.066
27	-0.036	0.139	0.200	0.119	-0.051	0.065	0.000	-0.028	0.034	0.128
28	0.080	0.030	0.010	-0.114	-0.038	-0.009	0.000	-0.133	-0.098	-0.018
29	0.090	0.239	0.018	-0.045	0.194	0.072	0.000	0.220	-0.051	0.177
30	0.145	0.257	0.223	-0.118	-0.018	0.294	0.000	0.415	0.129	0.199
31	-0.001	0.180	-0.061	-0.093	0.180	0.045	0.000	0.062	-0.139	0.075
32	0.000	0.215	-0.063	-0.061	0.180	0.096	0.000	0.051	-0.173	0.036

.237 = 95% ⬭

.309 = 99% ▭

TABLE 2 - Continued

CORRELATION MATRIX, CONTROL SCHOOL 3-13-69 N= ~~86~~ 69 PAGE 2

VAR	Arith 11 Comp	Reading 12 Comp.	Reading 13 Vocab.	Self 14 Reliance	Personal 15 worth	Personal 16 Freedom	Feeling 17 Belonging	Withdrawing 18 Tendencies	Nervous 19 Symptoms	Social 20 Standards
M	27.304	65.043	58.580	57.580	65.884	47.710	48.826	55.884	46.290	38.391
SD	24.890	25.525	28.331	26.641	24.355	28.060	28.023	30.461	28.003	26.977
1	-0.226	-0.274	-0.301	0.097	-0.035	-0.039	-0.064	-0.172	-0.006	0.194
2	0.209	0.486	0.538	0.058	0.010	0.051	0.031	0.214	0.146	0.032
3	0.315	0.504	0.590	0.132	0.113	0.131	0.047	0.134	0.175	0.106
4	0.023	-0.022	-0.064	0.013	0.075	0.165	0.092	0.203	0.062	-0.218
5	-0.060	0.024	0.048	0.179	-0.042	0.015	-0.109	-0.003	-0.082	-0.204
6	0.027	0.190	0.226	-0.115	-0.021	0.053	0.015	0.134	0.192	-0.142
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.397	0.672	0.637	0.132	-0.093	-0.097	-0.018	-0.090	-0.011	-0.057
9	0.514	0.607	0.635	0.132	-0.137	0.102	0.018	0.028	0.001	-0.060
10	0.489	0.650	0.687	0.243	-0.058	0.056	0.025	0.098	0.129	-0.017
11	1.000	0.479	0.541	-0.050	0.005	-0.060	0.016	-0.021	0.135	-0.114
12	0.479	1.000	0.868	0.155	-0.017	0.006	-0.132	0.007	0.116	-0.130
13	0.541	0.868	1.000	0.130	-0.025	0.024	-0.045	-0.009	0.175	-0.099
14	-0.050	0.155	0.130	1.000	0.379	0.318	0.295	0.424	0.271	0.309
15	0.005	-0.017	-0.025	0.379	1.000	0.389	0.575	0.469	0.174	0.302
16	-0.060	0.006	0.024	0.318	0.389	1.000	0.471	0.546	0.252	0.235
17	0.016	-0.132	-0.045	0.295	0.575	0.471	1.000	0.430	0.311	0.412
18	-0.021	0.007	-0.009	0.424	0.469	0.546	0.430	1.000	0.528	0.179
19	0.135	0.116	0.175	0.271	0.174	0.252	0.311	0.528	1.000	0.194
20	-0.114	-0.130	-0.099	0.309	0.302	0.235	0.412	0.179	0.194	1.000
21	-0.107	-0.051	-0.080	0.174	0.396	0.274	0.472	0.149	0.098	0.446
22	-0.070	-0.077	-0.021	0.306	0.267	0.312	0.321	0.471	0.325	0.300
23	-0.140	-0.108	-0.047	0.292	0.395	0.295	0.560	0.484	0.346	0.490
24	-0.108	-0.214	-0.181	0.320	0.371	0.297	0.495	0.456	0.335	0.508
25	-0.164	0.066	0.014	0.312	0.313	0.379	0.378	0.262	0.341	0.470
26	-0.091	-0.065	-0.055	0.566	0.614	0.605	0.643	0.725	0.573	0.607
27	0.064	0.069	0.082	0.607	0.665	0.699	0.650	0.792	0.617	0.377
28	-0.221	-0.161	-0.146	0.412	0.439	0.377	0.550	0.510	0.416	0.622
29	0.073	0.295	0.342	0.116	-0.114	0.009	-0.146	-0.072	0.228	-0.086
30	0.030	0.298	0.388	0.169	0.113	-0.063	0.161	-0.065	0.081	0.026
31	0.057	0.150	0.173	0.008	-0.154	-0.197	-0.164	-0.133	0.034	-0.044
32	0.029	0.110	0.135	-0.007	-0.203	-0.228	-0.171	-0.117	0.075	-0.020

.237 = 95% ⬭

.309 = 99% ▭

TABLE 2 - Continued

CORRELATION MATRIX, CONTROL SCHOOL 3-13-69 N= ~~86~~ 69 PAGE 3

VAR	Social 21 Skills	AntiSchool 22 Tendencies	Family 23 Relations	School 24 Relations	Community 25 Relations	Total 26 Adjustment	Personal 27 Adjustment	Social 28 Adjustment	Total 29 Originality	Total 30 Elaboration
M	53.275	26.362	35.087	42.986	38.652	42.696	47.029	35.797	18.493	18.449
SD	29.559	28.016	27.649	26.343	24.010	22.472	24.218	23.657	9.153	8.053
1	0.155	0.047	-0.102	0.031	0.072	0.045	-0.036	0.080	0.090	0.145
2	0.024	0.067	0.088	-0.050	0.075	0.092	0.139	0.030	0.239	0.257
3	0.048	-0.011	0.096	-0.057	0.026	0.120	0.200	0.010	0.018	0.223
4	0.092	-0.054	-0.058	-0.027	-0.044	0.008	0.119	-0.114	-0.045	-0.118
5	0.016	-0.022	-0.031	-0.106	-0.004	-0.070	-0.051	-0.038	0.194	-0.018
6	-0.095	-0.051	-0.068	-0.009	0.117	-0.003	0.065	-0.009	0.072	0.294
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	-0.035	-0.101	-0.144	-0.109	0.078	-0.103	-0.028	-0.133	0.220	0.415
9	-0.074	0.100	-0.054	-0.063	-0.042	-0.030	0.034	-0.098	-0.051	0.129
10	-0.102	0.149	0.046	-0.017	0.011	0.066	0.128	-0.018	0.177	0.199
11	-0.107	-0.070	-0.140	-0.108	-0.164	-0.091	0.064	-0.221	0.073	0.030
12	-0.051	-0.077	-0.108	-0.214	0.066	-0.065	0.069	-0.161	0.295	0.298
13	-0.080	-0.021	-0.047	-0.181	0.014	-0.055	0.082	-0.146	0.342	0.388
14	0.174	0.306	0.292	0.320	0.312	0.566	0.607	0.412	0.116	0.169
15	0.396	0.267	0.395	0.371	0.313	0.614	0.665	0.439	-0.114	0.113
16	0.274	0.312	0.295	0.297	0.379	0.605	0.699	0.377	0.009	-0.063
17	0.472	0.321	0.560	0.495	0.378	0.643	0.650	0.550	-0.146	0.161
18	0.149	0.471	0.484	0.456	0.262	0.725	0.792	0.510	-0.072	-0.065
19	0.098	0.325	0.346	0.335	0.341	0.573	0.617	0.416	0.228	0.081
20	0.446	0.300	0.490	0.508	0.470	0.607	0.377	0.622	-0.086	0.026
21	1.000	0.356	0.222	0.345	0.406	0.472	0.333	0.571	0.012	0.135
22	0.356	1.000	0.400	0.541	0.344	0.658	0.484	0.708	0.052	0.098
23	0.222	0.400	1.000	0.581	0.368	0.651	0.540	0.687	-0.088	-0.032
24	0.345	0.541	0.581	1.000	0.507	0.732	0.535	0.819	-0.173	-0.026
25	0.406	0.344	0.368	0.507	1.000	0.607	0.477	0.637	0.169	0.027
26	0.472	0.658	0.651	0.732	0.607	1.000	0.890	0.884	-0.026	0.065
27	0.333	0.484	0.540	0.535	0.477	0.890	1.000	0.640	0.017	0.140
28	0.571	0.708	0.687	0.819	0.637	0.884	0.640	1.000	-0.049	0.071
29	0.012	0.052	-0.088	-0.173	0.169	-0.026	0.017	-0.049	1.000	0.234
30	0.135	0.098	-0.032	-0.026	0.027	0.065	0.140	0.071	0.234	1.000
31	0.048	-0.102	-0.078	-0.157	0.091	-0.131	-0.184	-0.090	0.798	0.014
32	-0.004	-0.054	-0.032	-0.064	0.112	-0.099	-0.179	-0.038	0.744	0.048

.237 = 95% ⬭

.309 = 99% ▭

TABLE 2 - Continued

CORRELATION MATRIX, CONTROL SCHOOL 3-13-69 N= ~~86~~ 69 PAGE 4

VAR	~~TOTAL~~ TOTAL 31 Fluency	TOTAL 32 Flexibility
M	17.638	14.609
SD	6.797	4.722
1	-0.001	0.000
2	0.180	0.215
3	-0.061	-0.063
4	-0.093	-0.061
5	0.180	0.180
6	0.045	0.096
7	0.000	0.000
8	0.062	0.051
9	-0.139	-0.173
10	0.075	0.036
11	0.057	0.029
12	0.150	0.110
13	0.173	0.135
14	0.008	-0.007
15	-0.154	-0.203
16	-0.197	-0.228
17	-0.164	-0.171
18	-0.133	-0.117
19	0.034	0.075
20	-0.044	-0.020
21	0.048	-0.004
22	-0.102	-0.054
23	-0.078	-0.032
24	-0.157	-0.064
25	0.091	0.112
26	-0.131	-0.099
27	-0.184	-0.179
28	-0.090	-0.038
29	$\boxed{0.798}$	$\boxed{0.744}$
30	0.014	0.048
31	1.000	$\boxed{0.931}$
32	$\boxed{0.931}$	1.000

.237 = 95% ⬭

.309 = 99% ▭

SD is coding for Standard Deviation. Although variance is an acceptable way to describe the degree of spread in a distribution, it has a negative feature in that it is expressed in squared units of measurement. SD is the square root of the variance, and is an indication of variability expressed in the original measurement units. Note the SD for variable 1 (sex) is 0.491 and appears above the columns of correlations parallel with the letters SD.

At the intersection of each variable column and row, the correlation is 1,000 which indicates a perfect correlation. This is as expected, as we are comparing two sets of identical items. In all other cases the correlation values range from +1.000 to -1.000. These values show the degree of linear relationship between the two variables being considered. In general, the researcher is interested in those pairs of variables whose correlations are statistically significant from zero.

Statistical significance is normally measured at the .05 level and the .01 level. Being significant at the .05 level means that the probability of the value obtained being significantly different from zero due to chance alone is less than 5 out of 100 if the true correlation were zero. Likewise, being significant at the .01 level means that the probability of the value obtained being due to chance alone is less than 1 out of 100. The educator must be wary, however, of the possibility that statistical significance may have little value in bringing educational value to a program. Significance may be found statistically when analyzing aspects of a reading program. This result does not mean that you spend a fortune, revamp the staff and replace the entire reading curriculum. Minute differences may be significant statistically but not practically. It is up to the educator to weigh carefully the interpretation of the statistical analysis and then act as an administrator and not a statistician.

In order to clarify the reader's interpretation of the data, the coding used in the tables utilizes 95% and 99% values in place of the .05 and .01 levels previously described. This indicates the probabilities that the correlation coefficient is significantly different from 0.

In order to determine what values are significant at the 95% or 99% levels, statistical tables may be used. In the case of Table 6, correlations whose absolute values are greater than .237 are significant at the 95% level, and .309 are significant at the 99% level. The cut-off points were for the appropriate matrices appearong on the Table page.

There appears to be a high inter-correlation between variables 8 through 13, and variables 2 and 3 on Table 2.

This correlation is not surprising considering that these represent I.Q., readiness and achievement scores. It is of interest to note the negative correlations between these same variables and column 1 (sex). Since the coding for sex was 1 for males and 2 for females, the negative correlation would lead one to conclude that boys do slightly better than girls in these areas in the control school. As four of the six correlations are significant at the 95% level it is not very high.

In contrast, column 4, (years in school) has no significant correlation except with variable 5 (father's occupation) which is coded in a manner that would make this a spurious correlation. The coding key for father's occupation may be found in the appendix.

Column 7 (race) has no correlation with any variable, as it is a constant, since only Caucasians participated in this study. Race is, therefore, not a variable and might well have been dropped from the study.

As mentioned in Table 2, correlations between I.Q., readiness and achievement continue through columns 11, 12, and 13. In general, the Personality test variables 14 through 28 show a high degree of correlation with each other. It should be noted that there is no significant correlation between personality scores and I.Q., readiness or achievement scores. Table 2 continues the trend regarding the personality scores in variables 21 through 28. Columns 29 and 30 and columns 31 and 32 indicate correlations concerning creativity tests. Two points of note are that column 30 (elaboration) has no significant correlation with the other three creativity scores, while the other three tests are highly correlated. It would be expected that elaboration would correlate with the other creativity variables. Elaboration does appear to have some correlation with achievement.

Table 3 shows the correlation matrices for the experimental school. Correlations whose absolute values are greater than .192 are significant at the 95% level and .251 are significant at the 99% level. These values are lower than those used in Table 2, due to a larger sample size. (105 vs. 69).

The control school indicated high correlations between two clusters of variables:

a. Intelligence Quotient, readiness scores and achievement scores

b. Personality scores

These trends are continued in the experimental school. However, in the experimental school there appears to be a rather large degree of correlation between I.Q. and achieve-

TABLE 3

CORRELATION MATRIX. EXPERIMENTAL SCHOOL

CORRELATION MATRIX, EXPERIMENTAL SCHOOL 3-13-69 N= ~~116~~ 105 PAGE 1

VAR	SEX 1	MRT 2	I.Q. 3	YEARS in Present School 4	Fathers OCC. 5	Years 6 Ed. of Father	7 RACE	8 GRAM.	Arith 9 Reasoning	Arith 10 Concepts
M	1.457	74.210	111.505	3.667	18.390	14.867	1.000	60.152	66.133	69.733
SD	0.498	19.626	13.613	1.637	16.144	2.430	0.000	26.032	27.540	29.391
1	1.000	0.136	0.150	0.047	0.015	0.192	0.000	0.238	0.173	-0.011
2	0.136	1.000	0.518	-0.154	0.048	0.119	0.000	0.522	0.512	0.571
3	0.150	0.518	1.000	-0.138	0.087	0.176	0.000	0.579	0.570	0.661
4	0.047	-0.154	-0.138	1.000	0.145	-0.088	0.000	-0.111	-0.014	-0.049
5	0.015	0.048	0.087	0.145	1.000	-0.182	0.000	0.016	0.180	0.089
6	0.192	0.119	0.176	-0.088	-0.182	1.000	0.000	0.186	0.182	0.184
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.238	0.522	0.579	-0.111	0.016	0.186	0.000	1.000	0.616	0.557
9	0.173	0.512	0.570	-0.014	0.180	0.182	0.000	0.616	1.000	0.815
10	-0.011	0.571	0.661	-0.049	0.089	0.184	0.000	0.557	0.815	1.000
11	0.034	0.411	0.487	-0.048	0.131	0.162	0.000	0.425	0.607	0.630
12	0.066	0.394	0.620	-0.066	-0.006	0.185	0.000	0.681	0.660	0.670
13	0.148	0.562	0.646	-0.096	0.022	0.194	0.000	0.674	0.670	0.667
14	0.320	0.128	0.200	0.172	0.048	0.170	0.000	0.201	0.197	0.157
15	0.299	0.241	0.111	-0.055	-0.038	0.060	0.000	0.224	0.202	0.177
16	0.209	0.261	0.219	-0.007	-0.056	0.148	0.000	0.384	0.260	0.248
17	0.212	0.146	0.172	0.052	-0.013	0.108	0.000	0.347	0.164	0.162
18	-0.040	0.165	0.167	0.086	0.060	-0.043	0.000	0.211	0.164	0.193
19	0.061	0.121	0.157	0.043	0.064	0.059	0.000	0.215	0.188	0.136
20	0.165	0.227	0.425	-0.060	0.038	0.122	0.000	0.334	0.372	0.302
21	0.226	0.171	0.189	-0.139	-0.096	0.194	0.000	0.285	0.225	0.221
22	0.159	0.173	0.218	-0.003	0.043	0.040	0.000	0.253	0.282	0.218
23	0.294	0.056	0.17[illegible]	0.034	0.067	0.065	0.000	0.375	0.210	0.122
24	0.227	0.184	0.231	-0.020	0.051	0.014	0.000	0.343	0.269	0.209
25	0.186	0.111	0.243	-0.110	-0.038	0.110	0.000	0.435	0.291	0.257
26	0.284	0.220	0.281	0.014	0.057	0.091	0.000	0.423	0.325	0.264
27	0.231	0.260	0.238	0.057	0.048	0.125	0.000	0.373	0.278	0.237
28	0.280	0.181	0.307	-0.047	0.054	0.079	0.000	0.431	0.339	0.266
29	-0.081	-0.000	-0.014	-0.156	-0.101	-0.003	0.000	-0.062	-0.101	-0.067
30	0.024	0.137	0.194	-0.102	-0.005	-0.050	0.000	0.041	0.184	0.232
31	-0.217	-0.181	-0.135	-0.136	-0.071	-0.037	0.000	-0.204	-0.248	-0.217
32	-0.057	-0.101	-0.032	-0.142	-0.092	0.054	0.000	0.040	-0.089	-0.066

.192 = 95% ⬭

.251 = 99% ▭

TABLE 3 - Continued

CORRELATION MATRIX. EXPERIMENTAL SCHOOL 3-13-69 N= ~~116~~ 105 PAGE 2

VAR	Arith 11 Computation	Reading 12 COMP	Reading 13 VOCAB.	Self 14 Reliance	Personal 15 Worth	Personal 16 Freedom	Feeling 17 Belonging	Withdrawing 18 Tendencies	Nervous 19 Symptoms	Social 20 Standards
M	62.990	66.648	69.857	50.905	55.190	43.095	40.733	51.724	49.362	38.857
SD	28.908	26.887	27.406	23.112	28.382	25.971	29.328	28.830	27.301	26.219
1	0.034	0.066	0.148	0.320	0.299	0.209	0.212	-0.040	0.061	0.165
2	0.411	0.394	0.562	0.128	0.241	0.261	0.146	0.185	0.121	0.227
3	0.487	0.620	0.046	0.200	0.111	0.219	0.172	0.167	0.157	0.425
4	-0.048	-0.066	-0.096	0.172	-0.055	-0.007	0.052	0.086	0.043	-0.060
5	0.131	-0.006	0.022	0.048	-0.038	-0.056	-0.013	0.060	0.064	0.038
6	0.162	0.185	0.194	0.170	0.060	0.148	0.108	-0.043	0.059	0.122
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.425	0.681	0.694	0.201	0.224	0.384	0.347	0.211	0.215	0.334
9	0.507	0.660	0.670	0.197	0.202	0.260	0.164	0.164	0.188	0.372
10	0.630	0.670	0.667	0.157	0.177	0.248	0.162	0.193	0.136	0.302
11	1.000	0.487	0.541	0.132	0.221	0.271	0.097	0.143	0.169	0.211
12	0.487	1.000	0.809	0.100	0.163	0.244	0.196	0.123	0.188	0.436
13	0.541	0.809	1.000	0.186	0.247	0.257	0.228	0.132	0.161	0.429
14	0.132	0.100	0.186	1.000	0.354	0.268	0.360	0.204	0.284	0.111
15	0.221	0.163	0.247	0.384	1.000	0.367	0.523	0.408	0.198	0.040
16	0.271	0.244	0.257	0.268	0.367	1.000	0.593	0.588	0.477	0.129
17	0.097	0.196	0.228	0.360	0.523	0.593	1.000	0.618	0.403	0.266
18	0.143	0.123	0.132	0.204	0.408	0.588	0.618	1.000	0.536	0.139
19	0.164	0.186	0.161	0.284	0.198	0.477	0.403	0.536	1.000	0.163
20	0.211	0.435	0.429	0.111	0.040	0.129	0.266	0.139	0.163	1.000
21	0.241	0.214	0.294	0.371	0.359	0.257	0.364	0.220	0.309	0.394
22	0.192	0.231	0.279	0.325	0.335	0.478	0.432	0.571	0.566	0.325
23	0.121	0.190	0.269	0.256	0.297	0.554	0.443	0.433	0.428	0.322
24	0.216	0.256	0.316	0.230	0.478	0.493	0.567	0.557	0.526	0.412
25	0.204	0.256	0.397	0.258	0.292	0.447	0.440	0.273	0.324	0.427
26	0.246	0.297	0.360	0.496	0.562	0.691	0.721	0.689	0.661	0.441
27	0.231	0.236	0.289	0.555	0.670	0.750	0.786	0.792	0.670	0.206
28	0.227	0.321	0.405	0.355	0.403	0.551	0.554	0.512	0.534	0.586
29	-0.175	-0.072	-0.094	-0.164	-0.167	-0.015	0.032	-0.141	-0.025	-0.014
30	0.151	0.159	0.085	0.060	0.072	-0.029	-0.103	-0.007	0.045	0.084
31	-0.194	-0.203	-0.217	-0.160	-0.195	-0.258	-0.092	-0.168	-0.175	-0.100
32	-0.097	-0.002	-0.048	-0.158	-0.170	-0.146	0.071	-0.138	-0.077	0.120

.192 = 95% ⬭

.251 = 99% ▭

TABLE 3 - Continued

CORRELATION MATRIX, EXPERIMENTAL SCHOOL 3-13-69 N= ~~116~~ 165 PAGE 3

VAR	21. Social Skills	22 Anti-Social Tendencies	23 Family Relations	24 School Relations	25. Community Relations	26 TOTAL Adjustment	27 Personal Adjustment	28 Social Adjustment	29 TOTAL Originality	30 TOTAL Elaboration
M	46.200	26.933	35.029	43.590	40.638	39.133	42.133	34.819	25.552	12.743
SD	28.901	28.957	28.441	26.040	25.259	22.675	22.962	24.872	8.582	8.235
1	0.226	0.159	0.294	0.227	0.186	0.284	0.231	0.280	-0.081	0.024
2	0.171	0.173	0.056	0.189	0.111	0.220	0.260	0.181	-0.000	0.137
3	0.189	0.216	0.171	0.231	0.243	0.281	0.238	0.307	-0.014	0.194
4	-0.139	-0.003	0.034	-0.020	-0.110	0.014	0.057	-0.047	-0.156	-0.102
5	-0.096	0.043	0.067	0.051	-0.038	0.057	0.048	0.054	-0.101	-0.005
6	0.194	0.040	0.065	0.014	0.110	0.091	0.125	0.079	-0.003	-0.050
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.285	0.253	0.375	0.343	0.435	0.423	0.373	0.431	-0.062	0.041
9	0.225	0.282	0.210	0.269	0.291	0.325	0.278	0.339	-0.101	0.184
10	0.221	0.218	0.122	0.209	0.257	0.264	0.237	0.266	-0.067	0.232
11	0.241	0.192	0.121	0.216	0.204	0.246	0.231	0.227	-0.175	0.151
12	0.214	0.231	0.190	0.256	0.256	0.297	0.236	0.321	-0.072	0.159
13	0.294	0.279	0.269	0.316	0.397	0.360	0.289	0.405	-0.094	0.085
14	0.371	0.325	0.256	0.230	0.258	0.496	0.555	0.355	-0.164	-0.060
15	0.359	0.335	0.297	0.478	0.292	0.562	0.670	0.403	-0.167	0.072
16	0.257	0.478	0.554	0.493	0.447	0.691	0.750	0.551	-0.015	-0.029
17	0.364	0.432	0.443	0.567	0.440	0.721	0.786	0.554	0.032	-0.103
18	0.220	0.571	0.433	0.557	0.273	0.689	0.792	0.512	-0.141	-0.007
19	0.309	0.566	0.428	0.526	0.324	0.661	0.670	0.534	-0.025	0.045
20	0.394	0.325	0.322	0.412	0.427	0.441	0.206	0.586	-0.014	0.084
21	1.000	0.450	0.400	0.454	0.369	0.598	0.426	0.647	-0.025	0.124
22	0.450	1.000	0.578	0.617	0.312	0.786	0.654	0.796	-0.137	0.060
23	0.400	0.578	1.000	0.608	0.506	0.744	0.565	0.806	-0.154	-0.060
24	0.454	0.617	0.608	1.000	0.438	0.805	0.656	0.809	-0.090	0.056
25	0.369	0.312	0.506	0.438	1.000	0.588	0.447	0.623	-0.041	-0.013
26	0.598	0.786	0.744	0.805	0.588	1.000	0.893	0.918	-0.111	0.035
27	0.426	0.654	0.565	0.656	0.447	0.893	1.000	0.677	-0.133	0.011
28	0.647	0.796	0.806	0.809	0.623	0.918	0.677	1.000	-0.117	0.036
29	-0.025	-0.137	-0.154	-0.090	-0.041	-0.111	-0.133	-0.117	1.000	0.050
30	0.124	0.060	-0.060	0.056	-0.013	0.035	0.011	0.036	0.050	1.000
31	-0.126	0.192	-0.190	-0.137	-0.186	-0.237	0.245	-0.198	0.689	-0.073
32	0.018	-0.124	-0.050	0.025	-0.061	-0.071	-0.142	-0.015	0.812	0.065

.192 = 95% ⬭

.251 = 99% ▭

TABLE 3 - Continued

CORRELATION MATRIX, EXPERIMENTAL SCHOOL 3-13-69 N= ~~116~~ 105 PAGE 4

VAR	31 TOTAL	32 TOTAL
M	24.076	18.762
	Fluency	Flexibility
SD	6.324	4.516
1	-0.217	-0.057
2	-0.181	-0.101
3	-0.135	-0.032
4	-0.136	-0.142
5	-0.071	-0.092
6	-0.037	0.054
7	0.000	0.000
8	-0.204	0.040
9	-0.248	-0.059
10	-0.217	-0.066
11	-0.194	-0.097
12	-0.203	-0.002
13	-0.217	-0.048
14	-0.160	-0.158
15	-0.195	-0.170
16	-0.258	-0.146
17	-0.092	0.071
18	-0.108	-0.138
19	-0.175	-0.077
20	-0.100	0.120
21	-0.125	0.018
22	-0.192	-0.124
23	-0.190	-0.050
24	-0.137	0.025
25	-0.186	-0.061
26	-0.237	-0.071
27	-0.245	-0.142
28	-0.198	-0.015
29	0.689	0.012
30	-0.073	0.055
31	1.000	0.742
32	0.742	1.000

.192 = 95% ⬭

.251 = 99% ▭

ment scores and personality scores, which was not evident in the control school. This might indicate a feeling of less constraint on the student in the experimental school or the control school might make students do better, or perhaps the experimental doesn't emphasize the same values.

Seven personality variables which appear highly significant with achievement are personal freedom, school relations, community relations, total adjustment, personal adjustment, social adjustment, and social standards.

As in the control school, in the area of creativity scores, elaboration has no significant correlation with the other three creativity variables while they have high correlation with each other. Unlike the control school, elaboration shows little correlation with the other variables in the study, but the fluency scores show a negative correlation, at the 95% level, with all achievement scores and some negative correlation with some personality scores. As there is a negative correlation between fluency and all other variables with the exception of flexibility and originality, it is within the bounds of administrative speculation that perhaps the constraint in one school accounts for this fluency difference. A more formal approach to classroom control or administrative expectation may well have a bearing on the results. A great deal of research is indicated before conclusive results can be obtained.

Table 4 shows the correlation matrices for the combined schools with the addition of one variable (school). Correlations whose absolute values are greater than .149 are significant at the 95% level and .195 significant at the 99% level. The greater the N (number of students in the population) the lower the contingency coefficient to which you can attach statistical significance. As might be expected, the combined school's correlation matrices reflect a composite picture showing strong correlation among the various achievement scores and also strong correlation among the various personality scores. Other scattered correlations between these two groups indicate the heavier weight of the experimental group due to its size and do not show any specific pattern.

THE F-TEST

Tables 5 and 6 show a comparison of the means and the standard deviations of the experimental school vs. the control school. These comparisons are made through the use of two statistical methods, the F-Test and the t-Test.

The F-Test is used in this instance to determine whether or not the difference between the standard deviations of two sets of data is statistically significant. In Table 5,

TABLE 4

CORRELATION MATRIX, COMBINED SCHOOLS

ORRELATION MATRIX. COMBINED SCHOOLS 3-17-69 N= 174 PAGE 1

AR	School 1	SEX 2	METRO 3 Readiness	4 I.Q.	5 YEARS IN School	6 Father OCC.	7 Years of Ed. of Father	8 RACE	9 GRAM USAGE	10 ARITH REASONING
I	0.397	1.511	79.138	113.937	3.879	25.299	14.695	1.000	59.626	63.569
SD	0.489	0.500	19.551	13.151	1.584	21.132	2.627	0.000	27.232	29.567
1	1.000	0.134	0.311	0.228	0.166	0.403	-0.080	0.000	-0.024	-0.107
2	0.134	1.000	0.037	0.043	0.049	0.092	0.049	0.000	0.130	-0.080
3	0.311	0.037	1.000	0.569	-0.027	0.165	0.096	0.000	0.421	0.399
4	0.228	0.043	0.569	1.000	0.004	0.111	0.117	0.000	0.445	0.488
5	0.166	0.049	-0.027	0.004	1.000	0.232	-0.086	0.000	-0.062	-0.040
6	0.403	0.092	0.165	0.111	0.232	1.000	-0.254	0.000	0.095	0.037
7	-0.080	0.049	0.096	0.117	-0.086	-0.254	1.000	0.000	0.144	0.129
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	-0.024	0.130	0.421	0.445	-0.062	0.095	0.144	0.000	1.000	0.595
0	-0.107	-0.080	0.399	0.488	-0.040	0.037	0.129	0.000	0.595	1.000
1	-0.085	-0.166	0.469	0.553	-0.068	0.018	0.124	0.000	0.551	0.826
2	-0.538	-0.121	0.109	0.232	-0.109	0.183	0.133	0.000	0.359	0.530
3	-0.030	-0.067	0.395	0.557	-0.054	-0.004	0.188	0.000	0.675	0.634
4	-0.195	-0.057	0.453	0.550	-0.113	-0.048	0.219	0.000	0.661	0.658
5	0.132	0.237	0.135	0.196	0.127	0.158	0.024	0.000	0.165	0.150
6	0.191	0.200	0.214	0.150	0.020	0.043	0.011	0.000	0.095	0.045
7	0.084	0.116	0.197	0.198	0.072	0.016	0.097	0.000	0.169	0.178
8	0.136	0.123	0.142	0.155	0.087	0.003	0.056	0.000	0.191	0.086
9	0.069	-0.083	0.206	0.165	0.139	0.053	0.032	0.000	0.078	0.095
0	-0.054	0.027	0.106	0.146	0.040	-0.029	0.122	0.000	0.119	0.110
1	-0.009	0.173	0.144	0.298	-0.118	-0.077	0.005	0.000	0.166	0.182
2	0.118	0.214	0.147	0.160	-0.033	0.011	0.055	0.000	0.144	0.080
3	-0.010	0.113	0.132	0.130	-0.023	0.007	0.002	0.000	0.107	0.204
4	-0.009	0.138	0.061	0.138	-0.001	0.014	0.009	0.000	0.159	0.098
5	-0.011	0.147	0.093	0.121	-0.024	-0.028	0.005	0.000	0.151	0.124
6	-0.039	0.136	0.081	0.154	-0.092	-0.035	0.115	0.000	0.289	0.153
7	0.077	0.199	0.188	0.234	0.024	0.027	0.043	0.000	0.199	0.162
8	0.102	0.135	0.234	0.239	0.096	0.039	0.089	0.000	0.195	0.156
9	0.020	0.204	0.128	0.203	-0.066	0.017	0.040	0.000	0.198	0.151
0	-0.365	-0.060	-0.035	-0.085	0.165	-0.107	0.058	0.000	0.066	-0.033
1	0.324	0.110	0.262	0.262	-0.047	0.121	0.067	0.000	0.178	0.115
2	-0.435	-0.172	0.174	0.193	0.178	-0.130	0.035	0.000	-0.068	-0.132
3	-0.404	-0.085	-0.112	-0.130	0.167	-0.127	0.098	0.000	0.051	-0.071

.149 95% ⬭
.195 99% ▭

TABLE 4 - Continued

RRELATION MATRIX, COMBINED SCHOOLS 3-17-69 N= 174 PAGE 2

-R	ARith 11 CONCEPTS	ARith Comp.	13 Reading Comp.	14 Reading VOCAB	15 SELF Reliance	16 Personal North	17 Personal Freedom	18 Feeling of Belonging	19 Withdrawing Tendencies	20 Nervous Symptoms
. .	67.759	48.839	66.011	65.385	53.552	59.431	44.925	43.945	53.374	48.144
SD	28.594	32.476	26.367	28.319	24.788	27.362	26.913	29.088	29.558	27.622
1	-0.085	0.538	-0.030	0.195	0.132	0.191	0.084	0.136	0.069	-0.054
2	0.166	-0.121	-0.067	-0.057	0.237	0.200	0.116	0.123	-0.083	0.027
3	0.469	0.109	0.395	0.453	0.135	0.214	0.197	0.142	0.206	0.106
4	0.553	0.232	0.557	0.550	0.196	0.150	0.198	0.155	0.165	0.146
5	-0.068	-0.109	-0.054	-0.113	0.127	0.020	0.072	0.087	0.139	0.040
6	0.018	0.153	-0.004	-0.048	0.158	0.043	0.016	0.003	0.053	-0.029
7	0.124	0.133	0.188	0.219	0.024	0.011	0.097	0.056	0.032	0.122
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	0.551	0.359	0.675	0.661	0.165	0.095	0.169	0.191	0.078	0.119
0	0.826	0.530	0.634	0.658	0.150	0.045	0.178	0.086	0.095	0.110
1	1.000	0.534	0.663	0.675	0.177	0.078	0.163	0.099	0.148	0.137
2	0.534	1.000	0.424	0.551	-0.021	0.022	0.076	-0.016	0.031	0.161
3	0.663	0.424	1.000	0.821	0.118	0.092	0.145	0.069	0.074	0.161
4	0.675	0.551	0.821	1.000	0.131	0.103	0.138	0.091	0.058	0.174
5	0.177	-0.021	0.118	0.131	1.000	0.393	0.298	0.343	0.307	0.268
6	0.075	0.022	0.092	0.103	0.393	1.000	0.381	0.552	0.433	0.174
7	0.163	0.076	0.145	0.138	0.298	0.381	1.000	0.547	0.572	0.376
8	0.099	-0.016	0.069	0.091	0.343	0.552	0.547	1.000	0.545	0.355
9	0.148	0.031	0.074	0.058	0.307	0.433	0.572	0.545	1.000	0.527
0	0.137	0.161	0.161	0.174	0.268	0.174	0.376	0.355	0.527	1.000
1	0.180	0.061	0.215	0.209	0.194	0.132	0.172	0.319	0.155	0.176
2	0.056	0.031	0.106	0.114	0.296	0.384	0.271	0.416	0.197	0.215
3	0.193	0.069	0.115	0.159	0.312	0.303	0.408	0.385	0.529	0.470
4	0.094	0.029	0.078	0.142	0.267	0.324	0.445	0.481	0.451	0.395
5	0.124	0.088	0.075	0.114	0.265	0.428	0.408	0.532	0.513	0.448
6	0.170	0.084	0.186	0.249	0.272	0.286	0.414	0.407	0.265	0.332
7	0.181	0.063	0.156	0.174	0.528	0.582	0.657	0.693	0.705	0.619
8	0.183	0.086	0.166	0.178	0.583	0.669	0.730	0.734	0.793	0.638
9	0.150	0.049	0.141	0.181	0.377	0.411	0.480	0.550	0.511	0.486
0	0.058	0.132	0.080	0.153	-0.084	-0.204	-0.035	-0.086	-0.129	0.095
1	0.179	-0.088	0.191	0.128	0.142	0.142	-0.013	0.042	-0.006	0.038
2	-0.054	0.157	-0.042	0.039	-0.133	-0.241	-0.244	0.167	-0.167	-0.055
3	0.010	0.179	0.050	0.104	-0.136	-0.240	-0.199	-0.078	-0.146	0.009

.149 = 95% ⬭

.195 = 99% ▭

TABLE 4 - Continued

RRELATION MATRIX, COMBINED SCHOOLS 3-17-69

N= 174 PAGE 3

R D	21 Social 38.672 Standards 26.523	22 Social 49.006 Skills 29.366	23 Anti-Social 26.707 Tend. 28.589	24 Family 35.414 Relations 28.130	25 School 43.351 Relations 26.162	26 Community 39.851 Relations 24.790	27 Total 40.546 adjust 22.662	28 Personal 44.075 adjust. 23.590	29 Social 35.207 adjust 24.402	30 Total 22.753 [illegible] 9.466
1	-0.009	0.118	-0.010	-0.009	-0.011	-0.039	0.077	0.102	0.020	0.365
2	0.173	0.214	0.113	0.138	0.147	0.136	0.199	0.135	0.204	-0.060
3	0.144	0.147	0.132	0.061	0.093	0.081	0.188	0.234	0.128	-0.035
4	0.294	0.160	0.130	0.138	0.121	0.154	0.234	0.239	0.203	-0.085
5	-0.118	-0.033	-0.023	-0.001	-0.024	-0.092	0.024	0.096	-0.066	0.165
6	-0.077	0.011	0.007	0.014	-0.028	-0.035	0.027	0.039	0.017	-0.107
7	0.005	0.055	0.002	0.009	0.005	0.115	0.043	0.089	0.040	0.058
8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	0.166	0.144	0.107	0.159	0.151	0.289	0.199	0.195	0.198	0.066
0	0.182	0.080	0.204	0.098	0.124	0.153	0.162	0.156	0.151	-0.033
1	0.180	0.086	0.193	0.094	0.124	0.170	0.181	0.183	0.160	0.058
2	0.081	0.031	0.089	0.029	0.088	0.084	0.063	0.086	0.049	0.132
3	0.215	0.106	0.115	0.078	0.075	0.186	0.156	0.166	0.141	0.080
4	0.209	0.114	0.159	0.142	0.114	0.249	0.174	0.178	0.181	0.153
5	0.194	0.295	0.312	0.267	0.265	0.272	0.528	0.583	0.377	-0.084
6	0.132	0.384	0.303	0.324	0.428	0.286	0.582	0.669	0.411	0.204
7	0.172	0.271	0.408	0.445	0.408	0.414	0.657	0.730	0.480	-0.035
8	0.319	0.416	0.385	0.481	0.532	0.407	0.693	0.734	0.550	-0.086
9	0.155	0.197	0.529	0.451	0.513	0.265	0.705	0.793	0.511	-0.129
0	0.176	0.215	0.470	0.395	0.448	0.332	0.619	0.638	0.486	0.095
1	1.000	0.411	0.315	0.389	0.451	0.443	0.505	0.275	0.600	-0.038
2	0.411	1.000	0.408	0.326	0.406	0.375	0.551	0.395	0.615	-0.052
3	0.315	0.408	1.000	0.510	0.587	0.324	0.734	0.581	0.763	-0.053
4	0.389	0.326	0.510	1.000	0.598	0.454	0.705	0.550	0.761	-0.115
5	0.451	0.406	0.587	0.598	1.000	0.465	0.773	0.602	0.812	-0.111
6	0.443	0.375	0.324	0.454	0.465	1.000	0.590	0.452	0.627	0.054
7	0.505	0.551	0.734	0.705	0.773	0.590	1.000	0.892	0.903	-0.099
8	0.275	0.395	0.581	0.550	0.602	0.452	0.892	1.000	0.660	-0.101
9	0.600	0.515	0.763	0.761	0.812	0.627	0.903	0.660	1.000	-0.091
0	-0.038	-0.052	-0.053	-0.115	-0.111	0.054	-0.099	-0.101	-0.091	1.000
1	-0.055	0.159	0.067	-0.050	0.019	-0.011	0.069	0.092	0.053	-0.008
2	-0.065	-0.099	-0.135	-0.126	-0.126	-0.050	-0.207	0.240	-0.147	0.775
3	0.060	-0.040	-0.084	-0.036	-0.006	0.023	-0.107	0.184	-0.030	0.716

.149 = 95% ⬭

.195 = 99% ▭

TABLE 4 - Continued

RRELATION MATRIX, COMBINED SCHOOLS 3-17-69 N= 174 PAGE 4

-R	31	32	33
	TOTAL 15.006 ELAB	TOTAL 21.523 Fluency	TOTAL 17.115 FLEX
D	8.627	7.231	5.027
1	0.324	-0.435	-0.404
2	0.110	-0.172	-0.085
3	0.262	-0.174	-0.112
4	0.262	-0.193	-0.130
5	-0.047	-0.178	-0.167
6	0.121	-0.130	-0.127
7	0.067	0.035	0.098
8	0.000	0.000	0.000
9	0.174	-0.068	0.051
0	0.115	-0.132	-0.071
1	0.179	-0.054	0.010
2	-0.088	0.159	0.179
3	0.191	-0.042	0.050
4	0.128	0.039	0.104
5	0.142	-0.133	-0.136
6	0.142	-0.241	0.240
7	-0.013	-0.244	0.199
8	0.042	-0.167	-0.078
9	-0.006	-0.167	-0.146
0	0.038	-0.055	0.009
1	0.055	-0.065	0.060
2	0.159	-0.099	-0.040
3	0.067	-0.135	-0.084
4	-0.050	-0.126	-0.036
5	0.019	-0.126	-0.006
6	-0.011	-0.050	0.023
7	0.069	-0.207	-0.107
8	0.092	-0.240	0.184
9	0.053	-0.147	-0.030
0	-0.008	0.775	0.716
1	1.000	-0.173	-0.081
2	-0.173	1.000	0.853
3	-0.081	0.853	1.000

.149 = 95% ⬭

.195 = 99% ▭

TABLE 5

F-TEST

EXPERIMENTAL VS CONTROL SCHOOL

VAR	Ex Sch MEAN 1	Con Sch MEAN 2	Ex Sch S.DEV.1	Con Sch. S.DEV.2	F	NDF	
1	0.000	1.000	1,000	1.000	1,000	104,	68
2	1.457	1.594	0,498	0.491	1,029	104,	68
3	74.210	86,638	19,628	16.864	1,355	104,	68
4	111.505	117,638	13,613	11.464 ✓	1,410	104,	68
5	3.667	4.203	1,637	1.440	1,292	104,	68
6	18.390	35,812	16,144	23.374	$\boxed{2,096}$	68,	104
7	14.867	14,435	2,430	2.882	1,407	68,	104
8	1.000	1.000	1,000	1.000	1,000	104,	68
9	60.152	58,826	26,032	28.943	1,236	68,	104
10	66.133	59,667	27,546	32.019	1,352	68,	104
11	69.733	64,754	29,391	27.062	1,180	104,	68
12	62.990	27,304	28,908	24.890	1,349	104,	68
13	66.648	65,043	26,887	25.525	1,110	104,	68
14	69.857	58,580	27,406	28.331	1,069	68,	104
15	50.905	57,580	23,112	26.641	1,329	68,	104
16	55.190	65,884	28,382	24.355	1,358	104,	68
17	43.095	47,710	25,971	28.060	1,167	68,	104
18	40.733	48,826	29,328	28.023	1,095	104,	68
19	51.724	55,884	28,830	30.461	1,116	68,	104
20	49.362	46,290	27,301	28.003	1,052	68,	104
21	38.857	38,391	26,219	26.977	1,059	68,	104
22	46.200	53,275	28,901	29.559	1,046	68,	104
23	26.933	26,362	28,957	28.016	1,068	104,	68
24	35.629	35,087	28,441	27.649	1,058	104,	68
25	43.590	42,986	26,040	26.343	1,023	68,	104
26	40.638	38,652	25,259	24.010	1,107	104,	68
27	39.133	42,696	22,675	22.472	1,018	104,	68
28	42.133	47,029	22,962	24.218	1,112	68,	104
29	34.819	35,797	24,872	23.657	1,105	104,	68
30	25.552	18,493	8,582	9.153	1,137	68,	104
31	12.743	18,449	8,235	8.053	1,046	104,	68
32	24.076	17,638	6,324	6.797	1,155	68,	104
33	18.762	14,609	4,516	4.722	1,093	68,	104

F(104,68) 1.452= 95% = ⬭
1.695= 99% = ▭
F(68,104) 1.432= 95% = ⬭
1.667= 99% = ▭

the column labeled F gives the F value generated by comparing the two standard deviations. The two NDF columns give the degrees of freedom for the corresponding F value. The degrees of freedom available for evaluating a statistic depend upon the number of restrictions placed upon the observations --one degree of freedom being lost for each restriction imposed. In the case of the F-Test, the degrees of freedom are one less than the size of each sample.

Using a statistical table called "F-Test Levels of Significance" it can be determined that for 104, 68 degrees of freedom, F values greater than 1.452 are significant at the 99% level. For 68, 104 degrees of freedom, F values greater than 1.667 are significant at the 99% level.

It can be noted that only in variable 6 (father's occupation) is there any significant difference between the SD of the two groups. This significance is spurious, as indicated in the correlation matrices. The lack of significant differences between the SD of the other variables would indicate that the distributions of the two samples have the same spread. This would also allow the researcher to hypothesize that the SD of the populations are equal.

THE t-TEST

The t-Test is used to determine whether or not the difference between the means of two samples is statistically significant. In Table 6, the column labeled T, EQVAR gives the t scores determined by the two corresponding means with the assumption that the variances of the two populations are equal. This appears to be a valid assumption, with the exception of variable 6 for which DIVAR must be used. The next column labeled NDF gives the number of degrees of freedom for the particular t score. In this instance it would be two less than the sums of the two samples.

The column labeled T, DIFVAR gives the t scores determined by the corresponding means with the assumption that the variances of the two populations are different.

Using a statistical table called a "t-Test Levels of Significance" it can be determined that for 172 degrees of freedom, t scores whose absolute values are greater than 1.974 are significant at the 95% level, and t scores whose absolute values are greater than 2.605 are significant at the 99% level.

If one compares the sets of corresponding t values, it can be noted that they are very close. The pair of t values that have the largest difference are for variable 6 (father's occupation) which was the one case in which the SD was significantly different.

TABLE 6

t-TEST

3-13-69

N=69

VAR	T.EQVAR	NDF	T.DIFVAR	NDF
1.	-6.453	172	-6.453	147.573
2	-1.785	172	-1.790	149.047
3	-4.315	172	-4.453	162.181
4	-3.909	172	3.202	163.812
5	-2.214	172	-2.274	160.151
6	-5.816	172	-5.402	111.407
7	1.065	172	1.028	129.701
8	0.000	172	0.000	147.574
9	0.314	172	0.308	136.381
10	1.420	172	1.376	131.753
11	1.128	172	1.147	155.918
12	8.407	172	8.671	162.003
13	0.393	172	0.397	152.909
14	2.620	172	2.602	144.082
15	1.753	172	-1.702	132.618
16	-2.569	172	-2.651	162.285
17	-1.110	172	-1.093	139.403
18	-1.812	172	-1.829	152.258
19	-0.910	172	-0.900	141.769
20	0.719	172	0.715	144.906
21	0.113	172	0.113	144.578
22	-1.565	172	-1.558	145.210
23	0.129	172	0.130	150.990
24	0.124	172	0.125	150.500
25	0.149	172	0.149	146.362
26	0.517	172	0.523	152.781
27	-1.018	172	-1.019	148.511
28	-1.346	172	-1.331	141.957
29	-0.259	172	-0.261	152.718
30	5.169	172	5.100	140.774
31	-4.510	172	-4.531	149.894
32	6.376	172	6.282	139.957
33	5.828	172	5.774	142.874

1.96 = 95% = ⬭
2.58 = 99% = ▭

It can be noted that the difference between the means of variable 1 (school) is significant as would be expected. Areas where significant differences in the means are noted are readiness, I.Q., years in school, father's occupation, arithmetic computation, reading vocabulary and personal worth.

The greatest statistical difference in the t-Test results was in variable 12 (arithmetic computation). As an educational administrator, the magnitude of this difference would certainly merit investigation. In this instance, it was first believed that the data was in error, but further verification proved it to be correct. It is also a possibility that some atypical occurrence or an error in testing procedure would account for this difference. Upon investigation with the administrative personnel of the control school, no such events were noted, and therefore the data must be assumed to be representative of the performance of the population on this portion of the achievement battery. Although no specific testing error was determined, testing or data error is still suspect due to the great difference in scores.

Significant difference was also evidenced in the four creativity tests. This would tend to substantiate the different correlations of these items between the experimental school and the control school as noted in Table 2.

Elaboration appears to be a much more developed characteristic of the control school than in the experimental school. In the experimental school, however, originality, fluency, and flexibility seem to have the greater development.

CHI SQUARE ANALYSIS

The Chi-square analysis in this study is a comparison of the test data obtained against the hypothesis that there is no significant relationship between the two variables concerned. Statistically, this is referred to as the null hypothesis.

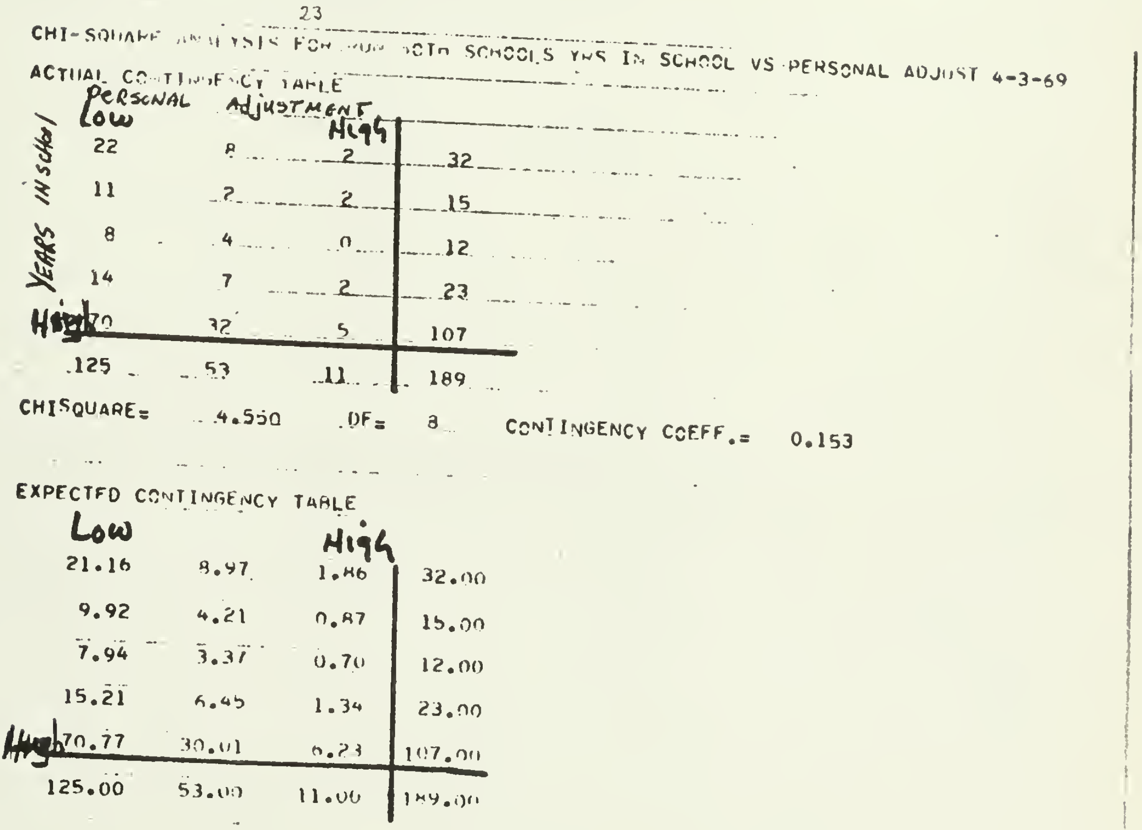
The null hypothesis has been used in this study for 41 chi-square analyses. Significant results from thirteen of the forty-one hypotheses tested are presented in detail. When no significant relationship was obtained the analysis was not reported. The entire 41 hypotheses tested are listed in the appendix.

Levels of significance have been determined by use of a Chi-square table. The degrees of freedom for each test have been determined by the formula, $DF=(C-1)x(R-1)$ where C is the number of columns and R is the number of rows in the contingency table.

Using Table 7 as an example, first note the title at

TABLE 7

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS YEARS IN SCHOOL VS. PERSONAL ADJUSTMENT 4-3-69



```
                    23
CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS YRS IN SCHOOL VS PERSONAL ADJUST 4-3-69
ACTUAL CONTINGENCY TABLE
       Personal  Adjustment
       Low                 High
        22        8         2  |   32
        11        2         2  |   15
         8        4         0  |   12
        14        7         2  |   23
  High  70       32         5  |  107
       ------------------------+
       125       53        11  |  189
YEARS IN school
CHISQUARE=      4.550     DF=   8      CONTINGENCY COEFF.=   0.153

EXPECTED CONTINGENCY TABLE
      Low                 High
      21.16     8.97     1.86  |   32.00
       9.92     4.21     0.87  |   15.00
       7.94     3.37     0.70  |   12.00
      15.21     6.45     1.34  |   23.00
High  70.77    30.01     6.23  |  107.00
      -------------------------+
     125.00    53.00    11.00  |  189.00
```

Cut off Points

Yrs. in School	Personal Adjustment
-1	-50
2	
3	85
4	
5+	86+

the top of the print-out which describes the two variables compared, in this case, years in school vs. personal adjustment for both schools. On the same line, the cut-off points for the two variables are given in the same order as the variables. Therefore, years in school are broken down into categories of 1 or less, 1 to 2, 2 to 3, 3 to 4, and 5 or more. Personal adjustment percentile rank is broken down into categories of 50 or less, 51 to 85, and 86 to 99. The date shown following the title, 4-3-69, is the date this program was run.

The two contingency tables that appear on Table 7, actual and expected, show the number of pupils in each category with respect to years in school and personal adjustment. For example; in the actual contingency table, there were 22 students who had 1 or less years in school and ranked in the 50th or below percentile for personal adjustment. Likewise, there were 7 students who were in school from 3 to 4 years and ranked between the 51st and 85th percentile. From this it can be seen that the construction of the tables is such that those students with low scores fall in the upper left-hand corner moving progressively higher to the lower right-hand corner. The last column and the last row are the totals for each respective column and row.

The expected contingency table shows the number of students in each category that should occur if there were no relationship between the two variables.

The Chi-square test compares the differences between the corresponding categories in the two tables to determine whether the differences are statistically significant. The resultant Chi-square value can be located between the two tables.

In the case of Table 7, the Chi-square value of 4.550 is not significant at the 95% level or the 99% level. Following the Chi-square value, the degrees of freedom are given, in this case, 8.

The contingency coefficient provides a measure of correlations between the two variables being considered. Its values are not being considered in this study.

Table 8, run 5-9-69, is a consideration of the same two values as Table 7. The difference between the two runs is that in the later run the categories for personal adjustment percentile were changed to 23rd or lower, 24th to 77th and 78th to 99. This adjustment was made because of the large amount of data falling into the first category in Table 7. It will be noticed that the Chi-square value obtained on the later run was higher than on the first run, but still not significant.

TABLE 8

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
YEARS IN SCHOOL VS. PERSONAL ADJUSTMENT
HYPOTHESIS NUMBER 10 - 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS YEARS IN SCHOOL VS PERSONAL ADJUST  HYPOT  10  5-9-69

ACTUAL CONTINGENCY TABLE
  PERSONAL  Adjustment
Low                        High
(Years in School)
       9        21        2  |   32
       5         8        2  |   15
       6         5        1  |   12
       4        17        2  |   23
High  24        69       14  |  107
      ---------------------------------
      48       120       21  |  189

CHISQUARE=    7.180     DF=   8     CONTINGENCY COEFF.=   0.191


EXPECTED CONTINGENCY TABLE

Low                        High
      8.13     20.32     3.56  |   32.00
      3.81      9.52     1.67  |   15.00
      3.05      7.62     1.33  |   12.00
      5.84     14.60     2.56  |   23.00
High 27.17     67.94    11.89  |  107.00
      ------------------------------------
     48.00    120.00    21.00  |  189.00
```

Cut off Points

Years in School	Personal Adjustment
-1	-23
2	
3	77
4	
5+	78+

A number of adjustments in cut-off points between the 4-3-69 run of data and the 5-9-69 run were made in order to compare the actual and expected cell entries to improve the spread of these entries. A bell curve spread in scores is the distribution sought in determining cut-off points.

Tables 9 through 14 show Chi-square analysis of I.Q. vs. the various achievement and readiness tests in both schools. In all instances these tests show significantly that there is a relationship between each set of variables concerned. In all cases except Table 11, I.Q. vs . arithmetic computation, the significance was at the 99% level. As previously stated, the arithmetic computation scores in the control school show a unique set of circumstances.

Tables 15 through 17 compare readiness vs. arithmetic achievement. In all three situations the significance is at the 99% level.

In comparing these results with those shown on Table 4, the correlation between the I.Q. and readiness and achievement and the correlation between readiness and arithmetic achievement were also significant at the 99% level, as would be expected.

Chi-square analysis was used to compare years in school vs. various personality factors. In all cases the differences

TABLE 9

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
I.Q. VS. ARITHMETIC REASONING
HYPOTHESIS NUMBER 1 - 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS IQ VS ARITH REASONING HYPOT 1  5-9-69
ACTUAL CONTINGENCY TABLE
        ARITH. REASONING
        Low                  High |
Low       6        2          0   |      8
         27       16          3   |     46
I.Q.     19       23         11   |     53
          9       14         26   |     49
High      4       13         29   |     46
     -----------------------------+---------
         65       68         69   |    202

CHISQUARE=  60.251       DF=  8       CONTINGENCY COEFF.=   0.479


EXPECTED CONTINGENCY TABLE
                                  |
          2.57      2.69      2.73  |    8.00
         14.80     15.49     15.71  |   46.00
         17.05     17.84     18.10  |   53.00
         15.77     16.50     16.74  |   49.00
         14.80     15.49     15.71  |   46.00
     -------------------------------+----------
         65.00     68.00     69.00  |  202.00
```

▭ = 99%

Cut off Points

I.Q.	Arithmetic Reasoning
-90	-50
105	
115	85
125+	86+

TABLE 10

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
I.Q. VS. ARITHMETIC CONCEPTS
HYPOTHESIS NUMBER 2
5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS IQ VS ARITH CONCEPTS  HYPOT 2  5-9-69

ACTUAL CONTINGENCY TABLE
       ARITH. CONCEPTS
  Low                  High
         6       2       0   |   8
        28      13       5   |  46
  I.Q.  18      17      18   |  53
         4      15      30   |  49
  High   4       6      35   |  45
      -------------------------------
        60      53      88   | 201

CHISQUARE=   [70,227]    DF=   8     CONTINGENCY COEFF.=   0.509        [  ] = 99%


EXPECTED CONTINGENCY TABLE

       2,39     2.11     3,50  |   8,00
      13,73    12.13    20,14  |  46,00
      15,82    13.98    23,20  |  53,00
      14,63    12.92    21,45  |  49,00
      13.43    11.87    19,70  |  45.00
     ------------------------------------
      60.00    53.00    88,00  | 201.00
```

Cut off Points

I.Q.	Arithmetic Concepts
-90	-50
105	85
115	86+
125+	

TABLE 11

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
I.Q. VS. ARITHMETIC COMPUTATION
HYPOTHESIS NUMBER 3 - 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS IQ VS ARITH COMP  HYPUT 3  5-9-69

ACTUAL CONTINGENCY TABLE
       ARITH. COMP.
                          High
Low     6       2       0   |     8
       31      11       4   |    46
I.Q.   32      14       7   |    53
       25      12      12   |    49
High   17      12      17   |    46
     ----------------------------------
      111      51      40   |   202

CHISQUARE=  18.092    DF=   8     CONTINGENCY COEFF.=   0.287


EXPECTED CONTINGENCY TABLE

     4.40     2.02     1.58  |    8.00
    25.28    11.61     9.11  |   46.00
    29.12    13.38    10.50  |   53.00
    26.93    12.37     9.70  |   49.00
    25.28    11.61     9.11  |   46.00
   --------------------------------------
   111.00    51.00    40.00  |  202.00
```

○ = 95%

Cut off Points

I.Q.	Arithmetic Computation
-90	
105	-50
115	85
125+	86+

TABLE 12

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
I.Q. VS. READING VOCABULARY
HYPOTHESIS NUMBER 4
5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS IQ VS READING VOCAB  HYPOT 4  5-9-69

ACTUAL CONTINGENCY TABLE
      READING VOCAB.  High
Low   6       2       0   |    8
      25      17      4   |   46
Q     20      20      13  |   53
I     10      22      18  |   50
High  5       5       36  |   46
      ----------------------------
      66      66      71  |  203

CHISQUARE=   68,380    DF=   8    CONTINGENCY COEFF,=   0,502


EXPECTED CONTINGENCY TABLE
                             |
      2,60     2.60    2,80  |    8,00
     14,96    14.96   16,09  |   46,00
     17,23    17,23   18,54  |   53,00
     16,26    16.26   17,49  |   50,00
     14,96    14.96   16,09  |   46,00
     ---------------------------------
     66,00    66.00   71,00  |  203,00
```

= 99%

Cut off Points

I.Q.	Reading Vocabulary
-90	-50
105	85
115	
125+	86+

TABLE 13

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
I.Q. VS. READING COMPREHENSION
HYPOTHESIS NUMBER 5 - 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS IQ VS READING COMP  HYPOT 5  5-9-69

ACTUAL CONTINGENCY TABLE
      READING COMP.   High
Low   8       0       0   |   8
      23      19      4   |  46
I.Q.  16      29      7   |  52
      7       19      24  |  50
High  5       12      28  |  45
      ------------------------------
      59      79      63  | 201

CHISQUARE=    71,519     DF=   8     CONTINGENCY COEFF.=   0,512


EXPECTED CONTINGENCY TABLE

        2,35    3.14    2,51  |   8.00
       13,50   18.08   14,42  |  46.00
       15,26   20.44   16,30  |  52.00
       14,68   19.65   15,67  |  50.00
       13,21   17.69   14,10  |  45.00
      -------------------------------
       59,00   79.00   63,00  | 201.00
```

$\boxed{}$ = 99%

Cut off Points

I.Q.	Reading Comprehension
-90	-50
105	
115	85
125+	86+

TABLE 14

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
I.Q. VS. TOTAL READINESS
HYPOTHESIS NUMBER 6
5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS IQ VS TOTAL READINESS  HYPOT 6  5-9-69

ACTUAL CONTINGENCY TABLE
         Total Readiness  High
  Low   1        5        2   |    8
        7       24       15   |   46
  I.Q.  0       18       35   |   53
        0       11       39   |   50
  High  0        4       42   |   46
        -----------------------------
        8       62      133   |  203

CHISQUARE=  [55.979]   DF=  8    CONTINGENCY COEFF.=   0.465


EXPECTED CONTINGENCY TABLE

      0.32      2.44      5.24  |   8.00
      1.81     14.05     30.14  |  46.00
      2.09     16.19     34.72  |  53.00
      1.97     15.27     32.76  |  50.00
      1.81     14.05     30.14  |  46.00
    ---------------------------------
      8.00     62.00    133.00  | 203.00
```

☐ = 99%

Cut off Points

I.Q.	Total Readiness
-90	-23
105	
115	77
125+	78+

TABLE 15

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
READINESS VS. ARITHMETIC REASONING
HYPOTHESIS NUMBER 7 - 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS READINESS VS ARITH REASONING  HYPOT  7  5-9-69

ACTUAL CONTINGENCY TABLE
        ARITH. Reasoning   High
Low    5         3         0    |     8
READINESS
      32        18        12    |    62
High  28        47        57    |   132
---------------------------------------
      65        68        69    |   202

CHISQUARE=    [24,931]     DF=   4      CONTINGENCY COEFF.=    0,331


EXPECTED CONTINGENCY TABLE

      2,57      2,69      2,73  |    8,00
     19,95     20,87     21,18  |   62,00
     42,48     44,44     45,09  |  132,00
-----------------------------------------
     65,00     68,00     69,00  |  202,00
```

$\boxed{}$ = 99%

Cut off Points

Total Readiness	Arithmetic Reasoning
-23	-50
77	85
78+	86+

TABLE 16

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
READINESS VS. ARITHMETIC CONCEPTS
HYPOTHESIS NUMBER 8 - 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS READINESS VS ARITH CONCEPTS  HYPOT  8  5-9-69

ACTUAL CONTINGENCY TABLE
        ARITH. Concepts        High
  Low   6          2          0    |      8
 READINESS
       27         20         15    |     62
  High 27         31         73    |    131
      ---------------------------------------
       60         53         88    |    201

CHISQUARE=    27,496     DF=   4     CONTINGENCY COEFF.=   0.347


EXPECTED CONTINGENCY TABLE
                                   |
        2.39       2.11       3.50 |     8.00
       18.51      16.35      27.14 |    62.00
       39.10      34.54      57.35 |   131.00
      ---------------------------------------
       60.00      53.00      88.00 |   201.00
```

▭ = 99%

Cut off Points

Total Readiness	Arithmetic Concepts
-23	-50
77	85
78+	86+

TABLE 17

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS READINESS VS. ARITHMETIC COMPREHENSION HYPOTHESIS NUMBER 9 - 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS READINESS VS ARITH COMP  HYPOT  9  5-9-69
ACTUAL CONTINGENCY TABLE
   ARITH. COMP.         High
Low   7         1          0   |    8
     38        20          4   |   62
High 66        30         36   |  132
   ----------------------------+------
    111        51         40   |  202
READINESS
CHISQUARE=    15.524        DF=   4      CONTINGENCY COEFF.=    0.267


EXPECTED CONTINGENCY TABLE
                               |
      4,40      2.02      1,58 |     8,00
     34,07     15.65     12,28 |    62.00
     72,53     33.33     26,14 |   132.00
   ----------------------------+---------
    111.00     51.00     40,00 |   202.00
```

□ = 99%

Cut off Points

Total Readiness	Arithmetic Comprehension
-23	-50
77	85
78+	86+

TABLE 18

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
SEX VS. TOTAL ADJUSTMENT
HYPOTHESIS NUMBER 30
5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS SEX VS TOTAL ADJUSTMENT  HYPOT 30  5-9-69

ACTUAL CONTINGENCY TABLE
[redacted] Total  Adjustment High
SEX
   32 Boys  54          5    |    91
[redacted] 19 Girls 63         17    |    99
   ------------------------------------
   51       117        22    |   190

CHISQUARE=    [10.233]     DF=   2       CONTINGENCY COEFF.=   0.226           □ = 99%


EXPECTED CONTINGENCY TABLE

   24.43     56.04     10.54  |  91.00
   26.57     60.96     11.46  |  99.00
   ------------------------------------
   51.00    117.00     22.00  | 190.00
```

Cut off Points

Sex	Total Adjustment
1 Male	-23
2 Female	77
	78+

TABLE 19

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS
SCHOOL VS. READING VOCABULARY
HYPOTHESIS NUMBER 33
5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS SCHOOL VS READING VOCAB  HYPOT 33  5-9-69
ACTUAL CONTINGENCY TABLE
Low    READING    VOCAB;    High
School  30         39         48     |  117
High    36         27         23     |   86
-------------------------------------+------
        66         66         71     |  203
CHISQUARE=     (6.958)      DF=    2      CONTINGENCY COEFF.=    0.182

EXPECTED CONTINGENCY TABLE
                                        |
        38.04      38.04      40.92     |  117.00
        27.96      27.96      30.08     |   86.00
<---------------------------------------+---------
        66.00      66.00      71.00     |  203.00
```

⬭ = 95%

Cut off Points

School	Reading Vocabulary
1 Experimental	-50
2 Control	85
	86+

TABLE 20

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS SCHOOL VS. ARITHMETIC COMPREHENSION HYPOTHESIS NUMBER 37 - 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS SCHOOL VS ARITH COMP  HYPOT 37  5-9-69
ACTUAL CONTINGENCY TABLE
[redacted] ARITH. COMP.          High
School  41-Ex.   41        35   |   117
[redacted] 70-CON.  10         5   |    85
        -----------------------------------
        111      51        40   |   202
CHISQUARE=   ☐44,979☐     DF=   2      CONTINGENCY COEFF.=   0.427        ☐ = 99%

EXPECTED CONTINGENCY TABLE

     64.29     29.54     23.17  | 117.00
     46.71     21.46     16.83  |  85.00
   ---------------------------------------
    111.00     51.00     40.00  | 202.00
```

Cut off Points

School	Arithmetic Comprehension
1 = Experimental	-50
2 = Control	85
	86+

TABLE 21

CHI-SQUARE ANALYSIS FOR RUN BOTH SCHOOLS SCHOOL VS. TOTAL ORIGINALITY HYPOTHESIS NUMBER 41 5-9-69

```
CHI SQUARE ANALYSIS FOR RUN BOTH SCHOOLS SCHOOL VS TOTAL ORIGINALITY  HYPOY 41  5-9-69
ACTUAL CONTINGENCY TABLE
[redacted] TOTAL    ORIG.     High
School    8-EX.     61        37     |  106
[redacted] 26 -CON.  47        11     |   84
          34        108       48     |  190
CHISQUARE=   23,191     DF=   2     CONTINGENCY COEFF.=   0,330


EXPECTED CONTINGENCY TABLE

     18,97     60.25     26.78   | 106.00
     15,03     47,75     21.22   |  84.00
     34,00     108.00    48.00   | 190.00
```

▭ = 99%

Cut off Points

School	Total Originality
1 - Experimental	-13
2 - Control	29
	30+

between the actual and expected values are not significant. Again, this coincides with the significance of the correlations between these variables as shown on Table 4.

Chi-square analysis was employed to compare years in school vs. grammatical usage and showed no significant relationship.

Chi-square analysis was employed to compare years in school vs. the four creativity categories. No significant relationship is noted in any of these. However, it might be noted on Table 4 there does appear to be a significant correlation between years in school and three of these four creativity factors. This apparent conflict is not a forceful one as the significances shown on Table 4 are only at the 95% level, and the Chi-square value on these analyses, are not statistically significant.

Chi-square analysis was employed to compare years of education of father vs. readiness, I.Q. and grammatical usage. No significant relationship was noted in any of the three Chi-square tests.

Chi-square analysis was employed to compare sex vs. readiness, I.Q., total adjustment and total originality.

Only in the area of total adjustment does a significant relationship appear. This is illustrated in Table 18. This is again verified by the data on Table 4. This would reinforce the premise that females in the combined schools appear to make a more satisfactory adjustment.

Chi-square analysis was employed to compare school vs. various factors. The factors of years of education of father, reading comprehension, arithmetic reasoning, arithmetic concepts, total adjustment, personal adjustment and social adjustment show no significant relationships. Table 19, reading vocabulary shows a significant relationship at the 95% level. Tables 20 and 21 show significant relationships in the areas of arithmetic computation and total originality at the 99% level. All of these findings concur with those on Table 4. The arithmetic computation in the control school has been previously noted. The total originality factor has again appeared to be stronger in the experimental school.

It is worthy of note that to perform the Chi-square statistical analysis of the 41 hypotheses, the computer used considerably less than one minute of real time. (Time in which the computer actually made the analyses.)

It is conceivable that days or even weeks of work with a desk calculator might be needed to achieve the same result.

Although the actual calculations of the computer are measured in milliseconds, weeks, months or even years can be spent in obtaining and categorizing the data to be analyzed. When the data has been analyzed, interpretations must be made acting on this data. This data has always been available but without EDP, little use has been made of it.

STEPWISE MULTIPLE REGRESSION

Stepwise Multiple Regression is a statistical attempt to tie together three or more variables in the form of a mathematical equation by adding one variable in each successive step in order to determine its effect on the percent of variance of the original factor, in this case school. For instance, if variable number 1 (X_1) is to be expressed in terms of three other variables, (X_2, X_3, X_4) the end result might look like $X_1=AX_2+BX_3+CX_4=D$. In the above expression, A,B,C and D are the values which the multiple regression finds to provide the best fitting straight line for the data.

Tables 22 through 27 show the steps in a six step process designed to predict variable 1, (school), from 6 other variables. Table 22 shows the multiple regression for fitting variable 1, (school), with variable 31, (elaboration). Table 22, a reduced computer print-out, lists the Beta value, standard error, t value with degrees of freedom, the B coefficient, standard error of B and partial R, correlation coefficient in the same row listing variable 31.

For the purpose of this paper, we will be using only Beta, the t-Test on Beta, and the B coefficient, and the proportion of unexplained variance statement.

The t value, in this case, -6.3687, is used to determine the significance of the difference between Beta and zero.

This difference is significant to the 99% level in Table 22. From the data shown in this table one may now write $V_1=(-0.0291)V_{31}+1.0229$ where V_1 stands for variable 1 and V_{31} stands for variable 31.

Elaboration was chosen as the first variable because it has a high correlation with school and its unique non-correlation with the other three creativity tests.

Through the use of the elaboration factor it can be seen that approximately 20% of the variance of the school factor has been accounted for.

In Table 23, step 2, a second variable number 32, (fluencey) was considered. Its Beta value was calculated and a t-Test performed. The difference between this Beta value and zero was not significant, and it may be noted that the new equation, $V_1=(0.0221)V_{31}=(-0.0117)V_{32}+1.0739$, still only accounts for about 20% of the variance of

TABLE 22

STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN
COMBINED SCHOOLS, 5-24-69

```
STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN, COMBINED SCHOOLS, 5-24-69

STEP NO.  1     DEP. VAR. NO.  1-School   N= 175          DETERM=   1.0000
ELAB
VAR. NO.           BETA          STD.ERR.        T.NDF=173        B COEF.        S.E.B        PARTIAL R
   31            -0.4379         0.0688          -6.3687         -0.0291        0.0046        -0.4379
                                                       CONSTANT=  1.0229

MULTIPLE R=0.4379          STD.ERR.EST.=   0.4394          PROPORTION UNEXPLAINED VARIANCE=0.8083

        F=  41.0351          N.D.F.=  1.0, 173.0
```

$\boxed{}$ = 99%

TABLE 23

STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN COMBINED SCHOOLS, 5-24-69

```
STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN. COMBINED SCHOOLS, 5-24-69

STEP NO.  2     DEP. VAR. NO.  1-School    N= 175          DETERM=   0.2644

VAR. NO.            BETA          STD.ERR.        T.NDF=172       B COEF.        S.E.B        PARTIAL R
   31 ELAB       -0.3331          0.1334         -2.4973        -0.0221        0.0089        -0.1876
   32 FLUENCY    -0.1222          0.1334         -0.9158        -0.0117        0.0128        -0.0699
                                                     CONSTANT=   1.0739

MULTIPLE R=0.4423           STD.ERR.EST.=   0.4383          PROPORTION UNEXPLAINED VARIANCE=0.8043

        F=  20.9208          N.D.F.=  2.0, 172.0
```

⬭ = 95%

TABLE 24

STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN COMBINED SCHOOLS, 5-24-69

```
STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN, COMBINED SCHOOLS, 5-24-69
STEP NO.  3     DEP. VAR. NO.  1-School   N= 175          DETERM=   0.2597
VAR. NO.          BETA          STD.ERR.      T.NDF=171       B COEF.        S.E.B          PARTIAL R
   31 ELAB      -0.3057          0.1230        -2.4847        -0.0203        0.0082          -0.1867
   32 FLUENCY   -0.1011          0.1230        -0.8222        -0.0097        0.0118          -0.0628
    6 OCC.       0.3508          0.0638         5.5005         0.0081        0.0015           0.3877
                                                    CONSTANT=   0.7943
MULTIPLE R=0.5627          STD.ERR.EST.=   0.4040          PROPORTION UNEXPLAINED VARIANCE=0.6834
        F=  26.4046           N.D.F.=  3.0, 171.0
```

⬭ = 95%

▭ = 99%

TABLE 25

STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN COMBINED SCHOOLS, 5-24-69

```
STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN. COMBINED SCHOOLS. 5-24-69

STEP NO.  4     DEP. VAR. NO.  1 -School   N= 175           DETERM=   0.0989

VAR. NO.              BETA         STD.ERR.      T.NDF=170      B COEF.        S.E.B        PARTIAL R
   31 Elab.         -0.2742        0.1378        -1.9908       -0.0182        0.0091       -0.1505
   32 Fluency       -0.0907        0.1246        -0.7277       -0.0087        0.0120       -0.0556
    6 Occ.           0.3507        0.0637         5.5015        0.0081        0.0015        0.3878
   29 Soc. Adj.     -0.0519        0.1024        -0.5069       -0.0027        0.0053       -0.0387
                                                     CONSTANT=   0.7928

MULTIPLE R=0.5636           STD.ERR.EST.=   0.4037          PROPORTION UNEXPLAINED VARIANCE=0.6824

      F=  19.7811           N.D.F.=  4.0. 170.0
```

⬭ = 95%

▭ = 99%

TABLE 26

STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN
COMBINED SCHOOLS, 5-24-69

```
STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN, COMBINED SCHOOLS, 5-24-69
STEP NO.  5     DEP. VAR. NO.  1 -School   N= 175         DETERM=   0.0916

VAR. NO.            BETA          STD.ERR.       T.NDF=169       B COEF.         S.E.B         PARTIAL R
   31 ELAB.       -0.1513          0.1358         -1.1143        -0.0100         0.0090         -0.0849
   32 FLUENCY     -0.1392          0.1201         -1.1587        -0.0134         0.0115         -0.0883
    6 OCC.         0.3245          0.0615          5.2798         0.0075         0.0014          0.3744
   29 Soc. Adj.   -0.1196          0.0997         -1.2005        -0.0061         0.0051         -0.0914
   30 ORIG.        0.2444          0.0629          3.8855         0.0137         0.0035          0.2848
                                                      CONSTANT=   0.5844
MULTIPLE R=0.6107           STD.ERR.EST.=   0.3870          PROPORTION UNEXPLAINED VARIANCE=0.6270

        F=  20.1048          N.D.F.=  5.0, 169.0
```

□ = 99%

TABLE 27

STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN COMBINED SCHOOLS, 5-24-69

```
STEPWISE MULTIPLE REGRESSION FOR TRIAL FACTOR ANALYSIS RUN, COMBINED SCHOOLS. 5-24-69

STEP NO.  6     DEP. VAR. NO.  1-School    N= 175          DETERM=   0.0811

VAR. NO.              BETA          STD.ERR.        T.NDF=168        B COEF.          S.E.B         PARTIAL R
   31 ELAB.         -0.1022          0.1345         -0.7599         -0.0068          0.0089         -0.0580
   32 FLUENCY       -0.1484          0.1178         -1.2593         -0.0142          0.0113         -0.0959
    6 OCC.           0.3037          0.0608          4.9960          0.0070          0.0014          0.3569
   29 Soc. Adj.     -0.1489          0.0984         -1.5137         -0.0076          0.0050         -0.1150
   30 ORIG.          0.2087          0.0632          3.3046          0.0117          0.0035          0.2450
    3 Metro. Read.   0.1655          0.0631          2.6216          0.0041          0.0016          0.1966
                                                        CONSTANT=    0.2778

MULTIPLE R=0.6302          STD.ERR.EST.=    0.3794          PROPORTION UNEXPLAINED VARIANCE=0.6028

         F=   18.4496          N.D.F.=  6.0, 168.0
```

▭ = 99%

variable 1.

In Table 24, a third variable, variable 6 (occupation of father) was considered, its Beta value computed and a t-Test performed. This Beta value was found to be significant at the 99% level. The resulting equation using these three variables increases the explained variance of variable 1 (school) to approximately 32%. This is an increase in the accountable variance of approximately 12%.

Table 25 shows the addition of variable 29 with a Beta value that is not significant, and a resulting equation which does not greatly change the amount of accountable variance.

Table 26 adds variable 30 (originality). Its Beta value is significant at the 99% level and the resulting equation increases the accountable variance of variable 1 to approximately 37%, an increase of 5%.

Table 27 adds the last of the six variables, variable 3 (Metropolitan Total Readiness) whose Beta value is significant to the 99% level. The resulting equation, $V_1=-0.0068V_{32}+0.0070V_6-0.0076V_{29}+0.0117V_{30}+0.0041V_3+0.2778$ now accounts for approximately 40% of the variance of variable 1.

It may be noted that while the Beta value began, on Table 22, to be highly significant, the addition of succeeding variables reduced the Beta value significance of variable 31 to the 95% level. In steps two through four and to a below statistically significant level in steps 5 and 6.

Variable 6 (father's occupation) continues to have a high significance of its Beta value, despite the addition of three succeeding variables.

Although this consistently high value of the t-Test variable 6 is statistically interesting, it is due to the coding of the occupations themselves and does not have relevancy to the real world.

In step 6 the Beta values of variables 6, 30 and 3 all are highly significant from zero while the Beta values of variables 31, 32 and 29 are not. This would imply that the use of the B coefficient of the first three variables named would be a higher predictor of school. Elaboration in conjunction with the other variables no longer is statistically significant as a predictor of school.

Thus it can be seen through the use of six out of thirty-two variables, five of which showed a significant correlation with variable 1, an algebraic expression has been derived that accounts for approximately 40% of the variance of variable 1.

Addition of further variables would slowly increase the amount of explainable variance.

FACTOR ANALYSIS

Of the eight statistical treatments that were used in the study, factor analysis was the most difficult procedure for this administrator to interpret.

Factor analysis is a statistical method used to show:

1. The number of dimensions needed to account for a satisfactory amount of the variance of the data. Restricted to eight dimensions in this study.
2. The location of a reference axis system of this number of dimensions to produce "simple structure" which will maximize high and low loadings, minimizing medium loadings. (loading is the contribution of the original variable to the factor)

An analogy may be made with a topographical map where the problem posed is to serve the greatest population areas in the most economical manner by the construction of a highway system.

Were the highways to intersect at right angles, North and South, East and West, this might not fulfill the criteria stated: namely, to serve the greatest number of people in the most economical manner. To rotate these "spokes" until the maximum benefits are achieved and the minimum problems encountered would be logical.

Factor analysis, in this study, performs a similar function with matrices, but rotates the axis in a manner that will identify the factors which have the greatest effect on the variables. The computer then prints out the percent of variance accounted for by each factor until further considerations would account for little additional variance.

Tables 28 through 39 are reduced computer print-outs of factor analyses for 8 different considerations.

A great deal of the print-out is not pertinent to this study, but does indicate various sequential calculations of the computer in performing this factor analysis.

The first study will be included in its entirety, in order to acquaint the reader with the computer print-out pattern. For the last seven runs only the final output, the new rotated correlation matrix will be included with the percent of variance accounted for by each factor.

Tables 28 through 32 present the factor analysis for male students in the experimental school. Although this is actually one print-out of one run, it is labeled as one table for each page of print-out for purposes of easy identification. This selection causes the variables, school and sex to be constant and therefore will not enter into the calculations. In addition, the variable, race, is deleted, since it was a constant in the entire study.

Tables 28 through 30 are a print-out of the original correlation matrix between all thirty remaining variables.

Table 31, item named, principal component, number of iterations, latent root, principal component matrix, and accumulative percent variance accounted for are not of great interest to the educational administrator.

On Tables 31 and 32 the two items of interest are "percent variance accounted for by each factor" and the "varimax rotated factor matrix."

The percent variance table indicates the percentage of variance accounted for in each column of the final rotated matrix. On Table 31 it is noted that the first column accounts for 33.87% of the total variance. Proceeding down this column (to Table 33) it can be seen that this factor is very heavily loaded in variables, 14 through 26. These 13 variables are the percentiles on the personality scores. The conclusion to be drawn here is that a personality factor accounts for 33.87% of the total variance. Personality factors account for this high percent of the total variance due to the number of personality variables.

Column three shows the second highest accountable variance, 25.95%. In scanning this column, it can be seen that this factor is very heavily loaded in variables 1, 2, and 6 through 11. These are the I.Q., readiness and achievement scores.

The fifth column is third in importance and accounts for 9.81% of the variance. Here variables 27, 29, and 30 are heavily loaded. These are the originality, fluency and flexibility scores. Next is the second column, accounting for 8.98% of the variance. The important variables here are 3 through 5, years in school, father's occupation and years of father's education. In earlier parts of this study it has been noted that these are maverick variables which have appeared in unusual situations.

Column six accounts for 7.08% of the variance and shows a high relationship with items 12 and 13, self-reliance and personal worth. It may be noted that these are separated from the other personality variables, and hence are influenced by a factor distinct from the one previously mentioned.

Column eight accounts for 5.92% of the variance and is strongest in item 19 and 21, social skills and family relations.

Column four accounts for 4.93% of the variance and has variable 28, elaboration, as its focal point.

Column seven accounts for 4.37% of the variance with strongest contribution from item 5, years of education of father.

In total, the eight columns account for 100% of the variance accounted for in the original factoring.

Table 33 is the factor analysis for females in the experimental school. The first four major factors follow the same sequence of importance as the male in the experimental school with some variation on the percent of variance accounted for in each factor.

Table 34 is the factor analysis for males in the control school. The same general pattern appears in these results.

Table 35 is the factor analysis for females in the control school. The same general pattern appears in these results.

Table 36 is the factor analysis for males across both schools, control and experimental. The same general pattern appears in these results.

Table 37 is for the factor analysis for females across both schools. The first two major factors maintain the same relative importance in personality and achievement correlations.

The third most important factor in this grouping is the factor involved in school and elaboration as noted in the stepwise multiple regression analysis;when other variables are added the percent of variance accounted for by the variable, elaboration, does not remain statistically significant.

It would appear therefore that school is a more important factor for girls. As previously noted, school and elaboration have always been closely correlated.

Table 39 is for males and females in the experimental school, 40 is for the control school. The same pattern as previously noted in five of the other six groupings is consistent with those two groupings as well.

Through these eight different runs for factor analysis, it can be stated conclusively that the factor which contributes the greatest amount of variance is that involving personality due to the number of entries of data. The second area of importance is that factor involving I.Q., achievement and readiness. The third area of importance is that factor concerning creativity with the exception of the previously discussed variable of elaboration.

One of the major results of the factor analysis is to indicate that there is no apparent difference in factor structure and no major differences between schools or between sexes in the schools.

ANALYSIS OF VARIANCE

Analysis of variance is a statistical device which determines whether or not there is a statistical difference between two or more groups on the same variable, by ascribing

TABLE 28

CORRELATION MATRIX, SCHOOL 0 SEX 1 6-1-69
FACTOR ANALYSIS MALE EXPERIMENTAL SCHOOL

EX. MALE

CORRELATION MATRIX, SCHOOL 0 SEX 1 6-1-69

N= 57 PAGE 1

VAR	1	2	3	4	5	6	7	8	9	10
M	71.754	109.632	3.596	18.175	14.439	54.496	61.772	70.018	62.088	65.018
SD	21.0 4	13.676	1.663	15. 51	2.457	25.867	27.897	26.699	28.721	29.871
1	1.000	0.591	-0.185	-0. 46	0.068	0.572	0.502	0.616	0.470	0.416
2	0.591	1.000	-0. 58	-0.056	0.111	0.660	0.531	0.658	0.512	0.605
3	-0.185	-0.058	1.000	0.293	-0.111	-0.016	0.062	-0.040	0.043	-0.022
4	-0.046	-0.056	0.293	1. 00	-0.408	-0.154	0.147	-0.044	-0.088	-0.130
5	0.068	0.111	-0.111	-0.408	1.000	0.092	0.104	0.129	0.123	0.094
6	0.572	0.66	-0. 16	-0.154	0.092	1.000	0.622	0.690	0.491	0.733
7	0.502	0.531	0. 62	0.147	0.104	0.622	1.000	0.856	0.529	0.705
8	0.616	0.658	-0. 4	-0. 44	0.129	0.690	0.856	1.000	0.628	0.739
9	0.470	0.512	0. 43	-0. 88	0.123	0.491	0.529	0.628	1.000	0.551
10	0.410	0.605	-0. 22	-0.13	0.094	0.733	0.705	0.739	0.551	1.000
11	0. 56	0.652	-0. 42	-0.101	0.069	0.731	0.643	0.750	0.553	0.823
12	0.1 8	0.119	0.299	-0. 75	0.106	0.064	0.101	0.118	0.135	0.091
13	0.130	-0.015	-0. 53	-0.335	0.086	0.067	-0.035	0.107	0.164	0.095
14	0.199	0.143	-0. 29	-0.319	0.202	0.320	0.213	0.227	0.255	0.239
15	0.060	0.067	0.165	-0.30	0.120	0.176	0.082	0.097	0.085	0.090
16	0.085	0.144	0.132	-0.107	0.116	0.203	0.103	0.123	0.148	0.103
17	0.059	0.118	0.132	0. 32	0.034	0.103	0.079	0.079	0.127	0.154
18	0.059	0.52	0.109	-0. 18	0.116	0.399	0.500	0.425	0.326	0.463
19	0.088	0.047	-0. 59	-0.302	0.080	0.235	0.111	0.187	0.203	0.185
20	0.04	0.117	0. 57	-0. 71	0.162	0.181	0.242	0.246	0.177	0.269
21	-0.062	0.142	-0. 29	-0.173	0.086	0.278	0.088	0.110	0.031	0.208
22	0.053	0.17	0.113	-0.163	0.028	0.202	0.113	0.151	0.136	0.194
23	0.09	0.261	-0. 16	-0.206	0.150	0.378	0.237	0.244	0.244	0.267
24	0.111	0.216	0.137	-0.205	0.151	0.300	0.222	0.253	0.217	0.287
25	0.164	0.136	0.154	-0.214	0.190	0.223	0.142	0.184	0.202	0.176
26	0.062	0.253	0. 42	-0.20	0.119	0.338	0.260	0.279	0.198	0.332
27	0.045	-0.094	-0.19	-0. 51	-0.051	-0.133	-0.119	-0.246	-0.179	-0.202
28	0.2 3	0.14	0. 26	0. 05	-0.158	0.118	0.193	0.237	0.108	0.156
29	-0.121	-0.12	-0.152	-0. 63	0.047	-0.236	-0.233	-0.352	-0.096	-0.300
30	-0.063	-0.144	-0. 75	-0.128	0.043	0.031	-0.069	-0.188	-0.032	-0.097

TABLE 29

CORRELATION MATRIX, SCHOOL 0 SEX 1 6-1-69
FACTOR ANALYSIS MALE EXPERIMENTAL SCHOOL

CORRELATION MATRIX, SCHOOL EX SEX 1 Male 6-1-69 N= 57 PAGE 2

VAR	11	12	13	14	15	16	17	18	19	20
M	66.14	44.123	47.404	38.123	35.018	52.789	47.825	34.895	40.211	22.702
SD	29.029	24.335	27.555	26.666	29.468	29.496	28.533	24.889	28.246	26.361
1	0.56	0.100	0.136	.199	0.068	0.085	0.059	0.369	0.088	0.040
2	0.052	0.119	-0. 15	.143	0.067	0.144	0.118	0.520	0.047	0.117
3	-0.042	0.299	-0. 33	-. 29	0.165	0.132	0.132	0.109	-0.059	0.057
4	-0.102	-0.073	-0.335	- .319	-0.3 0	-0.107	0.032	-0.018	-0.302	-0.070
5	0.069	0.106	0. 86	.202	0.120	0.116	0.034	0.116	0.080	0.162
6	0.731	0.064	0. 67	.32	0.176	0.203	0.103	0.399	0.255	0.181
7	0.643	0.101	-0. 35	.213	0.082	0.103	0.079	0.500	0.111	0.242
8	0.75	0.110	0.107	.227	0.097	0.123	0.079	0.425	0.187	0.246
9	0.553	0.135	0.164	.255	0.085	0.148	0.127	0.326	0.203	0.177
10	0.623	0.091	0. 95	.239	0.090	0.103	0.154	0.463	0.185	0.269
11	1.000	0.066	0.125	.228	0.142	0.060	0.016	0.496	0.217	0.182
12	0.066	1.000	0.33	.281	0.342	0.254	0.252	0.099	0.312	0.216
13	0.125	0.33	1. 0	.295	0.5 3	0.388	0.164	0.032	0.341	0.163
14	0.228	0.281	0.295	1. 0	0.661	0.583	0.515	0.314	0.395	0.490
15	0.142	0.342	0.503	.661	1.000	0.668	0.501	0.385	0.434	0.469
16	0.06	0.254	0.388	.583	0.668	1.000	0.671	0.282	0.350	0.588
17	0.016	0.252	0.164	.515	0.5 1	0.671	1.000	0.291	0.306	0.584
18	0.496	0.099	0. 32	.314	0.385	0.282	0.291	1.000	0.302	0.373
19	0.217	0.312	0.341	.395	0.434	0.350	0.306	0.302	1.000	0.446
20	0.182	0.216	0.163	.49	0.469	0.588	0.584	0.373	0.446	1.000
21	0.254	0.069	0. 69	.533	0.404	0.371	0.559	0.446	0.475	0.489
22	0.211	0.083	0.379	.55	0.569	0.596	0.540	0.464	0.413	0.570
23	0.393	0.077	0.195	.529	0.450	0.327	0.343	0.559	0.486	0.278
24	0.259	0.404	0.463	.754	0.786	0.756	0.713	0.527	0.641	0.728
25	0.148	0.557	0.601	.759	0.825	0.827	0.707	0.328	0.477	0.589
26	0.344	0.17	0.246	.63	0.580	0.548	0.558	0.630	0.667	0.735
27	-0.135	-0.037	-0. 25	-. 22	-0.075	-0.217	-0.007	-0.054	0.017	-0.146
28	0.065	0.01	0.115	.012	-0.034	0.031	0.023	0.058	0.037	0.055
29	-0.202	-0.073	-0.917	-.222	-0.181	-0.240	-0.238	-0.153	-0.015	-0.153
30	-0.063	-0.213	-0. 23	-. 41	0.005	-0.264	-0.169	0.041	0.043	-0.118

TABLE 30

CORRELATION MATRIX, SCHOOL 0 SEX 1 6-1-69
FACTOR ANALYSIS MALE EXPERIMENTAL SCHOOL

CORRELATION MATRIX, SCHOOL EX MALE SEX 1 6-1-69 N= 57 PAGE 3

VAR	21	22	23	24	25	26	27	28	29	30
M	27.965	38.15	36.316	33.228	37.263	28.439	26.193	12.561	25.333	19.000
SD	26.283	24.23	25.60	21.531	22.812	22.780	8.174	9.470	5.913	3.802
1	-0.062	0.053	0. 9	0.111	0.164	0.062	0.045	0.203	-0.121	-0.063
2	0.142	0.17	0.261	0.216	0.136	0.253	-0.094	0.140	-0.120	-0.044
3	-0.029	0.11	-0. 16	0.137	0.154	0.042	-0.190	0.026	-0.152	-0.075
4	-0.170	-0.16	-0.206	-0.205	-0.214	-0.200	-0.061	0.005	-0.063	-0.128
5	0.080	0.02	0.15	0.151	0.190	0.119	-0.051	-0.158	0.047	0.043
6	0.270	0.20	0.378	0.30	0.223	0.338	-0.133	0.118	-0.236	0.031
7	0.080	0.113	0.237	0.222	0.142	0.260	-0.119	0.193	-0.233	-0.069
8	0.11	0.151	0.244	0.253	0.184	0.279	-0.246	0.237	-0.352	-0.188
9	0.03	0.133	0.244	0.217	0.2 2	0.198	-0.179	0.108	-0.096	-0.032
10	0.200	0.194	0.267	0.287	0.176	0.332	-0.202	0.156	-0.300	-0.097
11	0.254	0.211	0.393	0.259	0.148	0.344	-0.135	0.065	-0.202	-0.063
12	0.069	0.083	0. 77	0.404	0.557	0.170	-0.137	0.010	-0.073	-0.213
13	0.069	0.37	0.195	0.463	0.6 1	0.246	-0.025	0.115	-0.017	-0.023
14	0.530	0.55	0.529	0.754	0.759	0.630	-0.022	0.012	-0.222	-0.041
15	0.40	0.56	0.45	0.795	0.825	0.580	-0.075	-0.034	-0.181	0.005
16	0.37	0.59	0.327	0.756	0.827	0.548	-0.217	0.031	-0.240	-0.264
17	0.359	0.54	0.343	0.713	0.7 7	0.558	-0.007	0.023	-0.238	-0.169
18	0.440	0.464	0.559	0.527	0.328	0.630	-0.054	0.058	-0.153	0.041
19	0.475	0.413	0.486	0.641	0.477	0.667	0.017	0.037	-0.015	0.043
20	0.469	0.57	0.278	0.728	0.589	0.735	-0.146	0.055	-0.153	-0.118
21	1.000	0.57	0.612	0.668	0.389	0.838	-0.015	0.017	-0.054	0.091
22	0.579	1.000	0.415	0.769	0.616	0.766	0.004	0.059	-0.003	0.142
23	0.612	0.415	1. 0	0.616	0.424	0.688	0.054	-0.042	-0.134	0.025
24	0.666	0.769	0.616	1.000	0.886	0.883	-0.052	0.058	-0.196	-0.048
25	0.389	0.905	0.424	0.886	1.000	0.607	-0.108	0.048	-0.224	-0.161
26	0.633	0.765	0.688	0.883	0.507	1.000	-0.054	0.036	-0.115	0.048
27	-0.012	0.004	0. 54	-0. 52	-0.108	-0.054	1.000	0.057	0.598	0.571
28	0.017	0.05	-0. 42	0. 58	0.048	0.036	0.057	1.000	-0.114	0.063
29	-0.054	-0.005	-0.134	-0.195	-0.224	-0.115	0.598	-0.114	1.000	0.677
30	0.091	0.142	0. 25	-0.046	-0.161	0.048	0.571	0.063	0.677	1.000

TABLE 31

PRINCIPAL COMPONENT MATRIX
PERCENT VARIANCE
ACCOUNTED FOR

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        31.15     46.67     55.23     61.28     66.29     70.19     73.69     76.69
PRINCIPAL COMPONENT MATRIX

  1   0.3754    0,5915    0,0695   -0.2565    0.2416   -0.1449    0,2363   -0.2175
  2   0.4840    0,6250    0,0857    0.0055    0.0766    0.0748    0,1576   -0,1225
  3   0. 757   -0.1092   -0,3942     .2996    0.3998    0.4907   -0,3035    0,0877
  4  -0.2471    0,1288   -0,3382     .6136    0.3871    0.0651    0,1134   -0,1245
  5   0.2012   -0,0057    0,1465   -0.4195   -0.3760    0.4412    0,3375    0,3752
  6   0.5891    0,5887    0,1094   -0.0258   -0.0408   -0.0098   -0,0463   -0,1099
  7   0.5010    0,6658   -0,0427     .1249    0.1397    0.0935    0,0712    0,1487
  8   0.5674    0,7164   -0,0943   -0.0651    0.0256   -0.0521    0,0070    0,1276
  9   0.4677    0,5137    0,0024   -0.1713    0.1336    0.1294    0,0067    0,0602
 10   0.5740    0,6387   -0,0016    0.0163   -0.0689   -0.0062   -0,0799    0,1021
 11   0.5711    0,6614    0,1140    0.0016   -0.0721    0.0367   -0,1572   -0,1301
 12   0.3530   -0,1592   -0,3035   - ,3457    0.3368    0.3869   -0,2514    0,0834
 13   0.4052   -0,2563   -0,0094   - .5845    0.2231   -0.1903   -0,2684   -0,1144
 14   0.7435   -0,2613    0,0324   - ,1326   -0,0774   -0.0495    0,1394   -0,1047
 15   0.6976   -0,4315   -0,0518   - .1733    0.0930    0.0484   -0,0451   -0.1953
 16   0.6861   -0,3908   -0,2808   -0.0530    0.0882   -0,0896    0,2706   -0,0606
 17   0.6123   -0,3727   -0,2027    0.1726    0.1622   -0.0603    0,3783   -0.0338
 18   0.6612    0,2119    0,1582     .3271   -0.0023    0.1702    0,0024   -0,0952
 19   0.5961   -0,2372    0,2051   -0.0820   -0.0804   -0.0472   -0,3759    0,1322
 20   0.6792   -0,2000   -0,0863     .1934   -0.0298   -0.0240    0,2242    0,3855
 21   0.6245   -0,2643    0,2763    0.3667   -0.3049   -0.0543   -0,1588    0,0558
 22   0.6995   -0,3421    0,1729    0.1922    0,1031   -0.1052    0,0454    0,0076
 23   0.6576   -0.0775    0,2614     .1672   -0.2611    0.0630   -0,2068   -0,2678
 24   0.9098   -0,3793    0,0035    0.0450    0.0647    0.0012   -0,0095    0,0151
 25   0.7987   -0,4159   - ,1990   - .2549    0.2066    0.0247    0,0926   -0,0741
 26   0.8497   -0,2565    0,2024    0.2963   -0.1531   -0,0241   -0,0929    0,1045
 27  -0.1656   -0,1464    0,7089    0.0026    0.3680   -0.0476    0,1749   -0,1260
 28   0.1109    0,1603   -0,0013    0.0085    0,4031   -0.5865   -0,1592    0,4708
 29  -0.2982   -0,1756    0,7217   -0.0675    0.3108    0.2390    0,0770    0,0703
 30  -0.1088   -0,0793     ,8136    0.0593    0,2895    0.1228   -0,0286    0,0980

NUMBER OF ITERATIONS
          16        11        28         9         6        10         6         4

PERCENT VARIANCE ACCOUNTED FOR BY EACH FACTOR
        33,87      8.08     25.95      4.93      9.81      7.08      4.37      5,92

FINAL TRANSFORMATION MATRIX

     -0.8566   -0,0717   -0,4954    0.0052   -0.0705   -0.0587    0,0131   -0,0824
      0.4942    0,0028   -0,8656   -0.0242   -0.0559    0.1060   -0,0123    0,0016
     -0. 090   -0,4084   - ,0333   -0.0175    0,8452    0.2376    0,0871   -0,2309
     -0. 834    0,7029    0,0173    0.0703    0,1018    0.5647   -0,1816   -0,3626
     -0. 345    0,5350   - , 925   - .3940    0.4624   -0.4466    0,0767    0,3601
      0. 545    0,1049   -0,0556     .7023    0.1992   -0.4895   -0,4267   -0,1686
     -0.1006   -0,0830   -0,0132     .1856    0.1045    0.3985   -0,4372    0,7665
      0. 199   -0,1728    0,0269   -0.5579   -0.0529   -0.1096   -0,7616   -0,2507
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TABLE 32

VARIMAX ROTATED FACTOR MATRIX
MALE EXPERIMENTAL SCHOOL

VARIMAX ROTATED FACTOR MATRIX

1	0. 613	0,1182	,8406	-0.0735	-0.1069	0.0077	0,2237	-0,4569
2	0.1496	0,0087	,9640	.1284	-0.0934	-0.0807	0,0042	-0,1281
3	0.1089	-0,7341	-0,0193	.1293	0.0637	0.5606	-0,2283	0,2484
4	0.2346	0,9388	-0,0125	-.0328	-0.0033	0.1712	0,1137	0,1417
5	0.1439	0,6776	-,1000	0.3080	0.0036	0.1859	-0,6138	-0,0622
6	0.2463	0,1217	,9420	0.0553	0.0052	-0.0657	0,1409	0,0993
7	0.1304	-0,1417	,9507	-0.0721	0.0149	-0.0063	-0,2301	0,0272
8	0.1370	0,0648	,9571	-0.1438	0.1835	0.0147	-0,0793	0,0095
9	0.1748	0,1071	,9367	-0.0218	-0.0108	0.2644	-0,0844	-0,0542
10	0.1903	0,0870	,9446	-0.0692	0.1408	-0.0385	-0,0561	0,1863
11	0.1607	0,0922	,9389	0.0910	0.0179	-0.0335	0,1713	0,2124
12	0.3762	-0.0987	,0972	0.0390	0.1267	0,9044	-0,0599	-0,0101
13	0.4854	0,3427	-0,0006	-0.2787	0.0445	0.5619	0,4833	-0,1342
14	0.9366	0,2435	,1720	0.0974	0.0600	0.0154	0,0896	-0,1122
15	0.9150	0,0685	-0,0098	0.1158	0.0324	0.2973	0,2257	-0,0648
16	0.9073	-0,0592	,0039	0.0006	0.2405	0.0665	-0,0316	-0,3318
17	0.8827	-0,2457	-,0110	0.0123	0.0825	-0.0980	-0,1582	-0.3446
18	0.5984	-0,1874	,6457	0.2384	-0.1817	-0.1672	-0,0566	0.2638
19	0.7349	0,2832	,1020	-0.1837	-0.0547	0.2057	0,1529	0,5166
20	0.8421	-0,0285	,1080	-0.1747	0.1161	-0.1062	-0,4708	0,0433
21	0.7561	0,0738	,0560	0.0582	-0.0789	-0.3381	-0,0049	0,5439
22	0.9578	-0,0628	,0712	-0.1053	-0.1995	-0.1138	0,0248	0.0959
23	0.6946	0,1251	,2928	0.3185	-0.0946	-0.1677	0,2937	0,4372
24	0.9824	0,0032	,1305	-0.0180	0.0071	0.1034	0,0059	0,0816
25	0.8956	0,0386	,0600	-0.0059	0.1147	0.3463	0,0666	-0.2349
26	0.8837	0,0314	,1860	-0.0044	-0.0662	-0.1735	-0,0636	0,3807
27	0. 322	-0,0898	,1719	.993	0.9385	0.1242	-0,1564	0,1807
28	0. 393	-0,0953	,2236	-0.9693	-0.0111	-0.0102	-0,0115	0,0085
29	0.1821	-0,1650	,2584	-0.0065	0.9219	-0.1118	0,1022	-0,0054
30	0. 480	-0,1457	,0733	.1084	0.9613	0.0150	0,0367	-0,1835

TABLE 33

VARIMAX ROTATED FACTOR MATRIX

FEMALE EXPERIMENTAL SCHOOL

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PERCENT VARIANCE ACCOUNTED FOR BY EACH FACTOR
      26.44    29.31     5.33     7.12     5.71    10.56     4.80     6.20     4.51
FINAL TRANSFORMATION MATRIX

    -0.6391   0.7495   0. 767  - .1121  -0.0617  -0.0336   0.0607  -0.0250  -0.0423
    -0.6291  -0.5624   0.2165  - .2755   0.0345   0.3506  -0.0148  -0.1233   0.0446
     0.3644   0.2845   0. 348  - .3256  -0.0801   0.6079   0.0346  -0.1226   0.0593
    -0.1833  -0.0394  -0.2601    .4349  -0.3429   0.3611  -0.2641   0.6173  -0.0962
     0. 022   0.0742   0. 225  - .1612   0.8394   0.0721  -0.1456   0.4862  -0.0260
     0. 901  -0.0038   0.7029    .2046  -0.0901   0.0313   0.5633   0.3574   0.0404
    -0. 410   0.0568   0.2887    .6893   0.3062   0.2228  -0.2926  -0.4424   0.0873
     0. 030  -0.0437  -0. 539    .0734   0.0976   0.0958   0.2063  -0.1384  -0.9536
    -0.1397  -0.0399  -0.5444    .2607   0.2346   0.1668   0.6771  -0.0953   0.2533
VARIMAX ROTATED FACTOR MATRIX

  1  0.7259   0.2691   0. 394    .1011   0.0522   0.1429  -0.5518  -0.2362  -0.0737
  2  0.9822   0.0494  -0. 560    .1072  -0.0643  -0.0492   0.0513   0.0684   0.0655
  3  0.1910   0.0561   0.1157    .9534   0.1884   0.0301  -0.0380   0.0073  -0.0100
  4  0.2615   0.2553   0. 656  - .1360   0.0764   0.0466   0.1007   0.0323   0.9077

  5  0.3674  -0.2480   0.6871  -0.0729   0.0650  -0.0362  -0.0201  -0.0719  -0.0033
  6  0.7004   0.3619    .1968   0.0603   0.5498  -0.0548   0.0982  -0.0086  -0.1424
  7  0.9732   0.1651  -0.0278  -0.0143  -0.0670   0.1066   0.0809  -0.0456   0.0118
  8  0.9771   0.0652  -0. 731  -0.0275  -0.1088  -0.0723   0.0956  -0.0786   0.0502
  9  0.8652   0.1169   0. 320   0.0326  -0.2888   0.1981  -0.0016  -0.0880   0.3245
 10  0.9182   0.0594   0.0834   0.0231   0.2398  -0.1825  -0.0217   0.1977  -0.0953
 11  0.9183   0.2458   0.2002   0.0608   0.1391   0.0534   0.0272   0.0826  -0.1509
 12  0.1942   0.5205   0.0745   0.1055  -0.1558   0.0848   0.6981  -0.1164   0.0872
 13  0.3389   0.7072  -0. 902    .2259   0.1389   0.3715  -0.0761  -0.2761   0.2942
 14  0.3667   0.7316  -0.1300  - .1721   0.1271  -0.0373  -0.1347  -0.4973  -0.0270
 15  0.2524   0.6756   0. 476    .0695   0.5578  -0.2761  -0.0054  -0.1500   0.2443
 16  0.2360   0.8569  -0.2970  -0.0448   0.0432  -0.1913  -0.2046  -0.2331   0.1071
 17  0.2910   0.7663   0.0122  - .0529  -0.2274  -0.1074   0.1172  -0.1502  -0.3582
 18  0.3102   0.1634   0. 105    .2855   0.0451  -0.1442   0.0359   0.8781  -0.0078
 19  0.3245   0.4249   0.5460    .3917  -0.2457   0.1004  -0.1142   0.4191   0.0588
 20  0.2384   0.9133  -0. 192   0.0771  -0.2421   0.0260  -0.0190   0.1535  -0.1399
 21  0.1549   0.9196   0. 460  - .3068   0.0322   0.0706   0.1018   0.1213   0.0554
 22  0.3484   0.8709  -0. 187    .1829   0.0786   0.1085  -0.0603   0.2535   0.0235
 23  0.2852   0.4128  -0. 925    .2673   0.4000   0.2144   0.6658   0.0222  -0.1358
 24  0.2995   0.9363   0. 513    .1081   0.0159   0.0094   0.0851   0.1052   0.0273
 25  0.3223   0.9054   0.0380    .0289   0.0982  -0.0035   0.0167  -0.2438   0.0680
 26  0.3015   0.8587   0. 640    .1358  -0.0210   0.0318   0.1020   0.3706   0.0009
 27 -0. 846   0.0687  -0.0307  - .2144  -0.0784   0.9515   0.0703   0.1079   0.0994
 28  0.2982   0.0019   0. 762    .6333  -0.6712  -0.1290   0.1774  -0.0727   0.0140
 29  0.1300   0.0282  -0.0097  - .2584  -0.0201   0.9530  -0.0490   0.0284  -0.0596
 30  0. 009  -0.0124   0.1357    .2866   0.0559  -0.9355   0.0126   0.1400   0.0344
```

TABLE 34

VARIMAX ROTATED FACTOR MATRIX

MALE CONTROL SCHOOL

```
PERCENT VARIANCE ACCOUNTED FOR BY EACH FACTOR
     2 .15    31.9     5.88     6.41    10.69     6.15     7.27     6.53     3.93
FINAL TRANSFORMATION MATRIX

    -0.2131   0.0659   0.1473    . 326   0.0515   0.0102   0.0836  -0.0832  -0.0406
     0.9187   0.2115   0.0546  -. 870  -0.2908  -0.0555   0.1056   0.0323  -0.0286
    -0.265   -0.0581    .21 0    .2765  -0.3708  -0.0425   0.1286  -0.1276  -0.1136
     0. 266   0.0313    .5984  - .3114   0.0044   0.18 7  -0.6051  -0.3718  -0.0844
     0.1177  -0.1178    .3367    .4004   0.3389   0.1252   0.5159  -0.5456  -0.0648
    -0. 245  -0.0637    .2268  - . 767  -0.0257   0.81 9   0.2261   0.4738  -0.0907
    -0.1194  -0.0509    .7054  - .4048   0.0942  -0.5037   0.3811   0.3294  -0.2180
     0.1035   0.0492    .2865    .6954   0.1696  -0.18 3  -0.3671   0.4393  -0.1815
    -0. 126   0.0288    .3003    .0648  -0.0360  -0.0549   0.0429   0.1178   0.9405
VARIMAX ROTATED FACTOR MATRIX

 1  -0.5522   0.3667   0.1536  - .1619   0.0195   0.6546  -0.1538   0.0503   0.2361
 2  -0.5189   0.2273    .1356  - .7711   0.1797  -0.0434  -0.1774  -0.0161  -0.0137
 3   0. 537   0.2163    .8436    .0125   0.3692   0.3209  -0.1701   0.0445  -0.0946
 4   0. 551   0.0424  - .9151    .0030   0.2538   0.2519  -0.1504   0.0141  -0.0843

 5   0.2335   0.4188  -0.2384    .8222   0.1082  -0.0402  -0.1549  -0.0047  -0.0061
 6   0.8556   0.0500  - .1154  - .3474   0.0429   0.2358  -0.0933   0.2396  -0.0888
 7   0.8542   0.1745    .1323  - . 079  -0.2426   0.0637   0.0799   0.3672   0.1860
 8   0.8672   0.1794    .1518    .3464  -0.0 94   0.1930   0.0636   0.0993   0.3597
 9   0.8909   0.0632  - .0325  - .0683   0.1303  -0.3204   0.0971  -0.2595   0.0155
10   0.9290   0.0377    .0403    .1064   0.1971   0.0403  -0.0791  -0.0953  -0.2562
11   0.9606  -0.1108  - .0561    .1597   0.0078  -0.0123  -0.1136  -0.1352  -0.0672
12  -0.1888   0.4416    .2341  - .2030   0.0336  -0.8201  -0.1165   0.0313   0.1097
13   0.1391   0.5792    .1762    . 720  -0.0821  -0.1951   0.2366   0.6991   0.1507
14   0.1841   0.7520    .1997    .1211   0.0571   0.1102  -0.0072   0.2936   0.4944
15   0. 515   0.7665    . 923    .3739   0.1685   0.2159   0.3732   0.2139  -0.0367
16   0.2526   0.8198    .2177    .2034   0.1125  -0.018   -0.3368   0.2830  -0.0479
17  -0.1125   0.8046  - . 789  - . 710  -0.1255  -0.0032  -0.2195   0.3125  -0.4089
18  -0. 965   0.6498  - .1197  - .2071  -0.0297  -0.0601   0.2936  -0.5576   0.3312
19  -0.1185   0.3749    .1232    .1341  -0.2101   0.1756   0.0426  -0.0702   0.0801
20   0. 965   0.7061  - . 234  - .1732   0.1617   0.1897   0.3622   0.0176  -0.5145
21  -0. 108   0.9368  - . 514  - .1923   0.2074   0.0188  -0.1303  -0.1023   0.1090
22   0. 877   0.8581  - .2141  - . 425  -0.0 61   0.1065  -0.0589  -0.3861   0.0551
23   0. 609   0.8592    .1396    .1281  -0.2853  -0.1180   0.0118  -0.3355   0.0446
24   0.1336   0.9756    . 739  - . 665  -0.0461  -0.06 1   0.0612   0.1046   0.0105
25   0. 726   0.9107    . 256  - . 362   0.0108  -0.1601  -0.0229   0.3850   0.0911
26   0.0866    .9175  - . 171  - . 060  -0.0 79   0.0355   0.2616  -0.2286  -0.0324
27   0.4056  -0.1025  - . 374  - . 542   0.5828   0.0501   0.0112  -0.1952  -0.0434
28  -0.3160   0.1596  - .0279    .1656   0.0803  -0.3320   0.7801   0.0970  -0.0672
29   0.2295   0.0759  - . 896  - . 826   0.9592  -0.0435  -0.0396   0.0459   0.0314
30   0.1610   0.9472  - .1713  - .1039   0.9563   0.0078   0.0187   0.0984  -0.0109
```

TABLE 35

VARIMAX ROTATED FACTOR MATRIX

FEMALE CONTROL SCHOOL

```
PERCENT VARIANCE ACCOUNTED FOR BY EACH FACTOR
    2 .76    31.35    12. .4     5.47     7.34     5.70     5.98     5.16     5.20

FINAL TRANSFORMATION MATRIX

    -0. 879  -0.9616    .11 .8    .1038   0.0181   0.0128  -0.0063  -0.0694   0.0186
    -0.9695   0.075.  -  .2340    . 984   0.0447   0.0367   0.1139   0.0955  -0.0358
     0.1848  -0.1370  -  .9603  - .1343   0.0325  -0.0598  -0.1013   0.0480  -0.1142
     0. 599  -0.0024  -  , 765    .3787  -0.6415   0.2506   0.1492   0.1707  -0.1565
     0.1223   0.0093  -  .2015    .2348   0.3667   0.7792   0.2278   0.1985   0.2674
    -0.1377   0.0215  -  ,  359  - .1679  -0.2590   0.2946  -0.7122  -0.2222   0.4916
    -0. 182  -0.1515    .2372  - .5961  -0.1015   0.0895  -0.0598   0.7689  -0.0461
    -0. 209  -0.0030  -  . 651  - .4281  -0.2450  -0.0543   0.6239  -0.2671   0.5333
    -0. 553  -0.0083     , 701  - .4429  -0.0385   0.4768   0.0505  -0.4510  -0.6009

VARIMAX ROTATED FACTOR MATRIX

 1   0.8386   0.0659  -0.4106  - .1114  -0.0489   0.1712   0.1183   0.1777   0.1760
 2   0.7720   0.0995    . 505    .129   0.1942   0.4078  -0.0177   0.3125   0.2968
 3  -0. 163   0.0939  -0, 429  - .1924   0.2698  -0.9301   0.0251   0.0459   0.0133
 4  -0.1132   0.087.    .1069    . 349   0.9544  -0.0186   0.0063   0.1900   0.1109

 5  -0.3656   0.2056    .1490    . 592  -0.7761  -0.0645  -0.0026   0.3750   0.1902
 6  -0.9028   0.3879  -0.1731    .1682   0.2519   0.0138  -0.0686   0.2003   0.1024
 7   0.8107   0.0676    .0354    .2631  -0.1293  -0.1909  -0.1366   0.2255  -0.1409
 8   0.8376   0.2666  -  , 157    .2640  -0.2022  -0.2244  -0.1485   0.1809  -0.1047
 9  -0.5185   0.1329  -0.0172    .0529  -0.1548  -0.0333   0.7384  -0.1808  -0.0837
10  -0.9537   0.0850    , 061  - .0341  -0.1236  -0.0757  -0.0674   0.1765   0.1588
11  -0.9563   0.1134    .1530  - . 414  -0.1731   0.0823   0.0555   0.0869  -0.0063
12   0.2515   0.7910  - .1419    .3900  -0.2619  -0.0717  -0.0543  -0.2051   0.1359
13  -0. 183   0.7655    .0241    . 47    0.0773   0.1324   0.2547  -0.1332   0.4476
14   0.1124   0.5187   0.1969    .8239   0.0151  -0.0018   0.0164   0.0161   0.0016
15  -0. 278   0.8269    .1944    . 410  -0.0 74  -0.0497  -0.0558   0.0411   0.5188
16   0. 740   0.8348  -  , 203    .2878  -0.5634   0.3285  -0.3081  -0.2243  -0.0800
17   0.1660   0.5159  - .2365  -  . 125   0.2882   0.2334  -0.6305  -0.1159  -0.3189
18  -0. 863   0.7523  - .1224  -  . 305   0.2724  -0.2557   0.0613   0.5420   0.2466
19  -0. 896   0.6557    , 567    .0079   0.0778   0.4256   0.4365   0.4180   0.0589
20   0. 824   0.7760  - .1397    . 682  -0.1572  -0.2029   0.0042   0.0778  -0.5422
21  -0.1755   0.8348  -  ..486  - .3491  -0.1228  -0.1617  -0.0652   0.0830   0.2702
22  -0.1914   0.8625    .1574  - .3041  -0.0791  -0.0589   0.0086   0.0479  -0.2358
23   0.1577   0.6890  - .1581    . 189   0.2167  -0.0956   0.5766   0.0709  -0.2835
24   0. 442   0.9804    .0391    . 998   0.0816  -0.0006  -0.0264   0.0277  -0.0737
25   0.1720   0.3760    .2002    .2767   0.0509   0.1547  -0.2069  -0.1912   0.0974
26  -0. 643   0.9269  -  .1528  - .2060   0.0312  -0.0744   0.1528   0.1236  -0.2148
27  -0.2731   0.0933    .0160  - .1793   0.0675   0.0194  -0.0393   0.1616   0.0990
28   0.0836   0.0305  -  .1172  - .2593   0.1443  -0.0078   0.0993  -0.5896   0.2738
29  -0. 157   0.1532    .0620  -  . 227   0.0010   0.0141  -0.0196  -0.0508  -0.0911
30  -0. 107   0.1130    .0690    .189   -0.0655  -0.0060   0.0573  -0.0529   0.0440
```

TABLE 36

VARIMAX ROTATED FACTOR MATRIX

MALE IN BOTH SCHOOLS

```
VARIMAX ROTATED FACTOR MATRIX

  1   0.5940   0.0968   0.2865   0.0852   0.2915   0.1487   0.0251   0.0537
  2   0.2480   0.6955   0.0278   0.1029   0.1963   0.1786  -0.2797   0.5421
  3   0.2860   0.7972   0.1197   0.1585  -0.0243  -0.0523  -0.2157   0.4397
  4   0.3149  -0.0491   0.8290   0.1890  -0.3038   0.1541   0.0401  -0.2337
  5  -0.1135  -0.0424  -0.9489   0.0826  -0.0667   0.0069   0.0046  -0.2711
  6   0.1296   0.0013  -0.6715   0.2712  -0.4041   0.4228   0.1049   0.3252
  7  -0.0395   0.9730  -0.0045   0.0647  -0.0465   0.0374   0.1806   0.0505
  8   0.2419   0.9578   0.1012  -0.0379   0.0011  -0.0990   0.0077  -0.0505
  9   0.1867   0.9636  -0.0650  -0.0246   0.1104  -0.0096  -0.0895  -0.1074
 10  -0.3394   0.6983  -0.1791  -0.0062  -0.2002   0.0904  -0.1330  -0.5469
 11   0.0848   0.9870  -0.0166   0.0876   0.0519   0.0176   0.0626  -0.0614
 12  -0.0106   0.9901  -0.0106   0.1032  -0.0089  -0.0019   0.0918  -0.0164
 13   0.2124   0.2014   0.4129   0.4369   0.0181   0.7265   0.0522  -0.1485
 14   0.1361   0.0257  -0.0228   0.5104   0.4100   0.7331  -0.0162   0.1188
 15   0.1550   0.1160  -0.1043   0.9053  -0.1014   0.3136   0.0234   0.1511
 16   0.2205   0.0330  -0.0215   0.8883   0.0779   0.3729   0.1157   0.0470
 17   0.2643  -0.0336  -0.0122   0.8672  -0.0917   0.2175  -0.3461  -0.0350
 18  -0.0168   0.0481   0.0582   0.8453  -0.0464  -0.0287  -0.4881  -0.1957
 19  -0.0538   0.5327   0.0213   0.6566  -0.1615  -0.4025   0.2890   0.1047
 20  -0.0610   0.1827  -0.0491   0.6043   0.4027   0.1371   0.6351  -0.1051
 21   0.2059   0.1064  -0.0873   0.6599   0.1610  -0.2485  -0.0963  -0.3198
 22   0.1568   0.1187  -0.0309   0.6582  -0.0534  -0.3067   0.2766   0.2232
 23  -0.0123   0.0643  -0.0654   0.9586   0.0386  -0.2398  -0.0670   0.0778
 24  -0.1350   0.2624  -0.0667   0.7820  -0.2539  -0.0787   0.4439   0.1709
 25   0.1054   0.1258   0.0400   0.9776   0.0439   0.1146   0.0236  -0.0084
 26   0.1666   0.0725   0.0277   0.8700   0.0452   0.4237  -0.1626  -0.0354
 27   0.0688   0.1639  -0.0522   0.9201   0.0426  -0.2274   0.2543   0.0292
 28   0.9911  -0.0009   0.0165  -0.0088  -0.0650  -0.0077   0.1009  -0.0538
 29   0.1290   0.2711   0.0324   0.0715   0.9499  -0.0223  -0.0266   0.0069
 30   0.9888   0.0875   0.0067   0.1096   0.0339  -0.0155  -0.0275   0.0233
 31   0.9913  -0.0188  -0.0429   0.0248   0.0146   0.0422  -0.1014  -0.0479

PERCENT VARIANCE ACCOUNTED FOR BY EACH FACTOR
      13.37    22.50     7.73    32.55     5.92     7.43     4.75     5.76

FINAL TRANSFORMATION MATRIX

     -0.2445   0.4112   0.0035   0.8674  -0.0528  -0.1048  -0.0404   0.0575
     -0.0639   0.8908   0.0369  -0.4377  -0.0494   0.0704   0.0069   0.0449
      0.8663   0.1755  -0.2551   0.2008   0.1277   0.1470  -0.1265  -0.2147
      0.4011   0.0186   0.0010   0.0047  -0.3780  -0.3444   0.0766   0.1799
      0.0159  -0.0418   0.6294   0.0809   0.0351   0.5787  -0.3205   0.1701
      0.0563  -0.0577  -0.4134  -0.0393  -0.4508   0.0556  -0.4198   0.6622
      0.0824   0.0329   0.0426  -0.0142   0.7834  -0.2555  -0.0308   0.5564
      0.1206  -0.0065  -0.0586   0.0864  -0.1247   0.3517   0.8345   0.3723
```

TABLE 37

VARIMAX ROTATED FACTOR MATRIX

FEMALE IN BOTH SCHOOLS

```
VARIMAX ROTATED FACTOR MATRIX

  1   0.3694   0.8912  -0.1961   0. 164   0.0728  -0.0263  -0.1541  -0.0025  -0.0685
  2   0.6539  -0.5952   0.1443   0.1216   0.0207  -0.0042  -0.1427  -0.3881   0.1049
  3   0.7669  -0.42 6  -0.0798   0.1279  -0.0874   0.2888   0.0045  -0.2759   0.2124
  4   0.1497  -0.0226  -0.1949   0.1236   0.9608  -0.0549  -0.0132  -0.0020   0.2124
  5   0. 410  -0.4965   0.6 69  -0. 214  -0.1485  -0.1108  -0.0548  -0.0020  -0.0090
  6   0.4590  -0.0671  -0.8420  -0. 959  -0.1121  -0.0812  -0.0849   0.1683  -0.1654
  7   0.8972  -0.1085   0.1819   0. 796   0.1307  -0.2010  -0.0121   0.1611  -0.1644
  8   0.9525   0.1674   0.0975   0.1142   0.0 54  -0.0030   0.1665   0.2918  -0.0317
  9   0.9587   0.0130   0.1513   0.1684  -0.0440   0.0896  -0.0643  -0.0633   0.0010
 10   0.7691   0.5866  -0.09 1   0. 401  -0.0 84  -0.0025   0.1519  -0.0893   0.0858
 11   0.9630  -0.1359  -0.1445   0. 145  -0.0246  -0.0154  -0.1010  -0.1199  -0.1212
 12   0.9593   0.0718  -0.1951   0. 756   0.0457  -0.0523  -0.1135   0.1484  -0.0036
 13   0.2197  -0.1713   0.1296   0.7199  -0.2949   0.0546  -0.1107   0.0799  -0.0820
 14   0.1605  -0.0063   0.1 57   0.7254  -0.0608   0.0699   0.3494   0.5332   0.0281
 15   0.2041   0.0529   0.1 76   0.6420  -0.1511  -0.4374   0.1571   0.1636   0.5285
 16   0.1191   0.0533   0.1021   0.7321   0.0340   0.0362  -0.0762  -0.2296   0.4581
 17   0.220   -0.0641   0.1788   0.8054  -0.2403  -0.2871  -0.0599   0.1941   0.6123
 18   0.2429  -0.0203  -0.2424   0.7124  -0.1529  -0.3425  -0.1341  -0.3122   0.2442
 19   0. 784   0.0022  -0.0340   0.4824   0.4414   0.7435  -0.0397  -0.1286  -0.4462
 20   0. 822  -0.1546  -0.1 62   0.5967  -0.1109   0.7639   0.0608  -0.0950   0.0421
 21   0.1789   0.0897   0.2028   0.8698   0.0603   0.0233  -0.0494   0.0471   0.0143
 22   0. 703   0.3397   0.2807   0.8638   0.0663   0.0158   0.0025  -0.2435  -0.3230
 23   0.1224   0.1662   0.2111   0.9050   0.1909   0.1514   0.1089  -0.0577  -0.1084
 24   0.2667   0.0557   0.0 97   0.6251   0.3434   0.0200   0.0141   0.0485  -0.1421
 25   0.1732   0.0206   0.1 53   0.9766   0.0419   0.0437   0.0308   0.6441   0.0389
 26   0.2418  -0.0432   0.0540   0.8960  -0.1682  -0.2184   0.0505  -0.0083   0.0183
 27   0.1305   0.0532   0.1425   0.9077   0.1751   0.2581  -0.0061  -0.0077   0.2350
 28  -0.2171  -0.1161   0.1254   0.1011  -0.0504   0.1080   0.9465   0.0305  -0.1941
 29   0.2109  -0.9182  -0.3 30  -0.0023   0.0615  -0.0196  -0.0446   0.0191  -0.0543
 30  -0. 203  -0.2675   0.0894   0.1374  -0.1024   0.0002   0.9364   0.0600  -0.1040
 31  -0. 932  -0.2702   0.1518   0. 630  -0.1771  -0.0721   0.9191  -0.0396  -0.0348
                                                                  0.0113   0.0992

PERCENT VARIANCE ACCOUNTED FOR BY EACH FACTOR
      22.65    10.38     6.78    29.71     5.38     5.97     9.55     4.66     4.92

FINAL TRANSFORMATION MATRIX

    -0.5103   0.0163  -0.0999  -0.8496  -0.0234  -0.0386  -0.0328  -0.0101   0.0670
    -0.7869   0.1165   0.2596   0.4250  -0.0642   0.0606   0.3245   0.0077  -0.0775
    -0.3011  -0.6541  -0.1542   0.2073   0.2433   0.0632  -0.5820   0.0334   0.1065
     0.1 82  -0.6967  -0.0653  -0. 944  -0.0146  -0.0573   0.6968  -0.0262  -0.0000
     0. 72    0.1797  -0.2844  -0. 085   0.5688   0.6721   0.2233   0.1451   0.2013
     0.1262  -0.1484   0.8579  -0.2077   0.2681   0.2140  -0.0861   0.1713  -0.1686
    -0. 136   0.1050  -0.1054   0. 492   0.3697  -0.5855   0.0977   0.3971   0.5733
    -0. 359   0.0292  -0.2584  -0. 079   0.2157  -0.2146   0.0178   0.5716  -0.7151
    -0. 233   0.0626  -0.0 09  -0. 007   0.5978  -0.3181   0.0467  -0.6806  -0.2622
```

TABLE 38

VARIMAX ROTATED FACTOR MATRIX

EXPERIMENTAL SCHOOL

PERCENT VARIANCE ACCOUNTED FOR BY EACH FACTOR

10.50	6.43	27.20	31.55	5.45	6.75	6.57	5.54

FINAL TRANSFORMATION MATRIX

-0.1197	-0.0698	0.5979	0.7747	0.0036	0.1420	0.0493	0.0224
-0.0100	-0.0563	0.7835	-0.6108	-0.0546	-0.0301	0.0664	0.0379
0.9594	-0.1278	0.0470	0.0892	-0.1727	0.0095	0.1500	0.0249
0.1459	0.5145	0.1403	0.1049	0.0315	-0.6152	-0.5421	0.0993
0.0879	-0.4579	0.0124	-0.0544	0.1462	0.3510	-0.7920	0.0872
0.1313	0.5131	0.0169	-0.0569	0.4915	0.4857	0.0812	0.4816
0.1370	0.0439	0.0745	-0.0116	0.6540	-0.0208	0.0220	-0.7382
-0.0114	-0.4859	-0.0276	0.0371	0.5249	-0.4907	0.2057	0.4506

VARIMAX ROTATED FACTOR MATRIX

1	0.1123	0.0760	0.1056	0.2263	-0.1832	0.9330	0.0983	-0.0745
2	0.0639	0.0012	0.8853	0.0773	0.2114	0.1661	-0.3645	0.0328
3	0.0309	0.0288	0.9914	0.0775	-0.0004	0.0518	0.0750	0.0331
4	-0.2294	0.3031	0.1495	-0.0269	0.9064	0.0932	-0.0061	0.0473
5	0.0863	-0.9231	0.1769	0.0119	-0.3116	0.0859	0.0560	0.0377
6	-0.0425	0.8689	0.2460	0.0226	-0.4063	0.1151	0.0579	0.0232
7	0.0181	0.1097	0.8775	0.2881	0.0422	0.1864	0.0485	-0.3094
8	0.1398	-0.0552	0.9678	0.1150	-0.1255	0.0489	0.0484	0.0836
9	0.0989	0.0331	0.9737	0.0547	-0.0404	-0.1074	-0.0706	0.1411
10	0.1917	0.0282	0.9345	0.1113	-0.0493	-0.0780	-0.1029	0.2402
11	0.0529	0.1290	0.9664	0.1116	-0.0061	-0.0694	0.1605	-0.0602
12	0.0991	0.1054	0.9523	0.1549	0.0545	0.1025	0.1323	-0.1315
13	0.1378	0.1475	0.1603	0.5025	-0.5064	0.5346	-0.1541	0.3392
14	0.1734	0.0403	0.1861	0.6060	0.1964	0.5324	-0.4880	0.0794
15	0.1017	0.1893	0.3058	0.8470	-0.0233	-0.0501	-0.2989	-0.2246
16	-0.1203	0.0684	0.1929	0.8734	-0.0876	0.1867	-0.2676	-0.2583
17	0.1056	-0.1134	0.1465	0.8641	0.0039	-0.2979	-0.3448	-0.0138
18	0.0461	0.0429	0.1670	0.8821	-0.1774	-0.3317	-0.0102	0.2199
19	-0.1081	0.0013	0.5237	0.3885	0.0692	0.1273	0.7361	0.0176
20	-0.0064	0.3244	0.2513	0.6430	0.1345	0.3563	0.3505	0.3877
21	0.1192	-0.0232	0.2256	0.9090	0.0051	-0.0888	0.1828	0.2586
22	0.1189	-0.0363	0.1617	0.8707	-0.0046	0.1422	0.3726	-0.2028
23	0.0135	-0.1165	0.2656	0.9245	0.1528	0.0967	0.1680	0.0091
24	0.1002	0.1786	0.3717	0.6869	0.1851	0.2165	0.3692	-0.3614
25	0.0575	0.0137	0.2656	0.9491	-0.0154	0.1303	0.0729	0.0517
26	0.0917	0.0517	0.2320	0.9051	-0.1046	0.0983	-0.3069	0.0341
27	0.0402	-0.0037	0.2891	0.8601	0.0806	0.1370	0.3855	0.0347
28	0.9937	-0.0355	-0.0135	0.0211	-0.0399	0.0183	0.0915	0.0192
29	-0.1159	-0.0791	0.2783	0.0163	0.2622	0.1048	-0.0162	0.9070
30	0.9845	0.0432	0.1389	0.0791	0.0103	0.0418	0.0328	-0.0208
31	0.9885	-0.0159	-0.0446	-0.0156	0.0072	-0.0393	-0.1373	-0.0026

TABLE 39

VARIMAX ROTATED FACTOR MATRIX

CONTROL SCHOOL

```
PERCENT VARIANCE ACCOUNTED FOR BY EACH FACTOR
      21.93    11.00    33.56     7.30     7.35     7.55     6.05     5.26
FINAL TRANSFORMATION MATRIX

       0.0029   0.1186  -0.9882  -0.0135   0.0641  -0.0313   0.0268  -0.0580
      -0.9742  -0.1758  -0.0173  -0.0737   0.0888  -0.0329  -0.0690  -0.0140
       0.1707  -0.9450  -0.1183   0.0171  -0.0728  -0.2209   0.0128   0.0986
       0.0884  -0.1304   0.0226   0.3406   0.7521   0.2868  -0.3868  -0.2438
      -0.0704   0.1370   0.0354   0.7353  -0.0117  -0.6331   0.1544  -0.0973
       0.0902   0.0515   0.0413  -0.5803   0.4244  -0.6248   0.0150  -0.2667
      -0.0277  -0.0754   0.0302   0.0243   0.3589   0.2275   0.9007   0.0147
       0.0096   0.1092  -0.0172  -0.0043   0.3286  -0.1545  -0.0968   0.9200
VARIMAX ROTATED FACTOR MATRIX

  1   -0.4877  -0.0693   0.0112  -0.1191  -0.1720   0.8436  -0.0385   0.0175

  2    0.7315  -0.2182   0.1477   0.1387   0.4142  -0.0528   0.2022  -0.4013
  3    0.8061   0.1309   0.1345   0.1005   0.4204  -0.0572   0.3215  -0.1465
  4   -0.0323   0.1010  -0.0278  -0.3522   0.9282   0.0226   0.0418   0.0145
  5   -0.0508   0.2652   0.0626   0.8287  -0.3024  -0.2644   0.2456   0.1212
  6    0.1425  -0.0548   0.0008   0.9314   0.2362   0.1422  -0.1625  -0.0749
  7   -0.8529   0.0400   0.1057   0.1292   0.0916  -0.4820   0.0489  -0.0064
  8   -0.9253  -0.2702   0.0112   0.1254   0.1342   0.1392   0.0841   0.1029
  9    0.9425   0.0079   0.1057  -0.1133  -0.1716  -0.1624  -0.1685  -0.0591
 10   -0.7979   0.0026   0.1350  -0.0063   0.1319   0.2914   0.0079  -0.4926
 11   -0.9692   0.1442   0.0640  -0.0907  -0.0460  -0.1232   0.0485  -0.0891
 12   -0.9685   0.1524   0.0282  -0.1421  -0.0425  -0.0910   0.0287  -0.0611
 13    0.2225  -0.0380   0.7061  -0.3506  -0.0668   0.3172  -0.3772   0.2781
 14   -0.0406   0.1730   0.6998  -0.0025   0.2089   0.0757   0.2640   0.5998
 15    0.0373   0.2221   0.7611  -0.0630   0.4388  -0.0322  -0.1339   0.3517
 16   -0.0037   0.2046   0.8258   0.0566   0.1087   0.0146   0.3394   0.3817
 17    0.0402   0.1172   0.7773   0.0098   0.4259  -0.2229  -0.3724   0.0768
 18    0.1459  -0.2017   0.7304   0.3646   0.2106  -0.0700  -0.4670   0.0656
 19   -0.0682   0.0303   0.7484  -0.0208  -0.4203   0.0827   0.4956  -0.0690
 20   -0.0831  -0.0502   0.6155  -0.1677   0.0686   0.3349   0.6827   0.0277
 21    0.0153   0.0716   0.5644  -0.0801  -0.1338   0.0455  -0.2433  -0.4024
 22   -0.0545   0.0494   0.9322  -0.0195  -0.0071  -0.2918   0.1247  -0.1412
 23   -0.1668   0.1417   0.9229   0.0006  -0.2035  -0.0760   0.0299  -0.2287
 24   -0.0010  -0.2517   0.9087   0.0702  -0.0736   0.2260   0.1780  -0.1333
 25   -0.0218   0.0591   0.9937   0.0086   0.0387   0.0242  -0.0457   0.0558
 26    0.1049   0.1171   0.6782   0.0615   0.2414   0.0335  -0.1848   0.3266
 27   -0.1283   0.0278   0.9424  -0.0066  -0.1459   0.0671   0.0952  -0.2443
 28   -0.2176   0.9400  -0.0327  -0.0203  -0.0448  -0.1921   0.1572  -0.0628
 29    0.4071  -0.0436   0.0854   0.3931   0.0033   0.8172   0.0510  -0.0135
 30   -0.0657   0.9891   0.0644   0.0277   0.0370   0.0052  -0.0773  -0.0291
 31   -0.0342   0.9901   0.0331  -0.0217   0.0163   0.0652  -0.0452   0.1022
```

the obtained variance to within group vs. between group differences to determine whether the groups look like random samples from the same population.

Tables 41 and 42 are print-outs of two treatments of data using an analysis of variance. Table 41 compares the factor elaboration, in four sets of students, namely, experimental school males, experimental school females, control school males and control school females. The first table lists these four groups with each sample size, sample mean, sample standard deviation, and sample z score. These quantities are informative only. The question being asked here is whether the means of all four samples are from the same population or whether there is a significant difference between at least two of these means.

The second table, "analysis of variance" provides various steps in the computational procedure arriving at a final F ratio of 10.6626. The F ratio must be compared at 3-199 degrees of freedom. By using an F table it has been determined that this value is significant at the 99% level. The conclusion here is that there is a significant difference between at least two of the four groups. The choice of elaboration for the analysis of variance was due to the uniqueness of this variable as compared with the other creativity factors.

Table 42 provides an analysis of variance concerning total adjustment in the experimental school vs. the control school. The final F ratio of 1.1808 is determined not to be significant with 1-201 degrees of freedom.

It should be noted the computer was not programmed to ignore any students that possesses missing variables. In these instances a score of zero was arbitrarily assigned. This information might cause the results to be less precise. However, it appears that this was not the case, as the results were similar with the Chi-square test run on the elaboration variable.

TABLE 40

ANALYSIS OF VARIANCE FOR ELABORATION
EXPERIMENTAL SCHOOL--MALE AND FEMALE
CONTROL SCHOOL--MALE AND FEMALE

```
BMD01V - ANALYSIS OF VARIANCE FOR ONE-WAY DESIGN - VERSION OF JUNE 11, 1964
HEALTH SCIENCES COMPUTING FACILITY, UCLA


PROBLEM CODE   TOTEL.
NUMBER OF TREATMENT GROUPS
NUMBER OF VARIABLE FORMAT CARDS
DATA INPUT TAPE    5

*    Z=MEAN / ST.DEV.

                              ELABORATION
                          Ex-M      Ex-F     Con-M     Con-F
TREATMENT GROUP             1         2         3         4

SAMPLE SIZE                64        53        36        50

MEAN                   11.188    12.415    16.889    19.860

STANDARD DEVIATION      9.837     7.833     9.404     8.576

Z                       1.137     1.585     1.796     2.316


                          ANALYSIS OF VARIANCE

                 SUM OF SQUARES    DF     MEAN SQUARE     F RATIO

BETWEEN GROUPS      2569.6686       3       856.5562     [10.6626]  =  99%
WITHIN GROUPS      15986.1935     199        80.3326

     TOTAL         18555.8621     202
```

TABLE 41

ANALYSIS OF VARIANCE TOTAL ADJUSTMENT
EXPERIMENTAL SCHOOL
CONTROL SCHOOL

```
BMD01V - ANALYSIS OF VARIANCE  FOR ONE-WAY DESIGN - VERSION OF JUNE 11, 1964
HEALTH SCIENCES COMPUTING FACILITY, UCLA



PROBLEM CODE   TOTADJ
NUMBER OF TREATMENT GROUPS       2
NUMBER OF VARIABLE FORMAT CARDS    1
DATA INPUT TAPE    5

*     Z=MEAN / ST.DEV.
                          TOTAL   AdjusTMENT

                          EX.   CON.
TREATMENT GROUP             1      2

SAMPLE SIZE               117     86

MEAN                    35.957  39.814

STANDARD DEVIATION      25.106  24.824

Z                        1.432   1.604



                         ANALYSIS OF VARIANCE

                SUM OF SQUARES     DF     MEAN SQUARE     F RATIO

BETWEEN GROUPS       737.2545        1      737.2545       1.1808   <---- NOT  Sig.
WITHIN GROUPS     125495.8096      201      624.3573

   TOTAL          126233.0640      202
```

CHAPTER V

SUMMARY AND CONCLUSIONS

This final chapter of the study shall be subdivided into four sections:

a. Restatement of the problem

b. Description of the procedures employed

c. Principal findings and conclusions

d. Recommendations for further research

RESTATEMENT OF THE PROBLEM

School administrators are faced with a formidable task to interpret and to use even the most routine information in connection with their decision-making responsibilities.

Vast amounts of data exist in the cumulative records, files, ledgers, accounts, registers, census reports, studies, professional books and publications of every school district.

The computer can provide a rapid information system as the foundation for the continuing program of upgrading the administration of the schools.

There is a need to acclimatize the administrator to the previously unfamiliar field of computer technology and for him to acquire the ability to interpret the basic statistical analyses to be used as a guide to an educational decision.

The "new breed" of educator will not be retrained to become a programmer, statistician or a computer technician, but should develop a degree of competence in these areas in order to collect, analyze, and interpret educational data, using the computer as the tool in the experience.

DESCRIPTION OF THE PROCEDURES EMPLOYED

Course work was completed in the field of Computer Science and Language in order to acquire sufficient knowledge in these areas to understand basically the function and limitations of the computer. Courses in Business Administration and Operations Analysis were audited to gain some familiarity with business statistical theory and computer use in simulation techniques.

Experience with computer support hardware such as key punch, print-out, sorting and duplicating devices was obtained over the space of eight months while running data batches and studying output results at the University of Massachusetts Computer Research Center.

Seminars concerning basic statistical analysis and computer function were frequently held by Dr. G. Ernest Anderson at his home as well as at the School of Education of the University.

There were two hundred three students used in this study. All were in their fifth year of schooling. One hundred seventeen were located in the experimental school and eighty-six in the control school. Each school was in a different school district and were compared in several social and economic factors.

Data was obtained from all students in the study through three sources:

1. Cumulative records
2. Standardized achievement and I.Q. tests administered by the children's classroom teachers
3. Personality and creativity tests administered by a guidance specialist who tested both groups

All the data obtained was key punched on IBM cards, and a number of statistical analyses were performed by the CDC 3600 computer at the University of Massachusetts Computer Research Center.

The following analyses were utilized:

a. Simple correlations of the thirty-three variables

b. t-Test, to determine the difference of 2 means

c. F Test, to determine the difference of 2 standard deviations

d. Chi square analysis of selected variables

e. Analysis of variance, to determine the differences between groups

f. Factor analysis, to obtain meaningful factors which are as consistent as possible from analysis to analysis

g. Multiple regression, to determine the best fitting equation relating to a variable predicting one variable to others

CONCLUSIONS

a. It is possible for a traditionally trained administrator to become familiar enough with the computer to understand the impact it has had on educational administration principally through educational data processing and to profit from this understanding.

b. It is possible to submit educational data to the computer for statistical analysis through selected basic programs which will utilize this existing data rather than to have it lay dormant.

c. It is possible to interpret the results of this statistical analysis to the extent necessary to profit from its use and aid educational decision making.

It has been determined that a high correlation exists between I.Q., readiness and achievement variables in both control and experimental schools.

The means of the control group were noticeably higher in I.Q. and readiness, but lower in all achievement means with the mean of arithmetic computation dramatically lower, which is suspected of being at least partially due to a testing or situation error, the t-Test value being 8.407 for this variable. Some special circumstances were offered by the control school administration to help explain the large difference in arithmetic computation scoring, i.e., change from "traditional" to "modern" mathematics, teacher' turnover, and inadequate teaching techniques. The experimental school students did as well or slightly better than control school students despite lower initial I.Q. and readiness scores.

	I.Q.	Readiness score
Control school mean	117.638	86.638
Experimental school mean	111.505	74.210

Administrative concern may well be indicated to explore methods by which the achievement of the control may be raised. The introduction of more flexible grouping structures as found in continuous progress organizational schemes may be indicated.

The personality traits, however, showed a high correlation with each other but did not show strong relationships with any other group of variables in the control school. In the experimental school this was not the case, as correlation between personality factors and achievement was significantly different from zero.

Variables such as teacher and administrative competency, curriculum and teacher mobility have not been considered in this study.

The Chi square analysis did show a significant relationship between the variables, sex, and total adjustment.

The Chi square analysis did not show significance when combined schools were compared to total adjustment. It would appear that adjustment is much more influenced by sex than by which school the student attends.

Administrative exploration is indicated in which the adjustment patterns for girls be reviewed. Grouping criteria in which standards for girls and boys are the same in their respective schools should be reevaluated in the light of this data.

In the creativity category, there was a high correlation among three of the four items, namely: originality, fluency and flexibility. The second variable, elaboration, did not correlate well with the other creativity measures.

The elaboration variable appears to have significance within the school. The analysis of variance reinforced the relationship and showed a significant F ratio at the 99% level. Both sexes were stronger in scoring on this variable in the control school.

Conversely, the experimental school showed a stronger relationship with the other three creativity variables than did the control school, but not to the same significance.

The interpretation of this phenomena is not as apparent as their administrator might desire. It does indicate that teaching practices and curriculum might play a role in these results. Expository writing or other creative language arts goals such as the writing of poetry or cross-disciplinary experience in independent study might have an influence. The statistical analysis of the data does not comfortably answer these questions and is indicative of the need for further investigation.

The factor analysis runs identified sharply consistency of factors when the axes of the correlation matrix were rotated. As the personality variables were also the greatest in number in the study, it is not surprising that they accounted for the heaviest load.

I.Q., readiness and achievement categories were next in order of importance. The correlation of these three categories is not surprising, as research has confirmed significant relationships in these areas in the past.

When data of combined schools was analyzed, no significant difference was noted as to the variable, sex. When the control and experimental schools are treated individually, the males in the control school show significant differences vs. females in four out of six of the achievement scores in the study. In the experimental school one significant correlation for females vs. grammatical usage appeared, and this only at the 95% level.

The implications for change do not appear to be great in the experimental school, but do suggest that the boys in the control school are performing better than the girls who are better adjusted to the school situation. The possibility that the boys in this upper middle class socioeconomic grouping identify with academic goals more so than the girls is worthy of consideration. The girls, who test better in the adjustment scales, might strive more for recognition in social and/or cultural areas.

In summary, this study concludes:

1. That the computer can be programmed to assist in facets of educational administration.
2. That administrators must familiarize themselves with the applications of the computer.
3. That it is possible for a traditionally trained administrator to acquire sufficient statistical, theoretical and practical knowledge to utilize a computer to assist his educational decisions.
4. That the acquisition of such knowledge, gained in the manner outlined in this study, takes time and perseverence on the part of the administrator.
5. That this study did make it possible for one administrator to acquire a new understanding of an existing administrative responsibility and the opportunity to apply it to a problem at hand.

RECOMMENDATIONS FOR FURTHER STUDY

A. During the course of this study a great deal of time was consumed in gaining basic familiarity with EDP through what was primarily an uncharted program. As a result of this experience a university-based program designed to train emerging and to retrain practicing administrators is indicated. The university should serve as a training and resource center for administrators to return to their school districts with basic statistical and EDP understanding.

The prevailing practice of offering EDP services which utilize the hardware and technical skill of the university but does not offer training and exposure to EDP for the administrator in the local school district is not fulfilling the needs of today's schools.

B. The educational administrator in training should pursue courses in basic statistical methods as part of the requirements for graduate degree programs on the master's and sixth year level. This advanced administrative training should include a course in basic statistics, a course in computer science and a course in the use of the computer in education today. Coupled with the course work, a program directly involving the administrator with school districts that have successful EDP programs that are tailored to meet their educational needs and research requirements should be developed. The instructorship of this program might be jointly shared by the technologists at the university and the practitioner in the field.

As the administrator gains understanding in the theory and the practice of EDP he will gain understanding of the technology employed.

C. There is a need for professors who teach EDP courses and who guide field work to have had experience as practicing educators themselves. This should aid in improving the communication between professor and student which often suffers when technical and administrative terminology meet. When such communication is improved, the view that to deal with educators is a frustrating experience and education itself is imprecise may be modified.

This study contains a voluminous amount of data, much of which has not been fully explored. A number of additional statistical analyses might have been done, and this lack of complete analysis of the data points to avenues for additional research. Two specific areas are of particular interest and would lend themselves to further investigation as they are administratively relevant hypotheses:

a. Personality factors appear to positively correlate with achievement.

b. The child's adjustment is influenced much more by his sex than his school.

APPENDIX

KEYS TO DATA CODING

0	Experimental School
1	Control School
1	Male
2	Female
1	White
2	Non-white
001	Insurance Consultant
002	Sales Representative
003	Engineer
004	Sales Manager
005	Attorney
006	Purchasing Agent
007	Insurance Clerk
008	Insurance Agent (salesman)
009	Machinist
010	Shipping Clerk
011	Aircraft Designer
012	Car Dealer (exec.)
013	Carpenter
014	Stock Broker
015	Real Estate Salesman
016	Grocery Manager
017	Salesclerk
018	Milkman
019	Printer

020	Teacher
021	Accountant
022	Insurance Executive
023	Manufacturer's Representative
024	Self-employed Retailer
025	Laborer
026	Self-employed Contractor
027	Physician
028	Dentist
029	Diemaker
030	Pharmacist
031	Minister
033	Auto Mechanic
034	Executive, Publishing Company
035	Writer
036	Lineman (telephone or electric co.)
037	Research Assistant
038	Business Executive
039	District Manager
040	Foreman (work crew)
041	Administrator (milling machines)
043	Service Station Attendant
044	Oil Burner Serviceman
045	Maintenance (van lines)
046	Travel Counselor

047	Superintendent of Maintenance
048	Meat Cutter
049	Botanist
050	Banker
051	Electrician
052	Psychologist
053	Window Trimmer
054	Chemist
055	Optometrist
056	Frameman (telephone co.)
057	Estate Planner
058	Private Investigator
059	Editor
060	Letter Carrier, Post Office Employee
061	Railroad Worker
062	Architect
063	Landscaper
064	Custodian
065	Manufacturer
066	Bus Driver
067	Plumber
068	Industrial Designer
069	Deceased
070	Not Disclosed
071	Internal Revenue Inspector

072	Mail Advertising
073	Expeditor
074	Hospital Representative
075	Textile Business
076	Assistant Traffic Manager

Elementary Education	08 years
Trade (technical school)	10 years
High School	12 years
Bachelor of Arts or Science	16 years
Master of Arts or Science	17 years
Ph. D.	18 years
LL. D.	19 years
M. D.	20 years

UNIVERSITY OF MASSACHUSETTS

CODING SHEET

PAGE_____OF_____

DATE_____________

1	School Code
2 3 4	Student Number
5 6 7 8 9 10	Date of Birth
11	Sex
12 13	Metropolitan Readiness Test
14 15 16	Intelligence Quotient
17 18	Years in School
19 20	Father's Occupation
21 22	Years of Education of Father
23	Race
24	Blank
25	Blank
26 27	Science Research Associates Test Grammatical Usage
28	Blank
29	Blank
30 31	Science Research Associates Test Arithmetic Reasoning
32 33	Science Research Associates Test Arithmetic Concepts
34 35	Science Research Associates Test Arithmetic Computation
36 37	Science Research Associates Test Reading Comprehension
38 39	Science Research Associates Test Reading Vocabulary
40	Blank
41	Blank
42 43	California Test of Personality Self Reliance
44 45	California Test of Personality Personal Worth
46 47	California Test of Personality Personal Freedom
48 49	California Test of Personality Belonging
50 51	California Test of Personality Withdrawing
52 53	California Test of Personality Nervous Symptoms
54 55	California Test of Personality Social Standards
56 57	California Test of Personality Social Skills
58 59	California Test of Personality Anti-Social
60 61	California Test of Personality Family Relations
62 63	California Test of Personality School Relations
	California Test of Personality Community Relations
	California Test of Personality Total Adjustment
	California Test of Personality Personal Adjustment
	California Test of Personality Social Adjustment
	Torrance Test of Creativity Total Originality
	Torrance Test of Creativity Total Elaboration
	Torrance Test of Creativity Total Fluency
	Torrance Test of Creativity Total Flexibility
	Blank

LISTING OF FORTY-ONE HYPOTHESES FOR CHI SQUARE ANALYSIS

The null hypothesis:

There is no significant relationship between the following forty-one pair of variables.

Hypothesis

1 I.Q. vs. Arithmetic Reasoning
2 I.Q. vs. Arithmetic Concepts
3 I.Q. vs. Arithmetic Computation
4 I.Q. vs. Reading Vocabulary
5 I.Q. vs. Reading Comprehension
6 I.Q. vs. Total Readiness
7 Readiness vs. Arithmetic Reasoning
8 Readiness vs. Arithmetic Concepts
9 Readiness vs. Arithmetic Comprehension
10 School vs. Personal Adjustment
11 School vs. Social Adjustment
12 School vs. Total Adjustment
13 School vs. Community Relations
14 School vs. School Relations
15 School vs. Sense of Personal Worth
16 School vs. Feeling of Belonging
17 School vs. Nervous Symptoms
18 School vs. Social Standards

19 School vs. Social Skills
20 School vs. Grammatical Usage
21 School vs. Total Originality
22 School vs. Total Elaboration
23 School vs. Total Fluency
24 School vs. Total Flexibility
25 Years of Education of Father vs. Readiness
26 Years of Education of Father vs. I.Q.
27 Years of Education of Father vs. Grammatical Usage
28 Sex vs. Total Readiness
29 Sex vs. I.Q.
30 Sex vs. Total Adjustment
31 Sex. vs. Total Originality
32 School vs. Years of Education of Father
33 School vs. Reading Vocabulary
34 School vs. Reading Comprehension
35 School vs. Arithmetic Reasoning
36 School vs. Arithmetic Concept
37 School vs. Arithmetic Computation
38 School vs. Total Adjustment
39 School vs. Personal Adjustment
40 School vs. Social Adjustment
41 School vs. Total Originality

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