1-1-1996

Development of an educational overburden index for New Mexico schools

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DEVELOPMENT OF AN EDUCATIONAL
OVERBURDEN INDEX
FOR NEW MEXICO SCHOOLS

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of

Doctor of Education

in

Educational Administration and Higher Education

Department of Educational Administration
and Higher Education
University of Nevada Las Vegas

August, 1996

UMI Number: 9700420

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ABSTRACT

The purpose of this study was to develop an educational overburden index (EOI) as a component in the New Mexico Public School Funding Formula. This is part of an ongoing research effort to develop a methodology for the distribution of funds based on the unique characteristics and needs of individual school districts. Research indicated that measuring and predicting populations containing at-risk students can be accomplished through application of multiple variables which reflect home, school, and community concerns. The study initially began with a selection of indicators from data provided by the New Mexico State Department of Education and the U.S. Census Bureau. According to current literature, these indicators supported predictions of students most likely to be at-risk. A total of 11 variables were analyzed for eighty-nine school districts. The variables were: Chapter 1 funds, free and reduced price lunch participation, dropout rate, ITBS and High School Competency Exam scores, pupils per square miles, teacher salary, training and experience, student mobility, limited English proficiency, special education, and gifted and talented.

School districts were classified into clusters based on relative need using an unsupervised learning neural network computer analysis that recognized patterns of variables of need across districts. The clusters were verified through a feedforward neural net computing program and the districts were assigned a numerical weight ordering them from districts with highest to lowest need. The numerical weights comprised the Educational Overburden Index (EOI) that was applied in a simulation to each New Mexico school district's share of the state funding formula. Use of the EOI in funding programs fosters local program flexibility, avoids "labeling" students and targets funds for districts with the highest incidence of youth in need.

TABLE OF CONTENTS

LIST OF FIGURES

Figure | Page

LIST OF TABLES

ACKNOWLEDGMENTS

I wish to express my love and appreciation to friends and family who offered their continuous support throughout this project. My husband and partner, Paul, cheerfully adjusted his schedule to accommodate my pursuits during the past two years. Our children, Jennifer (and husband Roland), Jessica, Justin (budding computer whiz), and Donáta; offered continual encouragement to keep me on track. Special thanks go to Gordon Higashi, computer whiz extraordinaire, and to David St. Onge, P.T., who helped get me to the finish line in one piece.

I worked with a superb group of fellow doctoral candidates, past and present, who shared ideas and offered continual support to keep everyone focused on reaching our goal. A special thanks is extended to my committee chair, Dr. Teresa Jordan and committee members, Dr. Anthony Saville, Dr. Patricia Markos, and Department Chair Carl Steinhoff. I also appreciate the wise contributions of my honorary contributing member, K. Forbis Jordan.

Lastly, I wish to express my appreciation for the love and care extended during my growing years by my brother, Jack, and my mother Mary. My father, Jack H. Stansfield, Sr. instilled a desire to pursue excellence through personal commitment to lifelong education. I dedicate this dissertation in his memory.

CHAPTER I

OVERVIEW

Introduction

In the aftermath of a complaint filed by nine school districts in New Mexico District Court claiming the existing "Public School Finance Act...is an unconstitutional derogation of the equal protection clause of the new Mexico Constitution," (Almogordo Public Schools, et al. V. New Mexico Department of Education and the Members of the New Mexico State Board of Education, 1995), the New Mexico Public School Funding Formula Task Force and Legislative Council Service authorized a study of the New Mexico Public School Funding Formula.

The current New Mexico state formula includes a system of student cost differentials that allows adjustments for individual school district enrollment, sparsity, enrollment growth, and instructional staff training and experience. In addition, transportation costs, and special education services are figured into the existing formula that was originally developed during the mid-1970's. Since then, the formula has undergone at least twelve revisions in an effort to make it more equitable to all students. One of the major tasks of this study is to examine the present system of student weights with adjustments for enrollment, sparsity, teacher education and experience and explore alternative funding strategies that address the complex set of educational needs across different types of school districts.

Student populations in districts vary in socio-economic and demographic factors. Some districts experience increased need for additional funds and resources based on their particular "overburden" due to characteristics, typically used to describe students at risk, such as conditions of poverty, student mobility, density, and the inability to speak English. This is often described as a district's "educational overburden" (Jordan, 1996).

The compelling need to improve educational opportunity for students falling into at-risk categories has been underscored by the national educational goals adopted by the Bush administration, and by numerous researchers such as Levin (1989) who warn that society will face higher public service costs associated with poverty and crime. Educators face an increasingly more challenging population of students.

There are many need variables adversely affecting the education of American children. To address these variables of need, legislatures in most states have adopted funding plans that guarantee all schools minimum funding on a per-pupil basis, thus providing each school with revenue for a basic level of education for all students. However, these "foundation" or "equalizing formula" plans have not eliminated disparities in funding among schools (Harp, 1992; Verstegen, 1990b). Districts are still free to add their property-tax-generated revenues to the foundation amounts. Ideally, restructured financing plans should raise the poorer districts to funding levels that approximate those in wealthier districts. A tangential issue is the concern that poorer districts are unable to address the multiple needs of at-risk students. These needs of students require additional personnel and programs that can severely impact district funds making it impossible to adequately meet the needs of these students.

Background and Related Research

Most school finance experts agree that different characteristics of school districts and the varied backgrounds of students they serve influence education costs. Webb, McCarthy, and Thomas (1989) argue that providing the same resources for all students served and for their individual districts will not ensure adequate and equitable programs. Initial finance reform that focused on horizontal equity (equal treatment of equals) has evolved into one of vertical equity in which educational equity is attained when the quantities and mix of school resources and services are varied according to the educational needs of individual students (Chambers, 1981).

As schools pursue responses to shifts in policy and pressures for educational reform, most current state funding systems assume identifiable students, quantifiable program standards, isolated and measurable services, and auditable expenditures. Today, school districts are confronted with increasing demands without concurrent increases in resources; thus, more flexible state funding approaches will be needed to enable districts to meet increasing expectations. In the current state of education reform, school finance litigation, deregulation, and shifts in economic and political philosophies, increasing attention is being given to alternative ways of funding that allow for more flexible and innovative responses to meeting the needs of students.

The Educational Overburden Index (EOI) is a recent development in public school finance that allocates funds based on the projected number of special needs children in a district. This methodology, also referred to as the educational need index, was originally developed for funding programs to serve at-risk youth, but could be applied to funding districts based on the socio-economic and educational conditions of each district. A significant advantage of this funding mechanism is that funding levels in the state school finance program are not directly linked to specific programs and classifications of students.

The funding index is a proxy for the magnitude of educational need based on the interaction of demographic, socio-economic, and educational factors. The process involves a search for a replicable algorithmic process for allocating differential need-based support by school districts because of variability of socio-economic and educational conditions among districts. Evidence of the link between educational need and socio-economic factors can be traced to Coleman's (1960) research. The continuing body of research justifies use of a funding methodology that addresses variations in educational need as a function of these socio-economic and demographic characteristics.

Purpose of the Study

The purpose of this study was to develop an educational overburden index (EOI) as part of an ongoing research effort to develop a methodology for the distribution of funds based on the unique characteristics and needs of individual school districts. The present study investigated potential variables to be included in an educational overburden index developed for the state of New Mexico. The educational overburden index was applied to each New Mexico school district, utilized as part of the funding formula, and examined in terms of its redistributive effect on different types of school districts. The intent of the educational overburden index (EOI) was to provide a method of allocating monies to school districts that fosters local program flexibility, avoids "labeling" students, and targets funds for the districts with the highest incidence of need. The goal was to develop an index as a funding mechanism based on identifiable variables of need that were most appropriate for the circumstances in a given state, in this case the state of New Mexico (Jordan & Lyons, 1992).

Research Questions

1. What variables among data elements can be supported by literature and research as indicators of educational overburden?
2. Which variables identified in question one are viable for developing an educational overburden index for the state of New Mexico?
3. Using a neural network computing procedure, how would districts be clustered according to educational need?

4. What would be the potential impact of the educational overburden index on schools districts of varying wealth distribution and size?

5. How would the application of an educational overburden index affect the allocation of funds to school districts in New Mexico?

Sources of Data

The data utilized in this study consisted of data from the New Mexico Accountability Report 1995-96, and the eighty-nine school districts in New Mexico, Measures used in the development of the EOI were selected from this data pool for each school district in New Mexico. The initial data variables included:

1. TITLE I % of ADM (TITLE I)
2. Free and Reduced Price Lunch % of ADM (FRPL)
3. Dropout Rate (DOUT)
4. ITBS Scores below 40 percentile (ITBS)
5. High School Competency Exam (HSComp)
6. Pupils Per Square Miles (P/P SQ.MI)
7. Teacher Salary Training and Experience Index (Tchr Sal)
8. Limited English Proficient (LEP)
9. Student Mobility (MOB)
10. Special Education Membership % of Total ADM (SPED)
11. Gifted and Talented % of ADM (GATE)

Research Procedures

This study consisted of three phases. Phase one consisted of the selection of variables from a pool of data supplied by New Mexico state that were predictive of student need and were documented in the research literature. Phase two consisted of the development of an educational overburden index (EOI) through the use of an neural network computing procedure. Phase three utilized the EOI to simulate the allocation of resources for the eighty-nine New Mexico school districts to determine the redistributive effect when compared with the current funding formula.

As part of phase one, the data sets for each of the identified indicators were assessed to determine if the information was complete for each district and for each variable. No districts submitted incomplete data, therefore all eighty-nine districts were included in this study. A correlation coefficient matrix was calculated to determine the extent of the interrelationship among the remaining variables. Originally, data measuring ethnicity, median household income and household education level as provided by the U.S. Bureau of the Census was considered. However, it was felt that this data would be outdated and would be difficult to compare with the most current information provided by the state of New Mexico.

Neuroshell2 (Ward Systems Group, Inc., 1993), a powerful neural network computing procedure utilizing a Kohonen neural net, was used during phase two of the study to process the selected indicators into clusters based on need. A second neural network analysis methodology, back propagation, was utilized to verify the clusters and weight the individual districts into a continuum from highest to lowest need. These clusters formed the basis for the construction of the educational overburden index (EOI) for the New Mexico state funding formula.

The construction of the educational overburden index utilized a set of models developed by Weiner (1994) to create an economic index for the Bureau of Indian Affairs-funded schools. The resulting clusters from the initial Kohonen analysis were subjected to five program runs to produce the final educational overburden index for each district. The procedure used to develop the index was based on the following criteria adapted for this study:

1. The steps are explainable and replicable.
2. The data reflects student needs.
3. The outcome is based on data available for public use.
4. The data cannot easily be manipulated by individual school districts.
5. The outcome will suggest increased financial resource allocation to districts based on needs as identified by the neural net clusters.

Phase three consisted of a simulation completed which compared the redistributive effect of the educational overburden index with the current state aid formula for New Mexico. The fiscal impact on school districts of varying wealth distribution and size is included in Chapter Four.

Significance of the Study

An EOI provides some important advantages over other funding models. The index uses multiple indicators of need, often preferred over single indicators for several reasons. First, a wide range of conditions (reflected by the multiple variables) contributes to students' poor chances for academic success. Also, credibility and bias problems may adhere to the use of a single indictor. Furthermore, variables must be resistant to manipulation by the school districts. Many socio-economic data are factors beyond a district's control. Finally, stability of funding results from multiple factors, allowing for longer range planning.

A composite indicator also allows data to represent several values, just as the education system itself is imbued with a variety of "American" values such as equality, adequacy, liberty, and efficiency. With these potential advantages, EOIs calculated by including the critical values peculiar to a state may become an important future tool for identifying students in need and projecting educational costs. Consequently, the present study provides further refinement of this methodology with its use of multiple indicators based on the unique funding values of New Mexico and the employment of a neural network computing procedure for categorizing districts according to the educational needs of its students.

Definition of Terms

In this study, the following terms were defined as indicated:

At-Risk Students. New Mexico defines at-risk students as those youth who are in danger of not graduating or not attaining skills, knowledge, and social skills necessary to achieve personal, economic, and social sufficiency in society (Anthony & Jacobson, 1992).

Average Daily Membership (ADM). This term refers to the total enrollment of fractional students and full-time students, minus withdrawals, of each school day for the current year as recorded on specific, designated dates (N.M. R. S., 1995).

Density. The product of the number of students divided by the number of square miles in each district (Bell & Forrer, 1994).

District Enrollment Size. Enrollment is determined by dividing the aggregate number of students enrolled during a specific period by the number of days in the period resulting in average daily membership (ADM) (Bell & Forrer, 1994).

District Student Mobility Rate. This variable is identified as the number of students taking one or more portions of the state's standardized achievement test battery who have been identified as being continuously enrolled in the district for only 1 or 2 years (Anthony & Jacobson, p. 132).

Dropout. The number of enrolled students who dropped out of school during the school year plus the number of students enrolled at the beginning of the previous year who failed to enroll at the beginning of the next school year. Students are not counted as dropouts if the districts' records indicate that the student withdrew or transferred to another public secondary level school (Anthony & Jacobson, 1992).

Educational Indicator. This statistic reveals something about the performance or health of the educational system covering three broad classes: (1) inputs--fiscal, material or other resource data, teacher qualifications and student background, (2) processes--school context and organization indicators, curriculum, teaching and instructional quality and (3) outputs--student achievement, participation, attitudes, and aspirations (de Neufville, 1978-9; Bell and Forrer, 1994, p.7).

Educational Overburden. This term refers to a configuration of socio-economic, demographic, and educational factors that result in a district's increased need for additional funds and resources in order to provide equal educational opportunity (Jordan & Associates, 1996).

Educational Overburden Index (EOI). EOI is a proxy for the magnitude of educational need of a school district based on selected variables (Jordan & Associates, 1996).

Gifted and Talented Education. A gifted student is defined as a school-age person whose measured intelligence quotient, either verbal or nonverbal, measures at least two standard deviations above the mean on an intelligence test approved by the State Board of Education and scores at least at the 95th percentile on the total battery score of a standardized achievement test or has outstanding creativity, divergent or critical thinking skills, or outstanding problem-solving ability (American Education Finance Association and Center for the Study of the States, 1995).

Instructional staff training and experience index. A staff training and experience index is calculated based upon five academic classifications and five levels of teaching experience. The index is used as a multiplier of the total early childhood, grades 1-12, special education and bilingual units in the New Mexico Funding Formula. Its purpose is to recognize differences in the profiles of training experiences of teachers among the New Mexico School Districts (Morgan, 1994).

ITBS. The Iowa Test of Basic Skills is a standardized achievement test used as part of the New Mexico Achievement Assessment (Bell & Forrer, 1994).

Limited English Proficient (LEP). This term refers to the number of students in the school district identified as Limited English Proficient (LEP) scoring below the 40 percentile on Language Proficiency Assessment criteria (Odden & Piccus, 1992).

Mobility. Mobility is characterized by 1) inner-city mobility, which is prompted largely by fluctuations in the job market; and 2) intra-city mobility, which may be caused by upward mobility, on the one hand, or poverty and homelessness, on the other (Schuler, 1990).

Neuroshell 2. Neuroshell2 is a software program that mimics the human brain's ability to classify patterns or to make predictions or decisions based upon experience. The human brain relies on neural stimuli, while the neural network uses data sets. Neuroshell2 enables the researcher to build sophisticated custom problem solving applications without programming. The researcher tells the network what he/she is trying to predict or classify and Neuroshell2 "learns" patterns from training data to make its own classification prediction or decision when presented with new data (Ward Systems Group, Inc., 1993).

Poverty Level. The family of a student identified at the poverty level reports an annual income at or below the official federal poverty line, eligible for Aid to Families with Dependent Children or other public assistance (Anthony & Jacobson, p. 131).

TITLE I. (Also known as compensatory education) This term refers to mandated remedial programs designed to provide special instructional assistance to students in grades 1-8 who fail to master essential competencies as established by the State Board of Education. These programs may include, but are not limited to tutoring or summer programs. A reading assessment instrument designated by the state serves to determine the need for remedial programs. Elementary and Secondary Education Act allocated federal dollars for migrant education through a Congressional amendment (Part A of Chapter 1 of Title I, Elementary and Secondary Education Act of 1965 amended by the Augustus F. Hawkins-Robert T. Stafford Elementary and Secondary School Improvement Amendments of 1988; Public Law 100-297).

USDA Free and Reduced Lunch Program. This variable includes the percentage of all expenditures for USDA Free and Reduced Lunch Program Funding (Bell & Forrer, 1994).

Assumptions

The design of this study is based on the following assumptions:

1. School districts accurately reported enrollment, absentee rate, achievement results, ethnic composition, number of students on free and reduced meals, students with limited English proficiency, special populations, education and training level of faculty, and pertinent financial data to the New Mexico Department of Education.
2. ITBS and New Mexico High School Competency Exam scores reported student achievement with a reasonable level of accuracy and with some continuity.

Delimitations and Limitations

The information gained through this study depended on the accuracy of the data collected and submitted by the New Mexico State Department of Education. This study does not attempt to classify or evaluate the various at-risk identifiers used to develop the overburden index.

Organization of the Study

This dissertation consists of five chapters. Background and introductory information are presented in the first chapter. Related literature and research are summarized in the second chapter. Research techniques and methodology are reported in the third chapter. Findings of the study are presented in the fourth chapter. The fifth chapter contains the summary of findings, conclusions and recommendations for further study.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Achieving financial equity among districts at the state level is one of the central focal points in education during the 1990's. Because most court challenges to school funding plans have been notoriously slow in being resolved, immediate change is difficult to accomplish. The attainment of financial equity is politically risky due to the involvement of state legislatures in constructing complex funding mechanisms that shift moneys from some school districts to others (McCarty, 1990). However, research and policy studies that promote educational equity with support from courts that continue to uphold the principle that all children deserve equal educational opportunity will assist the movement toward more equitable distribution of educational resources.

Hanushek (1989) reviewed 187 studies and found that school expenditures per se were not generally related to improved student performance. As Odden and Picus (1992) point out, such findings do not reduce the importance of financial equity. They simply indicate that certain types of investment of educational funds have not been shown to lead to higher levels of student achievement. The important message from this research, according to Odden and Picus, is that if additional educational revenues are allocated and spent in the same way as current educational revenues, increases in student performance are unlikely. Their message emphasizes that the way money is used matters. New revenues aligned to support new strategies will more successfully impact student achievement.

This review of literature will address four main topics that include the history of the New Mexico's school finance plan, related court rulings, identified variables attributed to increased district need, and related index-of-need studies.

New Mexico Finance Plan

The state share of revenues for public school operational expenditures has remained relatively stable from the implementation of the 1974 formula to the present (American Education Finance Association and Center for the Study of the States, 1995). The state percentage has remained at about 90 percent since 1983 with the 1993-94 percentage at 94.93 percent. Local tax revenue amounts to about 1.73 percent with property taxes at the local level contributing about .61 percent. Lastly, federal revenues contributed 3.34 percent. Operational revenues from state funds come from several sources including the state general fund, the current school fund, and federal mineral leases. Estimated general fund revenues are derived from gross receipt taxes, income taxes, interest, severance taxes, rents, and royalties, license fees, and miscellaneous. The public education share of general fund revenues has remained around 50 percent ranging from 51 percent in 1990-91 to 46 percent in 1993-94.

The basis of the funding formula for New Mexico is the State Equalization Guarantee that typically accounts for more than 85 percent of any district's operational revenues. The distribution is non categorical in nature and encourages local priority initiatives through absence of categorical funding and a fund "tracking" system. The State Equalization Guarantee is designed to insure that each of the 89 school districts will receive 100 percent of the calculated program costs.

The New Mexico Public School Funding Formula was implemented in 1974 and remains essentially the same, in spite of the 30 adjustments for need variables such as bilingual education, addition of urban density factors, and changes for reductions in pupil-teacher ratios, to name a few. In 1993-94, local operational revenues of $ 18.9 million were derived from a 0.5 mill property tax levy, fees from patrons, tuition from out-of-state, earnings from investments, rents, sales of real property and equipment, and miscellaneous including federal indirect revenues. Additional local non-operational revenues of $ 262.4 million were derived from fees from patrons, local grants, bond sales, and capital outlay taxes (American Education Finance Association and Center for the Study of the States, 1995).

New Mexico's State Equalization Guarantee Distribution is the amount of money distributed to each school district to insure that school district operating revenue is equal to the school district program cost. The formula is based primarily on the number of enrolled students in each school district. Need for individual districts is determined by the weighted sum of units based on educational program factors such as early childhood education, basic grades 1-12 programs, bilingual and special education, several size factors, enrollment growth, and a factor for teacher training and experience. These factors are used to establish program units that determine the overall district program cost and subsequent state equalization funds to the district (American Education Finance Association and Center for the Study of the States, 1995).

Capital outlay financing is both a local and state responsibility in New Mexico. Local capital outlay revenues are generated from sale of bonds, a direct public school building levy for larger districts, a local capital improvement levy, and earnings from investments, rents, sales of real property and equipment, and other miscellaneous sources. The state also provides capital outlay financing through emergency capital outlay funds and a state public school capital outlay match for local capital improvement levy. In all, total state and local capital outlay revenues, including taxes, interest, and abatements equaled $ 252.8 million in 1993-94.

New Mexico provides separate funds for instructional materials including textbooks and supplementary instructional materials. Funds are provided both for the cost of purchase and the transportation charges for these materials. A separate instructional materials account is kept for each school district, state institution, private school, or adult education center.

Funds are not appropriated to the districts as costs are debited against the individual accounts. The state purchases most instructional materials under the Instructional Material Law; however, districts spent additional operational funds on other textbooks, library and audiovisual materials, and other instructional supplies and materials. Lastly, it should be noted that local district special projects are funded by the state on the basis of competitive applications that included early intervention programs, lengthened school days or year, computer-based language arts, and charter school planning.

Litigation

Most school funding litigation brought against states during the past two decades has focused on the area of financial inequity and the lack of equal educational opportunity engendered by these plans. Between 1968 and 1990, twenty-seven court cases contesting school funding plans were filed. In about half of those cases including those in Texas, New Jersey, Kentucky, and Montana, the courts overturned financing plans on the basis that they violated either the education clause or the equal protection clause of the state's constitution. However, clear guidelines for remedying the fiscal inequity have not been given. Consequently, legislatures in these states have had to devise new plans that may have to face a second or even third round of court tests to assess their legal status. About twenty-five new cases were filed in the early 1990s. By 1992, sixteen cases were still outstanding, and cases are currently being developed in five additional states (Odden and Picus, 1992).

In 1995, nine school districts in New Mexico District Court filed suit claiming the existing "Public School Finance Act was... an unconstitutional derogation of the equal protection clause of the New Mexico Constitution," (Almogordo Public Schools, et. al. V. New Mexico Department of Education and the Members of the New Mexico State Board of Education, 1995). District Judge Richard A. Parsons dismissed the case concluding that "the plaintiffs lacked standing to pursue their equal protection and special legislation challenges and did not state a legally sufficient complaint to invalidate the funding formula"(p. 1). He further stated that most laws classify and may affect certain groups unevenly even though the law itself treats them no differently from all other members of the class. His last comments reflected his opinion that the funding formula must be handled as a legislative matter or "if one chooses, a political matter" because courts lack specialized knowledge and experience to resolve persistent and difficult questions of educational policy (Parsons, 1995). During the course of this litigation, the New Mexico Public School Funding Formula Task Force and Legislative Council Service authorized a study of the New Mexico Public School Funding Formula.

One central premise in litigation challenging the fairness of school finance systems is that equalization of funding will lead to equalization of educational opportunity, which, in turn, will lead to improved academic performance of students in lower funded districts. Research into the relationship between school expenditures and student achievement has not yet provided educators with a clear understanding of where districts can most effectively invest educational dollars (Odden and Picus, 1992). Districts continually battle with the question of how educational funds should be invested. Should they be used to reduce class size, provide staff development, improve instructional materials, or deal with increased student needs?

Educational Needs Variables

The research delineates different factors for districts to consider when providing an education for students in need. These factors influence the differential cost of educating children. Current research indicates that the presence or absence of these factors may affect a student's readiness to learn and his or her ability to benefit from the educational experience. Educators have developed numerous programs to address these areas of need adding to increasing educational costs. This discussion explores areas of need related to at-riskness that may influence educational costs in state school finance formulas across the nation. Areas of need discussed in this chapter include a description of the term "at risk" in general, dropouts, students who are Limited English Proficient (LEP), student mobility, poverty, TITLE I funds, school size as related to density, and special education.

At Risk

Most children are "at risk" at some time or another; however, the growing population and influx of immigrants continues to add to the complexity of modern life. There are increasing numbers of single parent families, skyrocketing divorce rates, and families in which both parents work (Olson, 1990). Even children of well-educated, middle class parents may come to school unprepared because of stress their families are undergoing. Certain children, however, are in critical need of intervention and have been traditionally termed "at-risk" (Forsyth, 1993). A disproportionate number of them comes from families at or below the poverty level and are members of minority groups (Brodinsky & Keough, 1989; McCormick, 1989; Slavin, Karweit, & Madden, 1989). Students belonging to poor minority families from other cultural backgrounds are also identified as at-risk students. Preschool age children who are born with demonstrated social, physical, or emotional disadvantage, may also be considered at-risk as identified by community outreach programs, such as Child Find, charged with administration of programs under IDEA (Public Law 101-336, 42 U.S.C.)

Low-income, single-parent, and homeless families are all on the rise. Drug and alcohol abuse, pregnancy, suicide, and teenage dropout rates continue to challenge school districts. These conditions account for an increase in students designated as "at risk." In 1988, Harold Hodgkinson reported twenty-three percent of U.S. children grew up in one-parent families. Ninety percent of these families were headed by single females.

According to Kathryn Keough (1986), 62 percent of single-parent families have annual incomes of less than $10,000 which statistically puts them at the poverty level.

School-age children account for 40 percent of the nation's poor, with nearly one-fourth of U.S. children living in poverty (Hodgkinson, 1989). John Carey (1989), in tracing the shift of the nation's middle-class from urban to suburban locales and gentrified city centers, observed that families living in poverty are being pushed into an continually expanding area located between the rich center city and the prosperous outer suburbs. Donna Harrington-Luecker (1989) reports families with children comprise 34 percent of the nation's homeless. Rural people account for one-fourth of the population in homeless shelters. School district residency requirements and transportation problems make it difficult for homeless children to attend school on a regular basis.

Many barriers and misperceptions exist for both parents and schools because at-risk parents may have feelings of inadequacy, failure, poor self-worth, and negative experience with schools (Baden, Genser, & Levine, 1982). At risk-parents from other cultures, as well as many low-income parents in general, see schools as institutionalized authority, and leave it to the teachers to educate their children. Many of these parents themselves lack an adequate education. Additionally, there are economic, emotional, and time constraints as those families are struggling just to survive. School officials attempting interventions encounter logistical problems such as lack of child care, transportation, scheduling conflicts, and language barriers that may inflate the educational costs (Brodinsky & Keough, 1989; Lightfoot, 1978b).

Dropouts

The cumulative personal income lost nationally as a result of student dropouts is staggering. For example, lost income from dropouts from the high school class of 1981 was estimated to be more than $238 billion, with lost tax revenues of $68 billion. The lifetime personal income lost as result of dropping out ranges from $20,000 to $200,000 per individual. Initial costs of programs focused on keeping economically disadvantaged youths in school are, according to most experts, well worth the investment, possibly yielding a long-term savings of $4.75 for every dollar spent (McCormick, 1989).

The definition of "dropout", however, varies among school districts, and mobility of students makes counting dropouts accurately very difficult. School districts define a dropout as a student who leaves school, for any reason except death, before graduation or completion of a program of studies and without transferring to another school or institution. Within this definition are common categories of students, including those:

--in grades 9 or 10-12 (or in a specific ungraded program equivalent to these grades) who leave during the school year and do not return within a specified length of time.

--who do not return to school after a break, summer vacation, or suspension.

--who are runaways or whose whereabouts are unknown.

--who enter the military, a trade or business school, prison, or any other program not qualifying as an elementary or secondary school.

--who are expelled.

Counting dropouts is more difficult than determining who they are because no system can correctly reflect the status of every student. Moreover, it is the ability of the staff member entering data to accurately evaluate every student's status that ultimately determines the quality of any analysis. While the basis for all dropout rates is the difference between the number of students enrolled at two different points in time, the points chosen by schools vary widely: September and September, September and June, November and June, the beginning term of the school's lowest grade level and that class's normal graduation date (Ascher & Schwartz, 1987).

Some schools are able to take into account students who leave school but should not be classified as dropouts, but others do not have the resources for such an elaborate system. Students erroneously counted as dropouts include those on an extended leave, those for whom transfer records should have been received but were not, those who move so frequently that it is impossible to keep track of them, and those who take extra time to graduate (Ascher & Schwartz, 1987).

Students who drop out often have problems from the beginning of their school careers. By monitoring students from the time they enter school, districts can offer assistance as soon as a problem is noticed. Therefore, some school districts are beginning dropout prevention activities at the elementary level. Crucial to identifying students at-risk, who may join the ranks of dropouts, is monitoring the various aspects of their performance: attendance, utilization of new sensitive testing devices to identify students' learning strengths and weaknesses, and maintaining comprehensive academic profiles of students to facilitate their placement in proper compensatory programs based on their past experience (Ascher & Schwartz).

Monitoring students' attendance, frequent evaluations, and maintenance of academic profiles have added administrative and support staff costs to public schools serving at-risk students. Schools can no longer depend on parents to account for their child's presence in schools, nor do most parents advocate on the behalf of their children who have been affected by poverty, family mobility, health factors or other factors common to families living in the 1990s.

Limited English Proficient(LEP)

The passage in 1968 of the Title VII Bilingual Education Act as a new provision of the Elementary and Secondary Education Act of 1965 authorized funds for local school districts. These funds were specifically intended for programs for students who spoke languages other than English. Title VII funded 76 bilingual programs in its first year, and served students who spoke 14 different languages (Blanco, 1978). A majority of Title VII funds supported bilingual programs in Spanish. In 1976, for example, 61% of the group of people, who called some language other than English their own, spoke Spanish (Blanco, 1978). The size of the Hispanic population has almost doubled since that time (Valdivieso & Davis, 1988). By 1968, fourteen states had enacted statutes that permitted bilingual programs, and thirteen others passed legislation that mandated them (National Clearinghouse, 1986).

In 1974, the Supreme Court decision, Lau v. Nichols, had an even greater effect on school districts' need to provide bilingual education. This decision held that school programs conducted exclusively in English denied equal access to education to students who spoke other languages. The Court determined that districts with such students had a responsibility to help them overcome their language disadvantage (Castellanos, 1983). The Court directed only that all students who do not speak English be served in some meaningful way. It stopped short of making bilingual education an absolute requirement.

Castellanos (1983) felt that Lau v. Nichols gave some recourse from discrimination to students who spoke languages other than English. This viewpoint holds that, like blacks, Mexican Americans and other Hispanic groups suffer from high rates of poverty, unemployment, and delayed educational progress resulting from ethnic or racial discrimination. The Lau decision expanded the legislated need for bilingual education in the United States and broadened it to include any district with students who spoke a language other than English (Lau v. Nichols, 1974).

Development trends reflected in the Title VII legislation and in Lau described multiple reasons for expanding the scope of bilingual education services. Although disputes focused on whether bilingual programs should preserve the cultures or whether they should be designed to help students to be competent in two languages, it was clear that such services were warranted due to the continued immigration of citizens from other countries. Further controversy focused on whether schools should primarily or exclusively turn students who come to school speaking other languages into monolingual English-speaking adults. These disputes about differing philosophical views toward second-language instruction continue as districts compete for funds to serve their diverse student populations.

In 1982, lawmakers amended the Title VII legislation to give school districts more flexibility in implementing the goals of bilingual programs, and to offer Title VII projects the option of using English exclusively. Even though the most sweeping proposed federal changes to bilingual education were not implemented, the provisions of the Title VII re-authorization of 1988 did authorize important changes in bilingual education (National Council of La Raza, 1987). For example, federal initiatives were able to direct up to 25% of funds to English-only programs for students with limited proficiency in English. At the state level there were also changes. Some states with large numbers of Mexican American students whose command of English was limited repealed (Colorado, in 1984, and California in 1987) or revised (Texas and Illinois in 1983) their bilingual statutes.

By conservative estimate, the number of students in the United States whose command of English is limited is in the millions. The majority speak Spanish as their native language. Of those, the majority are Mexican

Americans. At present, many districts provide well-established programs and employ veteran staff members dating from the bilingual resurgence of the 1960s and 1970s (National Council of La Raza, 1987). These programs reflect the need to serve Spanish-speaking students.

Student Achievement

Drazen (1992) used U.S. Department of Education data collected between 1972 and 1988 by the National Longitudinal Studies Program to study the changes in associations between student achievement levels in reading and math and such factors as students of low socio-economic status, family income, and community income. She found few changes in the correlations between achievement and family income over the sixteen-year period. Given the nature of the social changes over the past twenty years, she noted that simply stabilizing the association between achievement and family characteristics might be counted as progress.

Demographic studies suggest that urgent educational needs for the nation include comprehensive programs to address at-risk and low-achieving students. Believing that school performance is linked to social conditions, both David Snyder (1984) and Hodgkinson (1989) advocate networking services that attend to students' health, education, housing, legal, and transportation needs. Special emphasis should be given to preventive measures such as providing adequate head-start programs, low-income housing, mass transit systems, health care and family counseling programs, and attention by the schools to low-achieving students.

Mobility

While America has long been a nation "on the move," today two types of student mobility are most frequently encountered: 1) inner-city mobility, which is prompted largely by fluctuations in the job market; and 2) intra-city mobility, which may be caused by upward mobility, on the one hand, or poverty and homelessness, on the other. In fact, high rents, poor housing, and economic hardship seriously affect urban schools whose populations change as much as 100 percent a year (Schuler, 1990).

Most research shows that high mobility lowers student achievement--particularly when the students are from low-income, less-educated families (Sewell, 1982; Straits, 1987). Students who attend the same school for their whole career are most likely to graduate, whereas the most mobile school population--migrant students--has the highest rates of school failure and dropout (Lunon, 1986). Just as high poverty rates affect achievement even for non-poor students, high mobility rates affect students whose residence is stable. Schools with high dropout rates are more likely to be situated in unstable school districts, and to be in high-growth states (Neuman, 1987).

Lower student achievement associated with mobility is often compounded by other related factors such as poverty, limited English proficiency, substandard housing, and others. A recent analysis of student mobility found that children living with one parent move twice as frequently as children living with two parents, and that children in one-parent families also have lower achievement than those in two-parent families (Sewell, 1982).

High student mobility considerably impacts schools, both financially and administratively. Services developed for one population--for example, limited English proficient students--might suddenly become unnecessary if many of the users moved in the middle of the semester. Attempts to monitor school performance become meaningless if the student population tested one year has largely changed by the next.

One of the more prevalent administrative problems with mobile students stems from lack of prompt transfer of records. Students are often placed inappropriately, and even held back, while their receiving school waits three to five months for their records (Neuman, 1988; Sewell, 1982). At first, these record-keeping problems seemed most obvious with migrant students. However, record-keeping problems have long occurred with many students less clearly designated as "transient." Voluntary desegregation is well known for creating havoc with district record-keeping. More recently, homeless students have created a new surge in record transfers, and districts have often been financially penalized for students who were counted absent when they were already enrolled in a different district. Student mobility continues to create its own record-keeping nightmare--especially since schools have no motivation to cooperate with competing schools to provide rapid record transfers.

Poverty

Various federal, state, and local programs have been designed and implemented in an effort to offset difficulties encountered by children from economically and socially disadvantaged backgrounds when they enter public schools. Many programs prepare preschool children of low socioeconomic status for the challenges they face as they begin their education. Others seek to improve the achievement levels of these students who are already struggling in schools that lack the resources necessary to provide them with the attention they need to ensure a successful school career. Districts provide programs for these students to offer them the intellectual tools and social skills necessary to become productive, working adults.

Surprisingly, the United States has a much higher incidence of child poverty than does other Western nations. The percentage of impoverished children in the population has continued to increase during the past two decades (Cohen, 1993). Young people constitute only 25 percent of the population, however, they represent almost 40 percent of those persons classified as poor. A large majority of these impoverished children are black (43.1 percent) or Hispanic (39.6 percent) (McCormick, 1989). In 1987, 31 percent of impoverished children under the age of six lived in large cities (National Center for Children in Poverty, 1990).

There is no question that living in poverty profoundly impacts the lives of these children. Carta (1991) cites several sources indicating that impoverished children living in inner cities are much more likely to have educationally damaging circumstances as part of their life experiences than are children living above the poverty level. These children are exposed to such dangers as prenatal exposure to drugs and AIDS, low birth weight, poor nutrition, lead exposure, and personal injuries and accidents. To make matters worse, poor inner city youths are seven times more likely to be the victims of child abuse or neglect. Any one or combination of these factors increases the risk of children at the poverty level having depressed levels of academic achievement resulting in an increased chance of joining the ranks of dropouts. As many as one million of these at-risk students drop out each year (McCormick, 1989).

One recent study revealed strong links between family income levels and children's I.Q.s. Campbell (1991) described a study which sampled 900 children born with low birth weight. The researcher reported that those who lived in "persistent poverty" during their first five years had I.Q.s averaging 9.1 points lower than the I.Q.s of the children in the sample whose families were not impoverished. It is also noteworthy that researchers who have focused on family beliefs, values, and attitudes among poverty-level households found that poor parents who had rigid, authoritarian beliefs about rearing and educating children had a strongly negative influence on their children's achievement levels in reading. Fortunately, participation in an early childhood education intervention program tends to modify the authoritarian views of such parents (Campbell).

Datcher-Loury (1989) studied a group of low-income black children to determine if differences in academic performance were attributable "to differences in behavior and attitudes among the families." On the basis of the students' achievement results on reading and math tests and on interviews with and observations of the children's mothers, Datcher-Loury concluded that differences in family behavior and attitudes have "large and important long-term effects on children's academic performance." Districts who downplay or fail to address poverty likely will contribute to the cumulative effect of raising a nation of uneducated citizens who continue the cycle of poverty.

The self-esteem of students in inner-city neighborhoods is continually eroded by the pervasive negative images of minority men--on the streets, in schools, and in the media (Yarmolinsky, Liebman, & Schelling, 1981). These negative media images often cause students to doubt their own chances for success. Because the values and discipline necessary for achievement are absent in much of urban city life, many students are pressured by their peers not to achieve in school, and do not learn behaviors and habits that will help them be successful (Hill, Wise, & Shapiro, 1989).

Students from low-income families often find themselves clustered in schools that are grossly underfunded, while other nearby schools attended primarily by wealthier students receive substantially more funding on a per-pupil basis. Although the relationship between higher levels of per-pupil expenditures and improved levels of academic performance is not clear cut

(Hanushek, 1989), researchers have continued to point out inequities that unfairly penalize those living in poor school districts. Some policy-makers now argue that financial restructuring must take place to help poor students overcome the disadvantages built into current school finance structures (Harp, 1993). It seems apparent that if these at-risk children attend poorly funded schools, they will not achieve at the same levels as their counterparts attending better funded schools.

Federal funds from the Title I programs help state and local education agencies establish compensatory programs, especially in math, reading, and writing, for the millions of children whose families live at or below the poverty level. State education offices and school districts have programs that seek to give poor students better opportunities to succeed in their education. Federal monies available for programs targeted to at-risk children make up at most only about 7 percent of state education budgets (Drazen, 1992). As a result, local districts in low-income areas where compensatory programs are most needed, rarely have sufficient revenue to offer all the special programs required by their enrolled at-risk students.

Title I Funds

Since 1981, Title I of the Education Consolidation and Improvement Act has provided school districts with supplementary services funds for more than five million low-achieving students across the country. Districts have used Title I funds, whose allocation is based on the number of students from poor homes, to design programs to benefit low-achieving students.

Historically, to serve this population, the majority of schools have relied upon "pull-out" classes that both isolate Title I students from the larger student population and, as many have suggested, limit the educational effectiveness of the programs themselves by providing little beyond remedial instruction.

Under current legislation, the Hawkins-Stafford School Improvement Amendments of 1988, schools with an enrollment of at least 75 percent low-income students may use Title I funds to create "schoolwide projects" for improving educational programs throughout an individual school rather than for implementing a discrete remedial program. Such projects are intended to strengthen the education of Title I students through enriching the educational experience of all students. This effort to bring broader educational reform to entire schools rests on the assumption that, in the poorest schools, it makes more sense to serve all students than to provide isolated supplementary services (U.S. Department of Education, 1990, 1993). Thus, through schoolwide projects, students who may just miss eligibility for Title I, but who could still benefit from programs, can receive assistance.

Since 1978, Title I legislation has permitted schoolwide projects. However, they were rarely implemented before 1988 due to a requirement that districts match Federal grants with funds of their own (U.S. Department of Education, 1993). Since the passage of the Hawkins-Stafford Amendments, when the matching funding requirement was dropped, the number of schoolwide projects has grown much more rapidly than other types of Title I implementations (Millsap, Moss, & Gamse, 1993).

To encourage the implementation of schoolwide projects, The Hawkins-Stafford Amendments, the U.S. Department of Education's Chapter 1 of Title I Policy Manual (1990) suggests that projects may consist of class size reduction efforts, staff development and parent training, and extended day activities. Schoolwide projects vary widely across the country. Most schools, however, have used schoolwide projects to reduce class size and to strengthen a variety of already existing programs (U.S. Department of Education, 1993). Other typical schoolwide implementations include the following: an informal process of student selection for supplementary and pull-out services, formal staff development programs, services of supplementary professional staff members, such as counselors, social workers, project coordinators, and in-class teaching assistants. Family-oriented programs, such as in-school parent centers, ongoing home visits, collaborative projects with family service agencies, school-based child-care, early childhood education, along with innovative practices, including the development of teacher resource centers, cross-age groupings, cooperative learning programs, augmented school libraries have been developed through Title I funds. Other districts add enrichment programs, such as expanded field trips and extended-day or extended-year programs (Gittleman, 1992; Millsap et al., 1992).

Title I schoolwide projects have generated widespread enthusiasm because they provide underachieving students with extra help, allow greater flexibility, and are recognized as a way to remove the "disadvantaged" label from the poorest Title I schools (Gittleman, 1992). Nearly 85 percent of principals in schools with schoolwide projects have reported generally positive results from their projects (U.S. Department of Education, 1993). According to these principals, those projects can offer more creative programming in delivering supplementary services than traditional Title I programs, offer assistance to all students rather than to a limited population, while still serving traditional Title I students, and eliminate or transform many negative features of more traditional "pull-out" Title I programs.

School Size as Related to Density

There are several important reasons for fiscal strains experienced by densely populated urban school districts. During the 1950s and 1960s, education funds were most often raised at a local level based on property taxes, with funds from the federal government generally used to create special programming and other supplements. Since 1970, however, partly in the hope of reducing inequities between property rich and property poor districts, state aid for education has increasingly supplemented local school funding. All fifty states increased their education budgets in the early 1980s, and by 1984 states generally funded more than fifty percent of non-federal school costs (Augenblick, 1984). Despite their growth, state education budgets have not kept up with inflation (Ascher, 1989). This means that states have simply not had funds available to pick up the loss of federal dollars, or to give extra money to traditionally poor school districts. Consequently, in many urban areas, the state ratio of funding has remained significantly lower than fifty percent. In 1989, of Chicago's $1.9 billion education budget, for instance, the state supplied 42 percent, or $825 million (Byrd, 1989).

Although states have always exercised some control over the level of resources available for public schooling, the growth of state level funding has been accompanied by a consolidation of state control along with reduced local power to raise money or to determine how it is spent. Because state monies come with different stipulations each year, local school officials are unable to plan from year to year whether specific programs will be refunded or how much money will be available for discretionary spending.

Gladimus (1989) states that raising school taxes in urban areas is difficult for several reasons. In many cities, because the development of new housing is minimal, there are fewer options for raising property-based school taxes. In addition, city councils often attempt to attract commercial real estate interests with the incentive of abatements and exemptions. Urban school districts are likely to experience particular fiscal strain, both because they must make expenditures not necessary in other areas and because they can secure less for their education dollar. Many ghetto areas are forced to use "combat pay" to attract teachers. These high salaries must be borne by cities because state aid systems rarely include a training and experience factor for teachers in per pupil cost calculations. The cost of land for schools, and materials and labor for their construction and maintenance, are higher in urban areas as well (Ascher, 1989).

Unfortunately, urban schools located in high density areas also face greater costs due to vandalism and theft. Although new technology available in public schools obviously enhances education, it also encourages break-ins. Such thefts of VCRs, computers, and software equipment have greatly increased operating costs. In addition, urban schools have been affected by the changing composition of the inner city population. Augustine Garcia (1989) notes that inner cities and areas of high density immigration (California, Florida) are experiencing the intimidation and irrational violence of Neo-Nazi skinheads and numerous racial gangs. Multicultural education programs are often added in individual urban districts to provide a way to deal with prejudice and to foster appreciation for racial and ethnic differences. These programs may also require additional funds.

In an effort to more fairly calculate urban students' needs, New York's Salerno Commission (1989) recommended a number of reforms in state aid to education. Among them, the following have application in many states besides New York. The current pupil calculation by Average Daily Attendance (ADA) should be modified to reflect a blend of active membership (enrollment) and attendance. State aid distribution should also reflect the additional needs of disadvantaged and at-risk students. A final suggestion is that each school district's ability to pay for educational services--including regional cost differences, shifts in property values, and the use of a poverty factor to calculate the combined wealth ratio--should be calculated into the state aid formula (Salerno, 1989).

Special Education

In 1975, the U.S. Congress passed the Education for All Handicapped Children Act, which guarantees a free and appropriate public education to all children in the United States between the ages of 3 and 21. The law provides funds for special education programs to states and local districts that comply with a set of regulations. These regulations mandate provision of special education services including an individualized educational program to be carried out in the least restrictive environment, a comprehensive diagnosis of each child's disabilities by a qualified professional team, an annual review of each child's progress, and the involvement of parents in educational decisions. Amendments to the law, P.L. 98-199 and P.L. 99-457, also require that the local school districts actively search for and provide services to children between the ages of 3 and 5 who have disabilities (U.S. Department of Education, 1990).

The 1990 Individuals With Disabilities Education Act (IDEA) (a revision of the Education of the Handicapped Act) guarantees "that all children with disabilities have available to them...a free appropriate public education which emphasizes special education and related services designed to meet their needs..." In order to fully meet these goals, IDEA has: 1) expanded the definition of "special education" to include "instruction conducted in the classroom, in the home, in hospitals and institutions, and in other settings; and instruction in physical education" and 2) extended "related services" to include "social work services" and "rehabilitative counseling." In addition, the term "handicap" has been replaced throughout the Act with the term "disability," and terminology using "people first" has been utilized. Major additions from IDEA are the inclusion of "autism" and "traumatic brain injury" as separate categories under the definition of children with disabilities. Eligibility is based on the fact of a child's condition "adversely affecting the child's educational performance."

States are required to develop systems to provide early intervention services for infants from birth to age 3 who are developmentally delayed or at risk of becoming developmentally delayed. As considered in the Education for All Handicapped Children Act (Public Law 94-142), handicapped children must meet two criteria. The child must have one or more specified disabilities such as deaf, learning disabled, learning handicapped, etc.; and he or she must require special education and related services. Not all children who have a disability require special education. Many are able to attend school without any program modification (Council for Exceptional Children, 1989). Children suspected of having a handicap are evaluated by a multidisciplinary team that includes at least one teacher or other specialist with knowledge in the area of the suspected disability. Following a complete and individual evaluation of the child's educational needs, the team determines whether or not the child requires special education and related services. If the evaluation confirms that a child has one or more disabilities and because of the disabilities special education and related services are required, then states and localities must provide a free, appropriate public education for that child (U.S. Department of Education, 1990).

Currently, schools strive to teach more exceptional students in regular classrooms. A variety of approaches, including resource rooms and consultation services by special education teachers have been developed to implement mainstreaming. Regular classroom teachers are providing instruction to a wider diversity of students. Students with problems too severe to be served in a regular class are placed in the least restrictive environment, whenever possible.

Educational research supports the view that a child's ability to learn in school depends on skills learned as a toddler. Consequently, children with disabilities are receiving special education services earlier. In addition, schools are planning long range interventions such as assessing the abilities and talents of students with handicaps and matching them with potential occupations. Increased instruction in vocational skills is being provided to students with handicaps, and more programs are being offered to assist them in the transition from school to community life and work (Council for Exceptional Children, 1989). Providing such comprehensive educational services to special education students increasingly strains school district budgets as new mandates are often unfunded or underfunded and fiscal resources become more restricted.

Historical Development of Index of Need

In 1990, Lyons sought to develop a systematic methodology for the allocation of funds for states to use in their school finance formulas that would provide "local school districts with funds for programs and services to address the needs of at-risk students" (Lyons, 1990, p. 5). Her study described a series of "prototype programs to serve at-risk students, and developed a cost estimate for each prototype program". She also utilized these programs in selecting and simulating alternative methods for allocation of state funds through a state funding formula to local school districts to support programs and activities for at-risk students. One of the alternatives was an index-of-need that had been developed by the Arizona Department of Education. As part of this study, she evaluated the alternative methods for state funding allocations using a set of accepted criteria from the school finance literature. She concluded that the index-of-need had the potential as a funding methodology for at-risk because one did not need to label children and it offered maximum flexibility in program development for districts to design programs to meet their unique circumstances.

In 1990, Lyons developed another index-of-need for the state of Texas using a multiple regression model. Her study was undertaken to address some criticisms of the Arizona at-risk index (Arizona Department of Education, 1989). Texas was selected for the simulation of the index because its available data base was comprehensive and included socioeconomic and student performance variables. It had a full range of different types and configurations of school districts and it maintained a count of at-risk youth that could be used as a dependent variable in a multiple regression model.

In this study, data for a select group of eight variables related to students' being at-risk was secured for each of the 1,053 school districts in Texas. The eight variables explored were students at-risk, the number of students identified as being eligible for free or reduced-price meals from a family at or below the poverty level, limited English proficient students, actual number of student dropouts, students reported at one year older than their grade, students two or more years over their grade, students who failed at least one test in a standardized test battery, and students identified as being continuously enrolled in the district less than two years. Lyons noted the best predictive formula when compared with the actual number of reported at-risk students was based on a model which included the following four variables: the number of students eligible for free and reduced-price meals, a mobility factor, number of children with limited English proficiency, and students who had failed at least one test in a standardized test battery.

Lyons concluded that given the dearth of program evaluation and cost-effectiveness studies, the variations in the target groups and programs, and current categorical funding constraints, it did not seem appropriate for states to use traditional funding methodologies for at-risk populations. She felt an index-of-need option offered a funding method that resulted in funds being allocated to districts with greatest incidence of at-risk youth. In addition, it allowed for local districts to develop unique programs without having to label students. She cautioned, however, that each state must carefully select its variables for an index-of-need to represent its own unique set of circumstances and also develop accountability safeguards (Lyons, 1990).

While the Lyons index-of-need had promise as a funding methodology for at-risk it relied on the existence of a state-defined dependent variable. Since few states track at-risk students, this linearly calculated model had limited application. In response to the problem of developing an index using a linear methodology, Weiner (1994) developed an index-of need using a neural net methodology that mimics the brain's problem solving process by applying knowledge gained from experience to new situations. Using previously solved examples, a neural network builds a system of "neurons" connected by weights applied to values that enables it to make new decisions, classifications, and predictions. By processing inputs supplied by the researcher, neural networks produce an output that can be utilized to classify or predict.

Weiner's simulation examined the variation in educational need as a function of "reservation characteristics" of Bureau of Indian Affairs (BIA) schools (p. 72). The index was generated by applying a need factor for each reservation as an add-on weight. Resources were redistributed using this formula. She was the first person to utilize the neural nets to analyze data to develop an index-of-need.

Another study that probed at-risk identification criteria was recently completed by Joraanstad (1995). He attempted to project expenditures based on at-risk criteria by constructing an at-risk index, using that index through a funding formula simulation, and determining the redistributive effect on state funding of Arizona schools. Beginning with a selection of indicators from a pool of U.S. Census Bureau and Arizona District Schools data, Joraanstad utilized Weiner's neural network methodology to process and analyze multiple indicators of "at-riskness." The variables for 208 school districts were processed using the Neuroshell2 (Ward Systems Group, Inc., 1993) neural network computing software. Seven variables survived the selection process: special education students, limited English proficient students, students with low academic test scores, household income, children living in homes at or below the poverty level, student ethnicity, and parental education level (Joraanstad, 1995).

Using a Kohonen neural net analysis (Nelson & Illingworth, 1994), school district variables were clustered into eleven categories that were used in the development of the index (Joraanstad,1995, p. 82). The researcher reported two variables, ethnicity and low achievement test scores, as the most influential in determining the Kohonen categories. The at-risk index was a reliable indicator of the level of needs illustrated by its face validity when compared with related data and in the Arizona study, when the results were correlated with the current complex pupil weighting system.

The index-of-need is different from other methodologies in that it can be used to recognize cost burdens in school districts associated with the full range of special needs, i.e., children with disabilities, at-risk youth, limited

English proficient students, and disadvantaged youth. The strengths of the index are that the concept (1) accommodates differences in cost conditions among school districts, (2) provides a research-based proxy for the educational needs of all youth without requiring that students be labeled or be served in separate programs, and (3) empowers schools to create innovative educational environments to meet the unique needs of each student.

Summary of Review of the Literature

When examining the research concerning at-risk students and indicators of need, one can argue the need for additional variables to be considered. As the population continues to grow and vary in demographics, individual states will have to determine their own particular areas of need in order to equitably serve their student population. There is no question that a data-based approach as advocated by Stowitschek (1990) would be the most reliable means of demonstrating the need for educational interventions with at-risk youth.

This review of the literature has identified variables that substantiate the issue of need and could be used in developing an educational overburden index. It also explored the use of neural networks as a means of dealing with non-linear multi-dimensional data. Neural network computing appears to be a viable methodology for clustering districts based on their multi-dimensional needs. It has the potential for assisting in the development of a funding model that may be more equitable and at the same time allow districts more flexibility in meeting their own unique needs.

CHAPTER III

METHODOLOGY

Introduction

This study was designed to develop an alternative funding methodology for the allocation of state monies to local school districts based on their unique set of socio-economic and educational characteristics. This study consisted of three phases. Phase one consisted of the selection of variables from a pool of data supplied by the state of New Mexico that were predictive of student need and were documented in the research literature. Phase two consisted of the development of an educational overburden index (EOI) through the use of a neural network computing procedure. Phase three utilized the EOI to simulate the allocation of resources for the eighty-nine New Mexico school districts to determine the redistributive effect when compared with the current funding formula.

Purpose of the Study

The purpose of this study was to develop an educational overburden index (EOI) as part of an ongoing research effort to develop a methodology for the distribution of funds based on the unique characteristics and needs of individual school districts. The present study investigated potential variables to be included in an educational overburden index developed for the state of New Mexico. The educational overburden index was applied to each New Mexico school district, incorporated as part of the funding formula, and examined in terms of its redistributive effect on different types of school districts. The intent of the educational overburden index (EOI) was to provide a method of allocating monies to school districts that fosters local program flexibility, avoids "labeling" students and targets funds for the districts with the highest incidence of need. The goal was to develop an index as a funding mechanism based on identifiable variables of need that were most appropriate for the circumstances in a given state, in this case the state of New Mexico (Jordan and Lyons, 1992).

Research Questions

To fulfill the purpose of the study, the following research questions were formulated. They are:

1. What variables among data elements can be supported by literature and research as indicators of educational need?
2. Which variables identified in question one are viable for developing an educational overburden index for the state of New Mexico?
3. Using a neural network computing procedure, how would districts be clustered according to educational need?
4. What would be the potential impact of the educational overburden index on schools districts of varying wealth distribution and size?

5. How would the application of an educational overburden index affect the allocation of funds to school districts in New Mexico?

Data Sources

The data used in this study consisted of information organized by school districts and by specific variables that were included for consideration in the development of an educational overburden index. Measures used in the composite indicator were selected from data collected from the state of New Mexico (Bell & Forrer, 1994) and individual New Mexico school districts. The data variables selected were compiled from the district's existing data set and were conceptually consistent with possible indicators of need.

Candidate variables for the EOI included variables from the research literature indicative of student need as well as different groupings of special needs students currently being served by New Mexico, and the teacher training and experience index that is currently in the state's funding formula. By combining candidate variables, groupings of students with special needs, and teacher training and experience the potential data sets included:

1. Title I % of ADM (TITLE I)
2. Free and Reduced Price Lunch % of ADM (FRPL)
3. Dropout Rate (DOUT)
4. ITBS Scores below 40 percentile (ITBS)
5. High School Competency Exam (HSComp)

6. Pupils Per Square Miles (P/P SQ.MI)
7. Teacher Salary Training and Experience Index (Tchr Sal)
8. Limited English Proficient (LEP)
9. Student Mobility (MOB)
10. Special Education Membership % of Total ADM (SPED)
11. Gifted and Talented % of ADM (GATE)

Research Procedures

In phase one of this study, it was necessary to select educational and socio-economic variables that research demonstrates indicate areas of student need that require increased services and personnel. An extensive review of the research related to the variables that affect student performance and educational expenditures was conducted. Candidate variables were selected through information provided by New Mexico state agencies. A Correlation Coefficient Matrix was calculated for the independent variables to determine the degree of relationship among the various indicators. If a strong relationship between two variables introduced a statistical indication of multicollinearity, the redundancy was avoided by dropping the second redundant variable. Since the ability to predict would not be improved by including both variables (Bishop, 1994), a relationship above .80 was considered grounds for dropping one of the two related variables unless the variables measured completely different information.

Once the variables were selected, it was necessary to be able to group districts according to need based on their unique configuration of the delineated variables. In phase two, districts were clustered using a neural networking computer program to construct the educational overburden index utilizing a set of neural networking procedures developed by Weiner (1994). She first used this process to analyze indicators from schools funded by the Bureau of Indian Affairs (BIA).

Artificial neural net computing procedures have been studied in an effort to achieve human-like performance. These procedures are composed of many nonlinear computational elements operating in parallel and arranged in patterns similar to biological neural nets. Computational elements called nodes are connected via weights that are adapted during training to improve performance (Lippmann, 1987).

Neural network computing systems compare favorably traditional statistical systems at recognizing data patterns. These systems may be more efficient because they require less memory, provide relatively current statistics, and are more responsive to changes in data (Nelson & Illingworth, 1991). Neural nets can discern subtle and complex relationships among variables. Neural nets can match large amounts of input information in order to generate categorical outputs. The programs allow the researcher to set up the neural network through unsupervised or supervised learning, both which are utilized in this study.

Teuvo Kohonen developed an unsupervised neural network which he described as a "self-organizing map" (Kohonen, 1990). The "map" is a sheetlike artificial neural network, the cells of which are specifically tuned to various input signal patterns or classes of patterns through an unsupervised learning process. Self-organizing maps consisting of several map modules have been used for pattern analysis. The spatial segregation of different responses results in a high degree of efficiency in neural network operations.

Kohonen's algorithm creates a vector quantifier by adjusting weights from common input nodes to a specified number of output nodes arranged in a two dimensional grid. Output nodes are interconnected with many local connections. Continuous-valued input vectors are presented sequentially in time without specifying the desired output. After enough input vectors have been presented, weights will specify cluster centers that sample the input space allowing the point density function of the vector centers to approximate the probability density function of the input. In addition, the weights will be organized such that topologically close nodes are sensitive to inputs that are physically similar. Output nodes will be ordered in a natural manner. The algorithm that forms feature maps requires a neighborhood to be defined around each node as shown in Figure 1 (Werbos,1990).

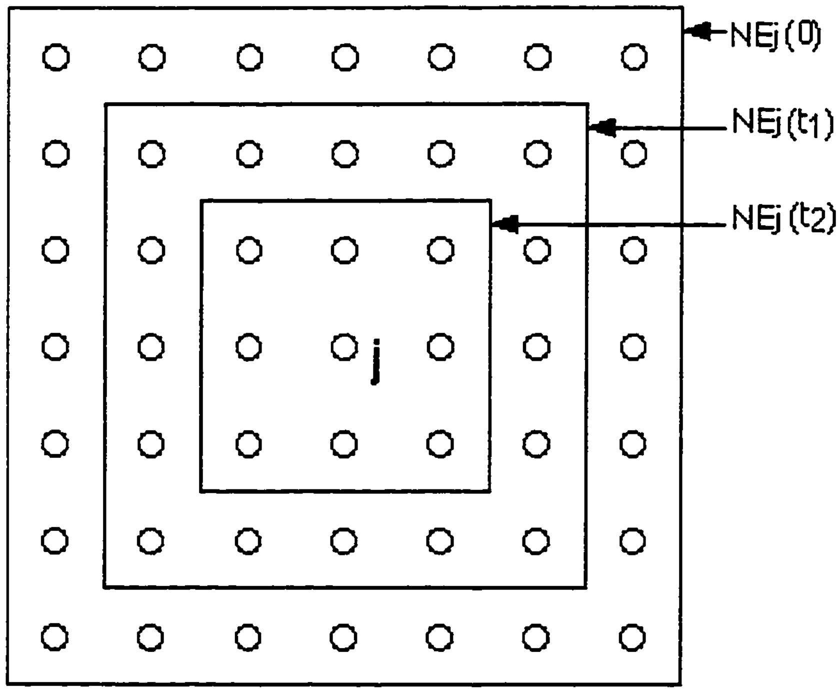


Figure 1. Topological neighborhoods at different times as feature maps are formed. NE_j (t) is the set of nodes considered to be in the neighborhood of node "j" at time "t". The neighborhood starts large and slowly decreases in size over time (Werbos, 1990).

Nonlinearity of self-organizing maps makes it difficult to evaluate output or results using traditional evaluation models. The specific characteristics of backpropagation, another type of neural network, was utilized to evaluate the results of the Kohonen processing.

A typical backpropagation neural net is comprised of an input layer, an output layer and a hidden layer of nodes all interconnected. The basic network structure is illustrated in Figure 2.

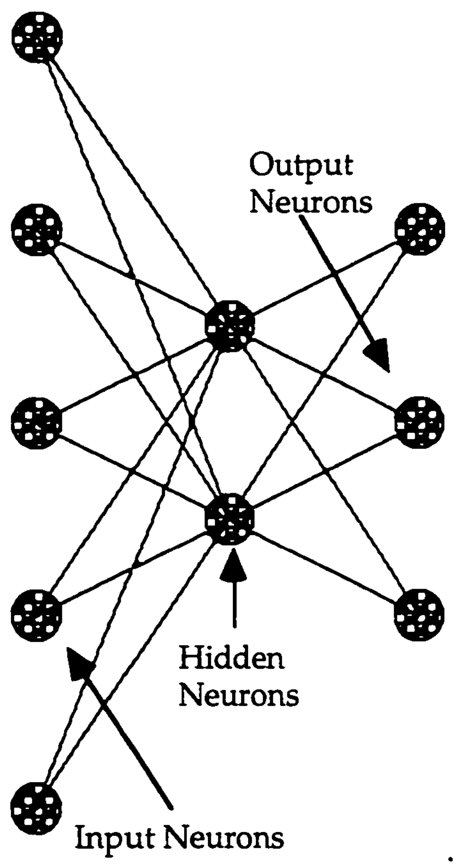


Figure 2. Network Structure (Ward Systems Group, Inc.)

The connection weight of any two connection nodes reflects the strength of the relationship between those nodes (Nelson & Illingworth, 1991). Determining these weights is the focus of the neural network's backpropagation computational process.

Backpropagation is a powerful tool and has been applied to concrete problems by Werbos (1990) and Pineda (1987) among others. It is simply an efficient and exact method for calculating all the derivatives of a single target quality such as pattern classification error with respect to a large set of input qualities (e.g. parameters or weights in a classification rule). It is also currently the most popular method for performing a supervised learning task. In supervised learning, the neural network is adapted so that its actual outputs (Y) come close to some target outputs Y for a training set which contains T patterns.

The main use of a trained net lies in pattern recognition work. In basic back-propagation, the weights are chosen so as to minimize square error over the training set as illustrated in Figure 3. The goal is to adapt the parameter of the network so that it performs well for patterns from outside the training set (Werbos, 1990).

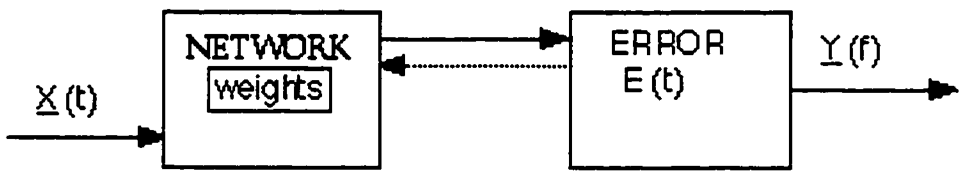


Figure 3. Basic backpropagation in pattern learning (Werbos)

The extent that the network can predict values that approximate training is dependent upon the degree of relationship between input variables and the output (or training) variables. Analysis presents the backpropagation with incidences of solved problems. The difference between the propagated and the training value is used to adjust connector weights which are then adjusted backwards through the net. Thus, the term backpropagation is used.

The statistical indicator R squared is used to compare accuracy of the model to the accuracy of a benchmark model wherein the prediction is the mean of all of the samples. A perfect fit would result in an R squared value of 1, a very good fit near 1 and a very poor fit near 0. If the neural predictions are worse than one could predict by simply using the mean of the sample case outputs, the R squared value will be 0.

Back propagation has been found to perform well in most cases and to find good solutions to the problems posed (Lippman, 1987). It was first applied to a social science case when Werbos (1974) utilized it to estimate a dynamic model to predict nationalism and social communication. As Werbos states, "backpropagation can be applied to many different categories of dynamic systems--neural networks, feed forward systems of equations, systems with time lags, systems with instantaneous feedback between variables, an so on." It has become one of the most popular neural net procedures used for pattern classification and continues to show great potential in the exploration of competing hypotheses (Lippman).

In this study, back propagation weighted the connections using the differences between inputs and outputs by utilizing its ability to perform the task according to the relationship between inputs and outputs. If the clusters generated by the Kohonen network proved accurate, the back propagation analysis would be able to predict the given outputs to at least a .90. Thus, the backpropagation process evaluates the validity of the Kohonen-produced clusters. Actual add-on weights were determined by comparing figures from the Kohonen categories and backpropagation clusters for each district until a continuum was developed listing districts from highest need (10) to lowest need(1). An index was constructed with a range limited to 1.00 - 1.50 which represented replacement of the value of the current special program indices. Add on weights were then assigned according to the index.

In phase three, each district's allocation of funds were then recalculated to determine the redistributive impact using the existing state appropriation. When comparing the current funding formula to the formula computed using the EOI, the indices for special education and bilingual were omitted because they are included in variables which comprise the EOI. Indices for school and district size and growth rate were retained because they were not included as one of the six EOI variables.

CHAPTER IV

DATA ANALYSIS

Introduction

The purpose of this study was to examine indicators of need for New Mexico school districts and to project expenditures based upon these criteria. This study consisted of three phases. Phase one involved the selection of variables from a pool of data supplied by New Mexico state that were predictive of student need and were documented in the research literature. Phase two consisted of the development of an educational overburden index (EOI) through the use of a neural network computing program. Phase three utilized the EOI to simulate the allocation of resources for the eighty-nine New Mexico school districts to determine the redistributive effect when compared with the current funding formula.

Selection of Need Variables

During phase one, the variables selected as predictive of student needs as supported in the literature were compared using a correlation matrix to determine how closely correlated they were. The correlation matrix, depicted in Table 1, revealed varying patterns among candidate variables. As expected ITBS and HSComp scores reported by districts showed some positive correlation (.586) greater than .5. In addition, there was some relationship between FPRL participants and SPED at least a .5 level. The number of LEP students as reported by individual districts had positive correlations above the .5 level with FPRL, ITBS and HSComp. This may support the viewpoint that districts with large populations of LEP students may report lower test scores overall. The variable SPED also had a correlation above the .5 level in relation to TITLE I supporting the view that many disadvantaged students may also qualify for special education services.

Table 1

Correlation Coefficient Matrix for Eleven Variables

VAR	TITLE I	FPRL	DOUT	ITBS	HSComp	P/P Sq	TchrSal	LEP	MOB	SPED	GATE
TITLE I	1	0.4072	0.163	0.39	0.4012	-0.1841	0.25550	0.39920	0.0586	0.05943	-0.22540
FPRL		1	0.293	0.51	0.4580	-0.0067	0.26810	0.54335	0.0424	0.42528	-0.27740
DOUT			1	0.30	0.1328	0.2921	0.22410	0.1190	-0.0120	-0.1238	0.03567
ITBS				1	0.5860	-0.1477	0.03740	0.50358	0.0306	0.03069	-0.15140
HSComp					1	-0.0517	0.15500	0.53370	0.1749	0.17489	0.21688
P/P Sq						1	0.07900	-0.06780	0.0403	0.03603	0.17896
TchrSal							1	0.15828	0.0668	0.06554	0.05458
LEP								1	0.0797	0.07943	-0.21813
MOB									1	0.50930	-0.27800
SPED										1	-0..2793
GATE											1

No large negative correlations were found for any two candidate variables. This is to be expected since indicators of need or "at riskness" should have more positive correlations than negative. Of the sixty-six correlations, thirteen were negative. Pupils per square mile (P/P SQ) had four negative correlations: TITLE I, FPRL, ITBS and HSComp.

When six variables were used as illustrated in Table 2 , only one high correlation remained. As discussed earlier, the variable MOB was retained because special education and mobility rates provide different information.

Table 2

Correlation Coefficient Matrix for Six Variables

VARIABLE	TITLE I	DOUT	TchrSal	LEP	MOB	SPED
TITLE I	1	0.163	0.2555	0.3992	0.0586	0.05943
DOUT		1	0.2241	0.0119	-0.0120	-0.01238
TchrSal			1	0.1582	0.0668	0.06554
LEP				1	0.0797	0.07943
MOB					1	0.50930
SPED						1

Development of EOI

During phase two, the eleven initial variables were analyzed and grouped using the Neuroshell2 neural network processing computer program to cluster them into categories of need from lowest to highest based on individual district's reporting of need factors. During this processing, several variables were dropped for reasons that would negatively impact districts in need. For example, a decision was made to drop ITBS and

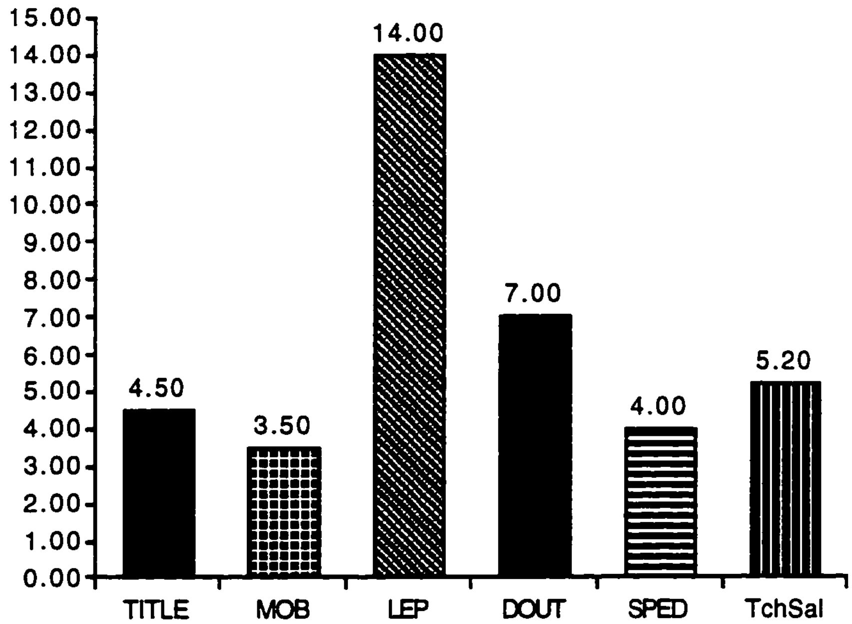
HSComp following initial Neuroshell2 runs because it was discovered that districts serving needy students that were doing a good job as indicated by higher test scores would be penalized by application of an EOI index utilizing test scores to determine level of need. In addition, two variables were dropped because they contained variable or irrational data. The variables selected were verified through backpropagation to determine which clusters were accurate and reliable.

The Neuroshell2 Kohonen processing rated districts into clusters ranging from 1.0 (lowest level of need) to 10.0 (highest level of need). The network was set up to separate districts into 10 clusters which were obtained at the end of five consecutive runs in which the final six variables included in the EOI index were identified. Those six variables comprised the EOI which was used in the current New Mexico funding formula to determine a hypothetical redistributive effect of the index on district funding, if it replaced the current indices for special education, limited English proficient, and the teacher training and experience index.

The Kohonen analysis was performed on the six variables listed in the correlation matrix depicted in Table 2. This Kohonen processing indicated that the relative contribution factors, or strength factors identified the LEP variable as the most significant indicator with a relative strength factors of approximately 14. As illustrated in Table 4, the LEP variable was followed by DOUT at 7.0, TchrSal at 6.0, TITLE I at 4.5, SPED at 4.0 and MOB at 3.5.

Figure 4

Relative Contribution Strength of Six Indicators



Strength

Backpropagation Analysis

To assess the validity of the clusters, the six indicators were further analyzed by the backpropagation method. Each district and its data on the six variables were entered as the desired input. The backpropagation process network then processed the information through a 36 neuron hidden layer and assigned a single number to each district ranging from 1.00 to 10.00. The results of this process are listed in Appendix A.

For this study, the learning rate, which dynamically increases by increment, was set at .1 which allowed the program to adjust increments as training proceeded. The initial weight which fluctuates as it is modified through the neural net process was set at .3. The momentum term, set at .1, kept the network generally going in the same direction and affected weight fluctuation adjustments. The backpropagation design consisted of a three-layer network illustrated below in Figure 5 with six neurons in the first layer (the number of indicators as inputs for each district) 36 in the second hidden layer and one neuron (categories designated as one output per district) in the third layer.

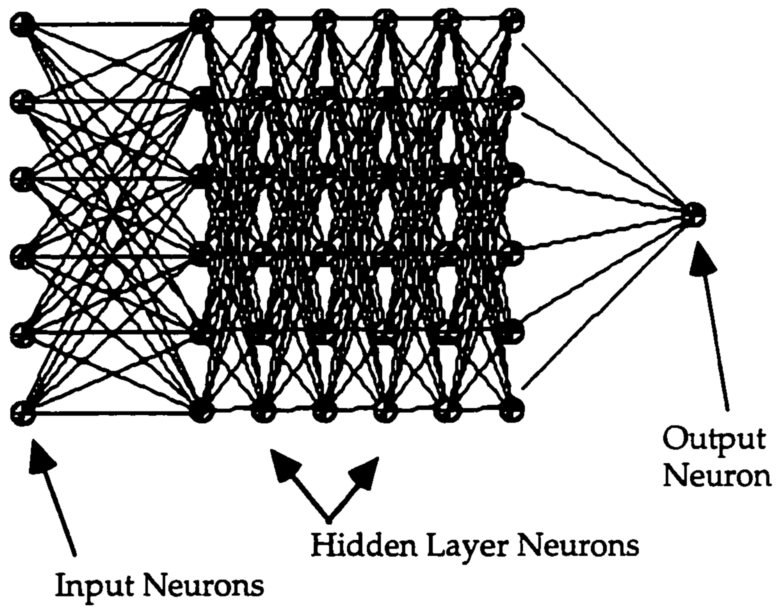


Figure 5 Diagram of Backpropagation Validation with Six Input Variables (Illustration by Justin Carter, 1996)

Cluster Assignments As Related to Wealth and Size

Phase two consisted of the development of an educational overburden index (EOI) through the use of a neural network computing program. Actual add-on weights were determined by comparing figures from the Kohonen categories and backpropagation clusters for each district until a continuum was developed listing districts from highest need (10) to lowest need(1). Table 3 lists the ten poorest districts, their current allocation and cluster assignment.

Table 3

Backpropagation Cluster Assignment for Ten Poorest Districts

School District	Current Allocation	Cluster Assignment
Zuni	$ 6,726,189.	10.00
Magdalena	1,877,889.	10.00
Hatch	5,231,983.	10.00
Peñasco	3,116,675.	10.00
Tularosa	4,821,405.	9.57
Dexter	4,187,565	8.47
Maxwell	959,059.	6.45
Mora	3,389,211.	4.43
Roy	708,431.	3.40
Floyd	1,372,409.	2.25

Of the ten poorest districts, measured by assessed valuation per pupil, four including Zuni, Peñasco, Magdelena and Hatch were clustered at 10.00. Two of the remaining six, Roy and Floyd, were ordered into clusters of high need. They both reported high need for the TITLE I variable. Floyd also reported a high mobility rate of .55. and LEP at .18. The last three districts listed were grouped in lowest-need clusters. They reported low incidence of SPED, TITLE I, or LEP.

Table 4 illustrates how the ten wealthiest districts were clustered. Jemez Mountain and Dulce reported high figures for variables LEP, MOB and TITLE I which accounted for their placement in cluster nine. Mosquero reported relatively high figures for the same variables. However, a relatively low dropout rate for Cimmaron, Corona, Aztec and Eunice was one contributing factor for placement in lower need clusters.

Table 4

Backpropagation Cluster Assignment for Ten Wealthiest Districts

School District	Current Allocation	Cluster Assignment
Jemez Mountain	$ 2,261,689.	9.94
Dulce	2,890,044.	9.56
Mosquero	407,668.	7.05
Bloomfield	11,186,645.	6.66
Santa Fe	42,530,737.	4.76
Jal	2,303,294.	4.72
Cimmaron	3,037,076.	3.86
Corona	567,283.	3.71
Aztec	10,169,155.	3.47
Eunice	2,992,975.	2.83

The backpropagation clusters were also analyzed during phase two in the areas of district size. As depicted in Table 5, the six largest school districts; Roswell, Gadsden, Santa Fe, Gallup-McKinley, Las Cruces and Albuquerque were clustered in categories 9 through 4 as illustrated in Table 5. Gadsden with a population of 11,030 MEM, was clustered highest with a backpropagation weight of 9.61. Gadsden reported low to moderate needs with highest need reported for the LEP variable. Gallup-McKinley identified TITLE I funding needs at .52 which would place it higher in the EOI. Table 5 lists the six largest school districts and their assigned cluster.

Table 5

EOI Cluster for Six Largest Districts in New Mexico

District	**ADM**	**Backpropagation**
Roswell	10,948.	4.33
Gadsden	11,030.	9.61
Santa Fe	12,672.	4.77
Gallup-McKinley	13,407.	6.68
Las Cruces	20,800.	5.44
Albuquerque	85,438.	7.06

Table 6 lists the six identified smallest New Mexico school districts which were clustered based on identified need variables in clusters two, three and seven. Vaughn (142 MEM) and Mosquero (57 MEM) scored in relatively high need clusters based on the identified need variables TITLE I, MOB and LEP. Smaller school districts typically reported little or no DOUT as a need variable. Of the smallest, only three reported a DOUT figure above zero.

Table 6

EOI Cluster for Six Smallest Districts in New Mexico

District	ADM	Backpropagation
Mosquero	57	7.04
Corona	94	3.72
Roy	113	3.40
House	125	2.21
Elida	133	2.09
Vaughn	142	7.06

Redistributive Effect

Phase three of the study utilized the EOI to simulate the allocation of resources for the eighty-nine New Mexico school districts to determine the redistributive effect when compared with the current funding formula. The EOI considers six areas of need in conjunction with existing funding considerations and should reflect each district's composite need for funds. In order to assess effects of the EOI, the potential redistribution of funds was analyzed in the areas of district wealth and size.

Funding adjustments as depicted in Appendix B show New Mexico school districts would be affected by funding changes ranging from 90 percent to 129 percent. Albuquerque would retain 90 per cent of its present funds according to the simulation utilizing the EOI as part of the state funding formula. Both Lake Arthur and Quemado would be funded at 129 percent. Quemado serves a large LEP student population and reported moderate figures for variables MOB and TITLE I. Lake Arthur reported moderate levels of need in areas of MOB and TITLE I. The near 30 % increase in funds suggests these two districts may be currently underfunded based on student needs.

Redistributive Effect Relative to District Size

Of the six largest New Mexico School Districts, utilizing the EOI would result in an 8.4 percent gain in funds for Gallup-McKinley and a 6.4 percent gain for Gadsden. Albuquerque and Las Cruces, would lose approximately 10 and 4 percent, respectively. Roswell and Santa Fe would retain 99 percent of their current funding allocation. Table 7 shows each district, its student ADM, backpropagation cluster, percent gain or loss and dollar amount using the EOI.

Table 7

EOI Cluster and Adjusted Allocation for Six Largest Districts in New Mexico

District	ADM	Backpropa-gation	% Gain or Loss	Dollar Gain or Loss
Roswell	10,948.	4.33	-0.2	$ -59,911.50
Gadsden	11,030.	9.61	+6.4	2,224,516.91
Santa Fe	12,672.	4.77	-0.2	-77,671.46
Gallup-McKinley	13,407.	6.68	+8.4	3,609,448.94
Las Cruces	20,800.	5.44	-3.8	-2,777,582.11
Albuquerque	85,438.	7.06	-9.7	- 31,626,889.17

All six of the smallest school districts in New Mexico would have a higher percentage of funds allocated according to figures if the EOI were part of the funding formula. Table 8 shows each district, its student ADM, backpropagation cluster, percent gain or loss and dollar amount using the EOI. Utilizing the EOI would increase funding levels for Mosquero, Corona, Roy, House, Elida, and Vaughn. Corona would realize the largest gain at 24.4 percent. Although a small district, Corona reports above 20 percent for variables TITLE I, MOB and LEP. Both Mosquero and Vaughn reported moderate percentages for variables TITLE I and LEP and lower for MOB. Districts Roy and House reported relatively low figures for all variables. Elida reported 29 percent for variable MOB and lower percentages for all others.

Table 8

EOI Cluster and Adjusted Allocation for Six Smallest Districts in New Mexico

District	ADM	Backpropaga tion	% Gain or Loss	Dollar Gain or Loss
Mosquero	57	7.04	+ 8.4	$ 34,428.47
Corona	94	3.72	+24.4	136,001.39
Roy	113	3.40	+12.2	86,191.77
House	125	2.21	+13.3	104,649.14
Elida	133	2.09	+17.1	132,898.90
Vaughn	142	7.06	+ 2.6	25,174.54

Redistributive Effect Relative to District Wealth

As part of phase three, the relative wealth of individual school districts was taken into consideration as part of the analysis of redistribution of district funds if the EOI were used as part of the funding formula. Of the ten poorest districts as measured by assessed value per pupil, all districts would gain funds except Zuni which would lose approximately three per cent of funds allocated under the current funding formula. Percentage gains ranged from a low of 1 percent (Tularosa) to 25 percent (Dexter). Figures for the six need variables affected each of the ten poorest districts in some way. However, no extreme fluctuations were noted. Table 9 lists each district's current funding allocation, cluster assignment, percentage gain or loss of funds and the dollar amount, if the EOI were used.

Table 9

EOI Cluster Adjusted Allocation for Ten Poorest Districts in New Mexico

School District	Current Allocation	Cluster Assignment	% Gain or Loss With EOI	Dollar Gain or Loss With EOI
Zuni	$ 6,726,189.	10.00	- 3.1	$ -211,406.11
Magdalena	1,877,889.	10.00	+13.8	261,130.06
Hatch	5,231,983.	10.00	+ 5.0	260,430.91
Peñasco	3,116,675.	10.00	+ 5.6	174,702.96
Tularosa	4,821,405.	9.57	+ 1.2	56,780.17
Dexter	4,187,565.	8.47	+25.9	307,798.25
Maxwell	959,059.	6.45	+11.7	112,289.03
Mora	3,389,211.	4.43	+ 1.0	32,989.08
Roy	708,431.	3.40	+12.2	86,191.77
Floyd	1,372,409.	2.25	+26.8	367,311.45

The ten wealthiest districts were also examined to determine how they would be affected by the EOI. Jemez Mountain and Dulce reported high figures for variables LEP, MOB and TITLE I which accounts for their placement in cluster nine. Jal and Cimarron reported needs for variables TITLE I and MOB. Mosquero reported relatively high figures for the TITLE I, MOB and LEP. Nine out of ten of New Mexico's wealthiest districts would gain a percentage of funds ranging from 7 to 15 percent utilizing the EOI. Santa Fe was funded at 99 per cent which would cause little effect. Table 10 lists each district's current funding allocation, cluster assignment, percentage gain or loss of funds and the dollar amount, if the EOI were used.

Table 10

EOI Cluster Adjusted Allocation for Ten Wealthiest Districts in New Mexico

School District	Current Allocation	Cluster Assignment	% Gain or Loss With EOI	Dollar Gain or Loss With EOI
Jemez Mountain	$ 2,261,689.	9.94	+15.4	$ 498,115.82
Dulce	2,890,044.	9.56	+13.0	374,670.56
Mosquero	407,668.	7.05	+ 8.4	34,428.47
Bloomfield	11,186,645.	6.66	+ 7.0	783,934.90
Santa Fe	42,530,737.	4.76	- 0.2	-77,671.46
Jal	2,303,294.	4.72	+15.4	354,045.78
Cimmaron	3,037,076.	3.86	+13.7	415,075.01
Corona	567,283.	3.71	+24.4	136,001.39
Aztec	10,169,155.	3.47	+10.1	1,027,395.66
Eunice	2,992,975.	2.83	+19.4	580,074.48

Summary

If the EOI were to be implemented as part of the New Mexico state funding formula, there would be no drastic changes. As expected, some districts would gain and some would lose funds as illustrated in Appendix B which includes data for all 89 school districts. The EOI treated districts with consistency according to the information reported for each of the six variables, TITLE I, MOB, LEP, DOUT, SPED and Tchr Sal. Analysis of the clusters overall demonstrated the high relative contribution of the LEP variable. The contribution of both MOB and TITLE I was apparent when examining gains and losses in funding allocations when taking district wealth and size into consideration. Since utilizing the EOI as part of the state funding formula need not affect the total dollar amount allocated, it could be considered as a viable option.

CHAPTER V

SUMMARY

Introduction

The national push to improve educational opportunity for students falling into at-risk categories has been spearheaded by educational goals adopted by the Bush administration, and by numerous researchers such as Levin (1989). As educators face an increasingly more challenging population of students, advocates of student equality warn that ignoring social problems such as poverty and increased crime will result in a weakened, poorly educated nation of non-productive citizens.

Student populations in districts continue to vary widely in socio-economic and demographic factors which result in districts experiencing critical needs for additional funds and resources. "Educational overburden" (Jordan, 1996) is a relatively new term used to describe a district's composite, interactive characteristics relative to the demographics, socio-economic and educational characteristics of its student population.

The purpose of this study was to develop an educational overburden index (EOI) for funding distribution based on the unique characteristics and needs of individual school districts. It was intended to address identified problems in developing funding mechanisms for at-risk populations in particular. The study consisted of three phases. Phase one consisted of the selection of variables from a pool of data supplied by New Mexico state that were predictive of student need and were documented in the research literature. Phase two consisted of the development of an educational overburden index (EOI) through the use of an neural network computing procedure. Phase three utilized the EOI to simulate the allocation of resources for the eighty-nine New Mexico school districts to determine the redistributive effect when compared with the current funding formula.

Phase one began with a selection of research-based indicators of need from data supplied by New Mexico State Department and New Mexico school districts. During phase two, six variables were analyzed for eighty-nine school districts and were processed by a neural network computing procedure called a Kohonen neural net which recognizes patterns and organizes them in a meaningful way. The results of the Kohonen processing were verified through another neural net process, backpropagation. Through these two processes, the districts were classified into clusters, the clusters verified and assigned a numerical weight according to need. The numerical weight assigned comprised the Educational Overburden Index (EOI). During phase three, the EOI was applied in a simulation of New Mexico school district as part of the state funding formula. The resulting EOI construction that simulates how New Mexico districts would fare utilizing the EOI in a funding formula is presented in Appendix B.

Findings of the Study

The findings in this study were generated in response to the following five research questions:

1. What variables among data elements can be supported by literature and research as indicators of educational overburden?

Research identified areas of need for students identified as "at risk" in general as potential dropout status, enrollment in bilingual education and other Limited English Proficient (LEP) programs, school size as related to density, student achievement, student mobility, students from families at or below the poverty level as served by TITLE I funded programs, urban schools, and special education. Also considered initially as potential variables for the EOI were student achievement as indicated by ITBS scores and high school competency exams. A decision was made to drop ITBS Scores (ITBS) and High School Competency Exam data(HSComp) following initial Neuroshell2 runs because it was discovered that districts serving needy students that were doing a good job as indicated by higher test scores would be penalized by application of an EOI index utilizing test scores to determine level of need. In other words, districts that effectively met the needs of at-risk students would be clustered in a lower need group and would lose funds.

Eleven variables were initially selected for Kohonen processing using Neuroshell2 software. Initial input data consisted of eleven variables:

1. TITLE I % of ADM (TITLE I)
2. Free and Reduced Price Lunch % of ADM (FRPL)
3. Dropout Rate (DROP)
4. ITBS Scores below 40 percentile (ITBS)
5. High School Competency Exam (HSComp)
6. Pupils Per Square Miles (P/P SQ.MI)
7. Teacher Salary Training and Experience Index (Tchr Sal)
8. Student Mobility (MOB)
9. Limited English Proficient (LEP)
10. Special Education % of ADM (SPED)
11. Gifted and Talented % of ADM (GATE)

2. Which variables identified in question one are viable for developing an educational overburden index for the state of New Mexico?

Six variables emerged as most feasible for inclusion in the EOI. They included Limited English Proficient (LEP), Dropout (DOUT), Teacher Salary Based on Training and Experience (Tchr Sal), TITLE I (TITLE I), Special Education (SPED) and Mobility (MOB). These six variables showed a consistent pattern which included a mix of positive correlations and few negative correlations. None were too closely related and the EOI produced clusters which closely related to current district ratings.

3. Using an neural network computing procedure, how would districts be clustered according to educational need?

The neural network computing procedure arranged the eighty-nine New Mexico school districts into ten clusters. Of the ten poorest districts, measured by assessed valuation per pupil, four including Zuni, Peñasco, Magdelena and Hatch were clustered at 10.00. Each of these districts reported high figures for one or more variables as expected. As discussed in Chapter Three, the variable LEP was the strongest indicator of need. DOUT was the next strongest indicator as reported by the Kohonen processing. This was illustrated by the fact that poorer districts: Cimmaron, Corona, Aztec and Eunice, reported a relatively low dropout rate and were placed in lower need clusters.

The backpropagation clusters were also analyzed in the areas of district size. The six largest school districts; Roswell, Gadsden, Santa Fe, Gallup-McKinley and Las Cruces were clustered in high need categories. Gadsden, with a population of 11,030 MEM, was clustered highest with a back-propagation weight of 9.61. Gadsden reported highest need for the LEP variable. Gallup-McKinley identified TITLE I funding needs at .52 which would place it higher in the EOI. As expected, districts reporting areas of need for one or more EOI variables were also placed in higher need clusters. Of the six identified smallest New Mexico school districts, only Vaughn (142 MEM) and Mosquero (57 MEM) scored in relatively high need clusters based on the fact that multiple identified need variables TITLE I, MOB and LEP were reported. Smaller school districts typically reported little or no DOUT as a need variable which also affected their rating. Of the smallest school districts, only three reported a DOUT figure above zero. This information demonstrates the consideration of several need variables in assigning an appropriate EOI designation.

4. What would be the potential impact of the educational overburden index on schools districts of varying wealth distribution and size?

The six largest school districts shown in Table 7 were Roswell, Gadsden, Santa Fe, Gallup-McKinley, Las Cruces, Albuquerque. Four were clustered in categories nine through four. Gadsden with a population of 11,030 MEM was clustered highest with a backpropagation weight 9.61. Gadsden reported low to moderate needs with highest need reported for the LEP variable. Gallup-McKinley identified TITLE I funding needs at .52 which would place it higher in the EOI.

The six identified smallest New Mexico school districts were Mosquero, Corona, Roy, House, Elida, and Vaughn. They were clustered based on identified need variables in clusters two, three and seven. Vaughn (142 MEM) and Mosquero (57 MEM) scored in relatively high need clusters based on identified need variables TITLE I, MOB and LEP. Smaller school districts typically reported little or no DOUT as a need variable. Of the smallest, only three reported a DOUT figure above zero.

The ten poorest districts were Zuni, Magdalena, Hatch, Peñasco, Tularosa, Dexter, Maxwell, Mora, Roy, and Floyd. Of these ten districts, measured by assessed valuation per pupil, four including Zuni, Peñasco, Magdelena and Hatch were clustered at 10.00. Two of the remaining six, Roy and Floyd, were ordered into clusters of high need most likely because they both reported high needs for the TITLE I variable. Floyd also reported a high mobility rate of .55. and LEP at .18. The last three districts listed were grouped in lowest-need clusters. As expected, they reported low incidence of SPED, TITLE I, or LEP.

The ten wealthiest districts were Jemez Mountain, Dulce, Mosquero, Bloomfield, Santa Fe, Jal, Cimmaron, Corona, Aztec, and Eunice. Jemez Mountain and Dulce reported high figures for variables LEP, MOB and TITLE I which accounts for their placement in a high need cluster. Mosquero reported relatively high figures for the same variables. However, a relatively low dropout rate for Cimmaron, Corona, Aztec and Eunice may explain placement in lower need clusters.

5. How would the application of an educational overburden index affect the allocation of funds to school districts in New Mexico?

The EOI was developed to consider six areas of need in conjunction with existing funding considerations and should reflect each district's composite need for funds. The six largest New Mexico School Districts were Roswell, Gadsen, Santa Fe, Gallup-McKinley, Las Cruces, and Albuquerque.

For these six districts, utilizing the EOI would result in an 8.4 percent gain in funds for Gallup-McKinley and 6.4 percent gain for Gadsden. Albuquerque and Las Cruces, would lose 9.7 and 3.8 percent, respectively. Roswell and Santa Fe would retain 99.8 percent of their current funding allocation. As discussed earlier, most districts would not realize drastic changes in their allocations using the EOI.

All six of the smallest school districts in New Mexico would gain funds allocated according to figures reported with the EOI as part of the funding formula. Thus, utilizing the EOI would increase funding levels for Mosquero, Corona, Roy, House, Elida, and Vaughn. Corona would realize the largest gain at 24.4 percent. Although a small district, Corona reported above 20 percent for variables TITLE I, MOB, and LEP. Both Mosquero and Vaughn reported moderate percentages for variables TITLE I and LEP and lower for MOB. Roy and House reported relatively low figures for all variables. Elida reported 29.2 percent for variable MOB and low percentages for all others.

Of the ten poorest districts as measured by assessed valuation per pupil, all would gain funds, except Zuni, which would lose 3.1 percent of funds allocated under the current funding formula. Percentage gains ranged from a low of 1.2 percent (Tularosa) to 25.9 percent (Dexter). District figures for the six need variables affected each of the ten poorest districts in some way. However, no extreme fluctuations were noted.

The ten wealthiest districts were also examined to determine how they would be affected by the EOI. Jemez Mountain and Dulce reported high figures for variables LEP, MOB, and TITLE I which netted a percentage increase of 15.4 and 13.0 percent, respectively. Nine out of ten of New Mexico's wealthiest districts would gain a percentage of funds ranging from 7.0 to 19.4 percent utilizing the EOI. Santa Fe which reported relatively low levels for all need variables was funded at 99.8 per cent which would cause little effect.

The contribution of LEP, MOB, and TITLE I variables was apparent when examining gains and losses in funding allocations. DOUT figures tended to impact larger districts in terms of contribution to EOI as a whole. Tchr Sal figures ranged from .81 to 1.19. Since teacher salary and training are already funded in the current funding formula, their relative contribution was similar for the current state funding formula and the EOI.

Conclusions

An EOI provides some important advantages over other funding models in that it can be used to recognize cost burdens in school districts associated with a full range of special needs youth, i.e. children with disabilities, limited English proficient students, and other categories of at risk-youth. The strengths of an educational overburden index are that the concept (1) can accommodate differences in cost conditions among school districts, (2) provides a research-based proxy for the educational needs of all youth without requiring students be label or served in separate programs, and (3) empowers all schools to create innovative educational environments to meet the unique needs of each student.

One way of evaluating the EOI is to address each of the nine generally accepted criteria for good school finance formulas: equity, adequacy, local choice, stability and predictability, responsiveness, feasibility, non-manipulability, and ease of administration. As the measure of needs in a state funding system, the EOI recognizes differences in the educational needs of students among different school districts, does not impose additional paperwork, and provides districts with sufficient flexibility to adopt creative reforms to improve instruction. Need variables that are difficult to manipulate and that can reflect accurate needs for individual districts can help districts achieve equity without bias. This addresses the current trend toward achieving vertical equity in funding formulas. Since it is assumed that the EOI functions as a block grant, funding is based on the predicted overall educational needs of individual districts. Therefore, funds are not attributable to a particular program or group of students.

Utilization of the EOI with its multiple indicators of need, can address a wide range of conditions (reflected by the multiple variables) that contribute to students' poor chances for academic success. Also, credibility and bias problems result from the use of a single indicator. Since the EOI simulation does not result in drastic changes, it would not contribute to a negative impact overall and would utilize information that can not easily be manipulated or otherwise misrepresented.

This study further refined a methodology of employing a neural network computing program for categorizing districts according to the educational needs. In earlier studies (Weiner,1994; Joranstaad, 1995), the authors utilized the Kohonen categories and the adjusted Z scores for the different variables. Using the Kohonen categories alone would have resulted in a stair-step set of cost differentials in which all districts within a category would have received the same cost differential. Use of the Z scores by themselves would have valued each of the eight variables equally and would not have recognized any interaction variables. The present study defined a legitimate number of clusters in which districts were divided and avoided a stair-step set of cost differentials by utilizing backpropagation figures to evenly distribute the districts on a continuum. This use of two neural network computing procedures, one to cluster districts based on a set of need variables and another to validate and weigh the clusters, results in an even transition of cost differential values among districts.

Awareness of specific need variables for each district should facilitate long range planning. With these potential advantages, EOIs calculated by including the critical values peculiar to a state may become an important future tool for projecting educational costs. A major advantage would be the flexibility that local school districts would have in designing programs. However, it is critical that the base level of funding is sufficient and that the resulting EOI accurately reflects the level of the overall educational need in the district. Also, a process for program accountability would be critical since educational systems do not allow tracking of funds to special students or programs.

Recommendations for Further Study

1. This index was constructed with a range arbitrarily limited to 1.00 - 1.50. Other ranges need to be explored both with this index and with other indexes utilizing this method of neural net processing.

2. Other combinations of variables should be explored in developing an EOI. Each state has its own particular set of contributing variables which should be considered. A heavy rural state population would have different contributing variables than a state with large urban populations.

3. Separate Kohonen processing should be used to analyze the needs of individual schools within a district. Average aggregation at the district level may distort the needs of individual schools.

APPENDIX A

NEW MEXICO SCHOOL DISTRICTS

EDUCATION OVERBURDEN INDEX (EOI)

EDUCATION OVERBURDEN INDEX (EOI)
GROUPINGS AND PREDICTED GROUPINGS

District	Backpro.	TITLE I	Mobility	LEP%	DOUT	SPED	Tchr Sal
Alamogordo	1.897	0.21	32.8	0.01	0.6	0.07	0.97
Albuquerque	7.059	0.21	47.3	0.29	12.1	0.11	1.01
Animas	1.934	0.07	26.2	0.06	2.5	0.05	0.89
Artesia	5.348	0.28	22.2	0.25	2.7	0.05	1.04
Aztec	3.477	0.19	28.7	0.03	8.3	0.07	0.93
Belen	6.469	0.33	31.6	0.33	7.4	0.09	0.93
Bernalillo	10.000	0.36	17.2	0.92	8 .0	0.08	1.02
Bloomfield	6.662	0.32	26.2	0.24	9.1	0.09	0.98
Capitan	3.289	0.15	20.7	0.19	0.6	0.04	0.97
Carlsbad	3.998	0.25	25.5	0.02	3.4	0.06	1.14
Carrizozo	2.288	0.23	25.4	0	4.3	0.05	0.90
Central Cons.	6.997	0.56	26.7	0.28	3.4	0.07	1.09
Chama Valley	8.278	0.37	12.7	0.59	1.8	0.03	1.00
Cimarron	3.857	0.11	21.5	0.13	2.2	0.07	1.06
Clayton	2.914	0.25	21.3	0.05	1.3	0.04	1.02
Cloudcraft	3.908	0.14	28.9	0.03	7.7	0.05	1.04
Clovis	3.908	0.25	26.2	0.04	6.9	0.05	1.00
Cobre Cons.	7.496	0.39	22.3	0.53	2.6	0.08	0.93
Corona	3.719	0.29	22.4	.034	0	0.07	0.81
Cuba	10.000	1.15	29.1	0.45	7.9	0.13	1.19
Deming	8.589	0.36	30.7	0.30	17.0	0.07	0.96
Des Moines	2.264	0.06	23.6	0.16	2.2	0.03	0.85
Dexter	8.478	0.22	25.8	0.56	6.0	0.11	1.00
Dora	2.040	0.17	16.5	0	0	0.10	0.94
Dulce	9.557	0.37	22.8	0.65	8.6	0.08	1.00
Elida	2.092	0.14	29.2	0.06	3.7	0.02	0.89
Española	8.855	0.42	15.8	0.60	6.1	0.06	0.93
Estancia	2.475	0.32	32.8	0.05	1.8	0.08	0.94
Eunice	2.840	0.28	22.6	0.05	1.2	0.08	0.98
Farmington	5.427	0.23	28.6	0.22	7.5	0.06	0.97
Floyd	2.555	0.27	55.6	0.18	3.1	0.06	0.91
Ft. Sumner	2.862	0.28	·23.6	0.04	2.8	0.09	0.94
Gadsden	9.611	0.39	31.8	0.57	15.1	0.06	0.95
Gallup-McKinley	6.680	0.52	26.4	0.30	5.4	0.09	0.96
Grady	3.570	0.11	14.7	0.31	0	0.06	0.86
Grants-Cibola	8.044	0.61	23.1	0.41	6.4	0.06	0.96
Hagerman	9.729	0.30	41.7	0.92	6.4	0.05	0.96
Hatch	10.00	0.40	23.9	0.68	16.7	0.05	1.14
Hobbs	2.500	0.30	34.9	0.05	2.2	0.05	0.97
Hondo Valley	2.567	0.49	19.2	0	0	0.02	0.98
House	2.205	0.15	12.0	0	0	0.15	0.92
Jal	4.729	0.35	20.7	0.05	3.4	0.05	1.14
Jemez Mountain	9.940	0.25	24.4	0.86	5.0	0.06	1.07
Jemez Valley	7.396	0.51	24.0	0.44	3.0	0.08	0.97
Lake Arthur	4.212	0.53	41.1	0.27	1.6	0.05	0.92

District	Backpro.	TITLE I	Mobility	LEP%	DOUT	SPED	Tchr Sal
Las Cruces	5.443	0.27	32.3	0.09	11.7	0.07	0.98
Las Vegas City	4.886	0.24	15.1	0.25	2.5	0.05	0.97
Las Vegas West	8.595	0.53	23.9	0.51	6.9	0.07	0.95
Logan	3.014	0.17	22.3	0	1.9	0.08	1.08
Lordsburg	6.857	0.43	22.4	0.27	6.9	0.09	0.98
Los Alamos	3.931	0.04	11.6	0.01	2.3	0.07	1.18
Los Lunas	5.468	0.16	30.7	0.42	2.6	0.08	0.93
Loving	9.412	0.22	21.6	0.73	5.1	0.07	1.04
Lovington	6.146	0.29	25.8	0.34	3.0	0.06	1.03
Magdalena	10.00	0.93	24.9	0.90	6.0	0.15	1.09
Maxwell	6.446	0.06	38.3	0.25	11.0	0.10	1.03
Melrose	2.442	0.18	38.3	0	4.0	0.08	1.00
Mesa Vista	9.623	0.47	46.9	0.86	1.2	0.09	1.10
Mora	4.434	0.41	22.0	0.21	0	0.03	1.03
Moriarty	3.097	0.11	26.0	0.17	0	0.11	0.98
Mosquero	7.046	0.46	26.7	0.58	0	0.07	0.90
Mountainair	3.516	0.46	24.9	0	2.4	0.12	1.01
Pecos	10.000	0.26	15.9	0.97	2.6	0.08	1.08
Peñasco	9.859	0.45	20.1	0.73	6.9	0.03	1.05
Pojoaque	8.660	0.11	08.7	0.52	8.5	0.04	1.00
Portales	3.644	0.35	36.1	0.18	1.4	0.05	1.00
Quemado	3.387	0.32	24.3	0.07	4.9	0.06	0.92
Questa	9.601	0.21	33.6	0.93	4.2	0.04	0.98
Raton	3.786	0.25	29.2	0.14	2.9	0.06	1.01
Reserve	2.557	0.29	28.3	0.02	3.1	0.07	0.94
Rio Rancho	6.243	0.06	33.6	0.31	8.2	0.12	0.99
Roswell	4.338	0.29	36.8	0.10	5.1	0.07	1.07
Roy	3.400	0.19	07.8	0	2.1	0.03	1.08
Ruidoso	7.065	0.17	36.7	0.13	12.4	0.09	1.16
San Jon	2.626	0.30	20.6	0	1.5	0.09	0.97
Santa Fe	4.768	0.17	19.9	0.13	9.0	0.05	0.93
Santa Rosa	8.238	0.48	19.5	0.52	2.0	0.06	1.04
Silver City	7.302	0.26	25.9	0.34	5.3	0.11	1.08
Socorro	7.363	0.33	23.6	0.39	6.6	0.08	0.97
Springer	3.357	0.28	20.7	0	3.9	0.04	1.04
Taos	8.100	0.37	21.8	0.45	6.3	0.06	1.01
Tatum	6.667	0.30	29.7	0.19	4.2	0.17	1.17
Texico	6.226	0.28	26.1	0	11.0	0.08	1.16
Truth or Conseq.	5.732	0.22	34.6	0.10	12.4	0.10	0.99
Tucumcari	8.540	0.42	26.6	0.28	12.7	0.10	1.05
Tularosa	9.528	0.72	25.1	0.54	8.1	0.10	1.00
Vaughn	9.016	0.53	19.1	0.56	0	0.12	1.04
Wagon Mound	9.671	0.78	05.8	0.60	0	0.37	0.93
Zuni	10.000	0.70	18.2	1.07	5.4	0.08	1.04

APPENDIX B

NEW MEXICO SCHOOL DISTRICT

SIMULATION WITH EOI

ALLOCATED FUNDS GAIN OR LOSS

DISTRICT	TOTAL PROGRAM COST @ $2,029	Back Prop	EOI 1.5	IndxUnits w/dst siz	$$ w/1.5 EOI Indx w/dst siz @$3,129.67	New % of Old
ALAMOGORDO	$25,532,256.29	1.8974	1.095	8,965.25	$28,058,273.97	109.90%
ALBUQUERQUE	$326,006,779.04	7.0592	1.353	94,061.00	$294,379,889.87	90.30%
ANIMAS	$1,987,409.56	1.9345	1.097	827.77	$2,590,646.94	130.40%
ARTESIA	$12,088,769.83	5.3476	1.267	4,212.15	$13,182,639.49	109.00%
AZTEC	$10,169,155.25	3.4766	1.174	3,577.55	$11,196,550.91	110.10%
BELEN	$15,687,552.34	6.469	1.323	5,160.50	$16,150,662.04	103.00%
BERNALILLO	$13,091,245.97	10	1.5	4,058.18	$12,700,764.20	97.00%
BLOOMFIELD	$11,186,645.99	6.662	1.333	3,824.87	$11,970,580.89	107.00%
CAPITAN	$2,278,960.63	3.289	1.164	837.77	$2,621,943.64	115.00%
CARLSBAD	$23,645,341.07	3.9982	1.2	7,406.86	$23,181,027.54	98.00%
CARRIZOZO	$1,108,316.90	2.2877	1.114	435	$1,361,406.45	122.80%
CENTRAL CONS.	$23,809,020.50	6.997	1.35	7,812.87	$24,451,704.85	102.70%
CHAMA VALLEY	$2,797,816.51	8.2784	1.414	1,017.19	$3,183,469.03	113.80%
CIMARRON	$3,037,076.19	3.8574	1.193	1,103.04	$3,452,151.20	113.70%
CLAYTON	$3,466,580.99	2.9141	1.146	1,186.92	$3,714,667.92	107.20%
CLOUDCROFT	$2,318,248.15	3.9084	1.195	867.21	$2,714,081.12	117.10%
CLOVIS	$27,194,214.24	3.9104	1.196	9,429.90	$29,512,475.13	108.50%
COBRE CONS.	$7,186,105.24	7.4964	1.375	2,451.94	$7,673,763.06	106.80%
CORONA	$557,283.11	3.7191	1.186	221.52	$693,284.50	124.40%
CUBA	$3,444,600.84	10	1.5	1,086.48	$3,400,323.86	98.70%
DEMING	$15,882,411.42	8.5889	1.429	5,666.32	$17,733,711.71	111.70%
DES MOINES	$838,076.42	2.2643	1.113	337.15	$1,055,168.24	125.90%
DEXTER	$4,187,565.85	8.4782	1.424	1,436.37	$4,495,364.10	107.40%
DORA	$1,228,671.10	2.0403	1.102	493.33	$1,543,960.10	125.70%
DULCE	$2,890,044.70	9.5571	1.478	1,043.15	$3,264,715.26	113.00%
ELIDA	$778,805.27	2.0923	1.105	291.31	$911,704.17	117.10%
ESPAÑOLA	$19,054,075.23	8.855	1.443	5,723.03	$17,911,195.30	94.00%
ESTANCIA	$3,104,029.13	2.4745	1.124	1,146.14	$3,587,039.97	115.60%
EUNICE	$2,992,975.87	2.84	1.142	1,141.67	$3,573,050.35	119.40%
FARMINGTON	$32,048,351.23	5.4274	1.271	10,690.50	$33,457,737.14	104.40%
FLOYD	$1,372,409.51	2.5555	1.128	555.88	$1,739,720.96	126.80%
FT. SUMNER	$1,978,066.01	2.8616	1.143	756.91	$2,368,878.52	119.80%
GADSDEN	$34,520,156.14	9.6106	1.481	11,740.75	$36,744,673.05	106.40%
GALLUP-McKINLEY	$43,221,171.62	6.6882	1.334	14,963.45	$46,830,660.56	108.40%
GRADY	$913,340.15	3.5702	1.179	375.5	$1,175,191.09	128.70%
GRANTS-CIBOLA	$12,694,598.79	8.0437	1.402	4,440.76	$13,898,113.35	109.50%
HAGERMAN	$1,812,560.48	9.7294	1.486	694.65	$2,174,025.27	119.90%
HATCH	$5,231,983.46	10	1.5	1,754.95	$5,492,414.37	105.00%
HOBBS	$23,845,938.15	2.5005	1.125	8,568.50	$26,816,577.40	112.50%
HONDO	$881,290.06	2.5671	1.128	348.92	$1,092,004.46	123.90%
HOUSE	$786,274.02	2.2052	1.11	284.67	$890,923.16	113.30%
JAL	$2,303,294.42	4.7291	1.236	849.08	$2,657,340.20	115.40%
JEMEZ MOUNTAIN	$2,261,689.78	9.9403	1.497	881.82	$2,759,805.60	122.00%
JEMEZ VALLEY	$2,912,732.98	7.3963	1.37	919.5	$2,877,731.57	98.80%
LAKE ARTHUR	$1,113,438.10	4.2119	1.211	459.22	$1,437,207.06	129.10%
LAS CRUCES	$72,476,334.50	5.4425	1.272	22,270.32	$69,698,752.39	96.20%
LAS VEGAS CITY	$9,866,146.41	4.8863	1.244	3,017.53	$9,443,873.12	95.70%
LAS VEGAS WEST	$7,964,192.25	8.5952	1.43	2,583.55	$8,085,658.93	101.50%
LOGAN	$1,445,770.04	3.0143	1.151	557.61	$1,745,135.29	120.70%

LORDSBURG	$3,513,885.10	6.8572	1.343	1,270.79	$3,977,153.34	113.20%
LOS ALAMOS	$13,074,565.56	3.9312	1.197	3,923.65	$12,279,729.70	93.90%
LOS LUNAS	$23,748,988.48	5.4679	1.273	7,768.25	$24,312,058.98	102.40%
LOVING	$2,262,201.09	9.412	1.471	815.25	$2,551,463.47	112.80%
LOVINGTON	$9,531,679.97	6.146	1.307	3,324.94	$10,405,964.97	109.20%
MAGDALENA	$1,887,889.14	10	1.5	686.66	$2,149,019.20	113.80%
MAXWELL	$959,059.60	6.4459	1.322	342.32	$1,071,348.63	111.70%
MELROSE	$1,435,892.87	2.442	1.122	534.01	$1,671,275.08	116.40%
MESA VISTA	$2,747,970.06	9.6228	1.481	974.51	$3,049,894.71	111.00%
MORA	$3,389,211.17	4.4339	1.222	1,093.47	$3,422,200.25	101.00%
MORIARTY	$14,413,656.87	3.0972	1.155	4,682.00	$14,653,114.94	101.70%
MOSQUERO	$407,668.71	7.046	1.352	141.26	$442,097.18	108.40%
MOUNTAINAIR	$1,937,567.17	3.5162	1.176	678.17	$2,122,448.30	109.50%
PECOS	$3,576,611.63	9.8588	1.493	1,208.21	$3,781,298.59	105.70%
PEÑASCO	$3,115,675.59	10	1.5	1,051.35	$3,290,378.55	105.60%
POJOAQUE	$6,535,579.44	8.6604	1.433	2,045.56	$6,401,927.77	98.00%
PORTALES	$9,730,284.57	3.6444	1.182	3,378.97	$10,575,061.04	108.70%
QUEMADO	$1,204,684.26	3.3875	1.169	497.59	$1,557,292.50	129.30%
QUESTA	$3,348,476.96	9.6009	1.48	1,139.93	$3,567,604.72	106.50%
RATON	$5,727,487.58	3.7864	1.189	1,871.86	$5,858,304.09	102.30%
RESERVE	$1,300,958.28	2.5568	1.128	515.09	$1,612,061.72	123.90%
RIO RANCHO	$21,292,035.85	6.2425	1.312	6,247.00	$19,551,048.49	91.80%
ROSWELL	$36,497,094.03	4.3385	1.217	11,642.50	$36,437,182.98	99.80%
ROY	$708,431.44	3.4002	1.17	253.9	$794,623.21	112.20%
RUIDOSO	$8,868,949.73	7.0646	1.353	2,777.58	$8,692,908.80	98.00%
SAN JON	$1,186,478.04	2.6263	1.131	457.82	$1,432,825.52	120.80%
SANTA FE	$42,530,737.41	4.7679	1.238	13,564.71	$42,453,065.95	99.80%
SANTA ROSA	$4,017,174.49	8.2376	1.412	1,326.99	$4,153,040.79	103.40%
SILVER CITY CONS.	$14,941,430.20	7.3021	1.365	4,600.54	$14,398,172.02	96.40%
SOCORRO	$7,428,755.38	7.3631	1.368	2,601.09	$8,140,553.34	109.60%
SPRINGER	$1,702,022.59	3.357	1.168	631.86	$1,977,513.29	116.20%
TAOS	$11,909,824.20	8.1004	1.405	3,697.44	$11,571,767.04	97.20%
TATUM	$1,948,036.81	6.667	1.333	707.17	$2,213,208.73	113.60%
TEXICO	$2,438,993.94	6.2265	1.311	878.88	$2,750,604.37	112.80%
TRUTH OR CONSEQ.	$5,863,842.46	5.7316	1.287	2,139.19	$6,694,958.77	114.20%
TUCUMCARI	$5,251,043.88	8.54	1.427	1,896.61	$5,935,763.42	113.00%
TULAROSA	$4,821,405.16	9.5284	1.476	1,558.69	$4,878,185.33	101.20%
VAUGHN	$954,411.17	9.0157	1.451	313	$979,586.71	102.60%
WAGON MOUND	$1,431,719.21	9.6713	1.484	509.18	$1,593,565.37	111.30%
ZUNI	$6,726,189.78	10	1.5	2,081.62	$6,514,783.67	96.90%
STATEWIDE	$1,121,568,341.60			358,366	$1,121,567,694.83	
				358,366.12	$3,129.67	
				1.54247009		

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