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ABSTRACT

The Rural Educational Environment (REE) is a complex mixture of demographic and economic forces that interact to impact the rural school corporation. The condition of REE financial and human capital indicates REE health and may influence student performance on standardized tests. This paper proposes an ecosystem model of the impact of financial, demographic, and school data on school failure or success on standardized tests. Of the 74 rural school corporations in Indiana, 21 were selected that had consistently high or low average scores on the Standardized Achievement Test, Indiana Statewide Test for Educational Progress, and Essential Skills Standards. Among the REE variables examined were socioeconomic status (measured by assisted school lunches), percentage of single-parent families, percentage of persons with less than a high school education, household and per capita income, families and children in poverty, suspension and expulsion rates, special education rates, graduation rates, school levies, assessed value, per pupil expenditures, and number and size of local businesses. Student performance on standardized tests was linked to two aspects of the REE: the carrying capacity (a measure of the quality and quantity of human and financial capital available to sustain school efforts to produce quality graduates) and the buffering capacity (a measure of the REE's ability to sustain the school financially). A threshold value for buffering the effects of combined negative impacts within the REE is proposed, along with a model for predicting scores from REE elements. (SV)

# Human and Financial Capital in the Rural Educational Environment: The Effects of Exceeding the Carrying Capacity Threshold On Standardized Test Scores in Rural Indiana

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## Abstract

Demographic, financial, and school data are linked with achievement on SAT, ISTEP, and ESS tests in Indiana rural schools. A model of interaction between the schools and the Rural Educational Environment (REE) is proposed. School success and failure is linked with the environmental carrying capacity and buffering capacity of the REE. A threshold value for buffering the effects of combined negative impacts within the REE is proposed along with a model for predicting scores from elements of the REE.
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## Introduction

In Indiana, rural public education has traditionally served the needs of small communities with predominantly agricultural economies. These small communities and their school corporations have historically been interconnected in Indiana because of the strong tradition of local control of education in Indiana. The rural educational landscape of Indiana is thus made up of "local areas" that elect resident school board members to oversee the operations of the schools. Because of the local control of education, changes in local economic and demographic factors impact rural schools with regard to available human and financial capital resources available to local schools. In rural Indiana, it is fair to say that demographics, economics, and education have evolved to form a coherent unit: the Rural Educational Environment (REE).

This environment is dynamic in that the schools, population, and communities are constantly changing. Rural areas are generally characterized by smaller, less diverse populations (Perry and Harmon, 1992) different distributions of age (Brown, 1980), educational levels, and earning capacities, and smaller and less diverse economic bases (Gorham, 1992) than suburban, urban and industrial areas. For these reasons, the REE is more sensitive to changes than other kinds of educational environments.

Primary forces shaping the environment were more or less stable in the first two-thirds of this century as technologic advances relieved the slowly dwindling rural work-force of the need for high labor populations. The rural educational environment remained stable, more or less, well into the nineteen-sixties. Demographic forces began destabilizing the economies of rural areas in the mid-sixties, a decade of marked rural to urban migration (Brown, 1980). This out migration from rural areas triggered a wave of economic degeneration in the rural areas of the state that compounded the recession of the nineteen-seventies (Schmuck and Schmuck, 1993),

Shifting economic and demographic factors have changed the landscape of rural Indiana and in doing so have changed the nature of education in the rural schools. Depopulation, inter- and intra-county commuting, changes in demographic profiles, and economic migrations have altered the symbiosis between the rural schools and their communities. Changes in local and regional economies have

consequences for the ecosystems in which the schools exist. More to the point, school success and community success are intimately linked in the rural setting. Understanding the economic and demographic driving forces within the REE that are linked to school and community success would be valuable because community and school successes and failures could be predicted if a model of the REE could be constructed.

## The Rural Education Environment

The Rural Education Environment (REE) consists of three elements: the demographics of the school watershed population, the economic elements impacting the school corporation, and characteristics of the schools within the REE. The demographics of the watershed population reflect the ability of the population to serve the needs of the school and in some ways even the willingness of that population to address issues of educational concern. Economic elements within the region impact the schools and their students in a variety of ways. Property valuation and taxation are the primary items associated with economic flux, but other concerns like commuting and migration also have consequences for the schools and their students. The schools themselves contribute to the REE by their selection of learning processes and curriculum as well as influencing local industry by the knowledge base and quality of their graduates.

It is of note that none of the above elements may be described as a singular portion of the REE. Demographics, economics, and schools are all intertwined in Indiana's rural communities. The symbiotic nature of the REE is best described as the product of the three elements and their independence. This is to say that to study one of the elements is to study them all. Just as in studying a simple biological symbiotic system, one finds the sum of the parts in the REE is more than the additive product. Take as an example, the lichen, which is a symbiotic product of an alga and a fungus. The lichen, however, is more than the two organisms because it looks like neither of then and has little in common with either of the original partners. If one dissects the lichen, the components return to the original independent organisms and do not retain resemblance to the lichen. In short, the symbiosis is more than the sum of the parts because they are synergistic. Synergy is the ability of two or

more additive components to become different, and generally more, than the individual components. Similarly, the REE is more than the sum of the component elements and studying the dissected pieces will not give one a complete picture of the schools, the economy, and the population within the REE.

The demographic elements contribute to understanding the dynamic interactions of the rural school by describing the people within the REE. The human capital may be described as the human resources available as service to and support for the schools within the REE. Observations reveal a profile of the age, education levels, etc. that in turn contribute to an understanding of the people within the REE. These data also contribute to the understanding of community burden, sustainability, buffering capacity, and other cumulative indices of probable school success with regard to achievement on standardized tests. More than just population, the demographic profiles of an REE describe the 'health' of the communities and populations with the REE.

Information about the local economy contributes to understanding the dynamics of the REE. In an era of economic migration, the business and industry profile of the region in and surrounding the REE helps define the financial capital of the REE. The financial capital may be described as the financial resources like funding, goods, and indirect services available as service to and support for the schools within the REE. This data may also illustrate the carrying capacity of the REE and the resources available within the REE sustain the efforts of the school corporations to produce quality graduates as measured by achievement on standardized tests.

The culture and performance of the schools is in many ways a reflection of the economic and demographic elements of the REE. The percentage of students graduating, expulsion and suspension rates, and other school variables contribute to understanding the expectations the community has for the schools within the REE. Clearly the schools are reflections of the economic and demographic elements within the REE. Understanding the positionality of the school—that is to say, the influence and respect the school enjoys—within the REE contributes to knowledge about the schools with regard to the philosophy and culture within the schools. These data enhance the knowledge we have of the interactions between the schools and the REE surrounding them.

In some ways understanding the schools and surrounding REE is a descriptive study that explains in part the success of students from those schools with regard to achievement on standardized tests. In other ways these study data contribute to a picture of the REE 'health' and it's ability to sustain the schools within it. Sustainable schools are those that may be supported by the human and financial capital within a REE. Sustained schools are those whose performance is unaffected by shifts in the elements within the REE. One way to look at the concept of sustainability is to study the ability of the REE to keep the schools not just running, but producing high quality graduates. One measure of high quality graduates is the their achievement on standardized tests like the SAT, ISTEP, and Essential Skills Standards.

Data obtained from studying interactions of REE's and schools also contributes to an understanding of the 'health' of the REE with regard to sustaining or carrying the schools. This carrying capacity is a direct analogy to the environmental sciences use of the terminology. Biologically speaking, a given area of land with certain kinds of food sources and predators can sustain a certain number of individuals of one species. If variety or number of food sources is altered, or if the numbers of predators varies, the carrying capacity of the area for that one species is changed. Similarly, a school corporation has available a certain number and diversity of sources of human and financial capital that form the carrying capacity for the schools. Altering the amount or diversity of the sources of human and financial capital within the school corporations watershed will alter the REE's carrying capacity with regard to the schools. One might imagine describing an REE in terms of "the ability to support the sustained efforts of a school corporation to produce a high quality graduate from a high school of 750 students and it's feeder system of elementary and middle schools." In other words, the REE can support some number of students with school corporations with a given amount of human and financial capital. Different distributions of financial and human capital with the REE will yield different carrying capacities even if the population of the REE remains constant.

The elements of the REE symbiotically combine to give the REE a given buffering capacity. Chemical buffer solutions can absorb some amount of acids and bases and still maintain the pH values despite

the changes in the system. Similarly, an REE can absorb some amount of damage without lessening it's ability to support the schools. A 'healthy' REE acts as a buffer because it has both financial and human capital enough to offset changes to the REE without altering it's carrying capacity with regard to the schools. Obviously an REE stripped of capital will have a diminished buffering capacity and will not be able to absorb much change before the carrying capacity is altered. For each REE there is a threshold point which is defined as the point at which the REE cannot absorb further impacts without succumbing to change. An example of a threshold value might be the relationship between a village and a stream. As long as the village remains unchanged, the downstream water quality will not be changed because the pollution effects of the small village are buffered by the stream. If the diversity or numbers of industries or people within the village changes and the threshold limit of the stream and the downstream water quality will be lower. Similarly, an REE may experience changes in the diversity and numbers of human and financial capital with the school corporation watershed. If the threshold level of the REE is exceeded, the schools will experience a change in the capital, both human and financial, available as support. The downstream result will be a change in the quality of graduating students as reflected by scores on standardized tests. Certain distributions of human and financial capital favor high buffering capacities while certain others are associated with low buffering capacities. In general, REE's with low buffering capacities cannot absorb much in the way of negative impacts before reaching their threshold level. Similarly, the higher the REE buffering capacity the greater amount of impact or change the system may absorb before reaching the threshold value.

The Rural Educational Environment is a complex mixture of demographic and economic forces that interact to impact the rural school corporation. The condition of REE financial and human capital indicate the health of the REE. Student performance on standardized tests in rural areas may well be linked to some, if not the majority of the variables selected for this study. The study seeks to construct a model that may predict school failure or success with regard to standardized testing based on demographic and financial data by establishing indices of demographic, financial, and school information and determining their impact on the REE as an interconnected group.

## Data Collection

Data were collected from electronic databases. The databases utilized were IDEANet (http://www.doe.state.in.us), The Workforce Development Database ((http://www.dwd.state,in.us), The Indiana Data Center (http://www.statelib.lib.in.us), and the United States Census (http://www.census.gov and http://www.venus.census.gov. These data were extracted matched for the 1996-1997 school year and the 1995-1996 calader year for non-school variables. These data are summarized in Figures 1 through 4, Figure 5 represents the summed rank order scores. Statistical significance was determined when the value of P was less than 0.05.

These data were considered representative of the condition of the financial and human capital available as resources to the school. Schools selected for the study were those exhibiting high standardized test scores as indictors of school success. Of the 74 rural school corporations in Indiana, the 21 studied school corporations were selected because they had either consistently low or high scores with regard to average scores on the SAT, ISTEP, and percentage seniors meeting essential skills standards (ESS). The selected rural school corporations were identified by an arbitrarily assigned number in order to eliminate possible bias.

Data associated with the condition of the families within the REE included single parent families, per capita income numbers, per household incomes, numbers of families living in poverty, numbers of children living in poverty, socioeconomic status, and numbers of at risk mothers. The data were intended to characterize both the range of diversity among families with regard to condition of human capital within the families as well as the degree of human capital and financial capital available to the children within the family structure. These data also illustrate the general social conditions of the children within the twenty-one selected REE's.

Information describing the economic condition and related variables was collected and tabulated. These data included watershed

populations and numbers of businesses, SIC codes, annual payrolls within the REE. This data set describes the diversity and condition of the business community within the school corporation watershed. Data describing the schools was collected and tabulated. The school related data included graduation rates, suspension and expulsion rates, numbers of special education students, and assessment, total expenditure, and levy per ADM. These data were collected and tabulated for presentation to illustrate the general condition of the population, economy, and schools within the twenty-one rural educational environments selected for study[1].

[1] The author gratefully acknowledges the assistance of Judith Byer in the assembly of these data, without whom this work could not have been accomplished.

# Results

## *SAT, ISTEP, ESS*

Figure One illustrates the mean of the Standardized Achievement Test (SAT), the Indiana Statewide Test for Educational Progress (ISTEP), and the Essential Skills Standards (ESS). Of all seventy-four rural school corporations, forty fell below the state mean SAT score of 981. Similarly, 43 fell below the state mean ISTEP score of 61.5 and 44 below the state mean ESS of 57.2%. The cut off limits for study inclusion were SAT > 1000, percentage meeting essential skills standards > 62.5, and ISTEP total battery > 64. For schools reporting consistently high scores. For the schools reporting low scores the cut off limits were SAT < 968, percentage meeting essential skills <51.25, and ISTEP < 58. There were a total of 21 schools selected, seven of which consistently reported high scores and 14 of which consistently reported low scores..

These data indicate that slightly more than half of the rural schools had average scores below the state mean. This distribution is not significantly different from the distribution of all scores (rural, small town, suburban, urban) state wide. Using the criteria for selection, twenty-one school corporations were selected for the study: seven school corporations with consistently high standardized scores in all three measures of student performance and fourteen with consistently low scores. The difference between the mean reported scores of the populations of lower and higher achieving school corporations was considered statistically significant ( $P < 0.05$).

## *SES*

The state mean value for reported socioeconomic status as measured by assisted lunches is eighty-three percent, meaning that seventeen percent of all students receive assistance in purchasing lunches. The mean for all rural schools is slightly higher at approximately nineteen percent assisted lunches (18.7%). Among those schools consistently scoring well on standardized tests, none reported an assisted lunch rate of higher than fourteen percent and the mean value for the higher achieving schools

corporations was approximately ten percent (10.3%). Thus, the higher achieving schools corporations reported an assisted lunch rate of slightly lower than half (45%) of the state mean. The lower achieving schools

corporations reported only one assisted lunch rate in the same range of the higher achieving schools (13%), while the remainder reported much higher assisted lunch rates with a mean rate of approximately twenty-five percent (25.4%). The mean reported percentages of assisted lunches were found to be significantly ($p < 0.05$) different from each other. These data indicate that the assisted lunch rate for lower achieving school corporations is approximately two and one-half times (2.47 times) that of the higher achieving school corporations.(See Figure 2)

*SPF*

The mean reported Single Parent Family (SPF) rate for all REE's studied is almost seventeen percent (16.9%). This is slightly lower than the state mean of almost nineteen percent (18.8%). Among the higher achieving school corporations, only one reported a single parent family percentage mean (21.3%) of greater than the state reported mean. The mean percentage reported among these schools was approximately twelve percent (12.3%), or two-thirds the state mean percentage. Of the lower achieving school corporations, only one reported single parent family rates less than the state mean. The difference in the two reported means of the populations of higher and lower achieving school corporations was found to be significant ($p < 0.05$). The mean reported single parent rate for lower achieving school corporations was twenty-one and one-half percent, or almost twice the percentage of single parent families living in the watershed areas of higher achieving school corporations.

*Education Levels*

Among the studied corporations, the mean percentage of persons within the watershed areas with less than a high school education was reported as approximately thirty percent (29.9%). This is somewhat higher than the state mean of approximately twenty-four percent (24.4%). Among those higher achieving school corporations, only one reported a percentage of higher than the rural mean, while among the lower achieving school corporations only two reported

mean percentages of watershed population of less than the rural school mean and the mean among those school corporations was approximately thirty-seven percent (37.3%). The difference in means for the two populations of school corporations was found to be statistically significant ($p < 0.05$). Those lower achieving school corporations reported nearly thirteen percent (12.9%) higher rates of persons with less than a high school degree in their watershed populations.

### *PHI/PCI*

The data describing both per capita incomes(PCI) and per household incomes (PHI) both indicate a statistically significant ($p < 0.05$) difference between higher and lower achieving school corporations. Of the two reported indicators, only two of the lower achieving school corporations have per capita incomes within the range of per capita income reported by those higher achieving schools. Only one reported lower achieving school corporation's mean per household income is within the range of those higher achieving school corporations. The mean per capita income among the higher achieving school corporations is $11,982. Compared to a mean PCI of $10, 258, the higher achieving schools generate $1,724 for each person in the watershed area of the school corporation. Similarly, the PHI values for the lower and higher achieving schools are $23,973 and $29,309 respectively. The difference in per households incomes is $5,336.

The state mean PCI of $12,614 is higher than the mean values for both populations of schools studied. The difference is $2,356 for those schools exhibiting lower achievement on standardized tests and $632 for the higher achieving group. Only one of the rural school corporations studied reported a mean PCI of greater than the state mean, indicating that in general, rural school corporation populations earn less than their statewide counterparts in different types of educational environments.

### *FIP/CIP/ARM*

The mean percentage of families in poverty (FIP) among the higher achieving school corporations is 7.9%. Among those lower achieving school corporations this mean value is 15.3%, or approximately twice as high. These data are illustrated in Table Two, Part C and Figures Thirteen and Fourteen. The difference in mean values with

regard to children in poverty (CIP) is only 5.1% (10% vs. 15.1%). The state mean percentage for families in poverty is 9.7%, or greater than all but one of the higher achieving schools studied, but less than every lower achieving school corporation. The difference in means between state (all schools) and the lower achieving school corporations is approximately six percent (5.6%), which represents an almost sixty percent (57.7%) increase in families in poverty among the lower achieving school corporations. This statistically significant difference ($p < 0.05$), when considered with the information regarding children in poverty and mean per capita and per household incomes, indicates that greater numbers of children in the households among the lower achieving school corporations have lowered quantities of financial capital available to them. In order to further characterize households within the selected Rural Educational Environments, data relating to "at risk" mothers (ARM). The mean percentage of at risk mothers (ARM) among the lower achieving counties is almost three times that of their higher achieving counterparts (3.5% vs. 1.2%). These data also indicate that compared to the state mean for at risk mothers of 2.3%, only two of the higher achieving schools reported higher percentages and four of the lower achieving schools reported lower percentages.

*Suspension/Expulsion, Special Education, and Graduation*

Figure 3 illustrates graduation rates and suspension/expulsion rates among the school corporations studied. Levy per ADM, assessed value per ADM, and total per pupil expenditure data. There are discernible and statistically significant ($p < 0.05$) differences between the high and low achieving school corporations with regard to suspension and expulsion rates. Those school corporations among the higher achieving group have a mean expulsion rate of 9 per 100 students while those in the lower achieving group have a mean of 16 per 100 students. The rate of expulsion/suspension among the lower achieving group is almost twice that of the higher achieving school corporations. Graduation rate data indicate a lower average graduation rate among the lower achieving schools (88.8 versus 92.4 percent), but the difference is not significant and the ranges of reported graduation rates overlap considerably among the studied corporations. The mean percentage of reported students in special education programs among the lower achieving school corporations

is significantly ($P < 0.05$) higher at 15.8% than that reported by the school corporations in the higher achieving group (11.8).

*Levy, Assessed Value, and Total Expenditure per ADM*

The collected data indicate that the higher achieving school corporations are within REE's higher assessments per ADM. This statistically significant difference in the means of the two groups is $10,547 per pupil, the means being $45,263 and $34,666. There is no statistically significant difference between the two groups with regard to total expenditure per student. In fact, the lower achieving group all expend between five and ten percent above the state mean for all school corporations, while the mean for the higher achieving school corporations more closely approximates the state mean. The mean levy per ADM is discernibly lower among the lower achieving school corporations. The higher achieving group mean is $2,344 as opposed to levy of the lower achieving schools mean of $1,925. Comparatively, the lower achieving school corporations levy at slightly higher rates (.055 vs. .052) than the higher achieving group.

Number of Businesses and SIC codes, Annual Payroll

The annual payroll of the studied REE's differs significantly ($P < 0.05$). Those higher achieving school corporations report mean annual payrolls of almost twice those of the lower achieving group ($215 million versus $121 million). These numbers do not approximate the same differences reflected in the per capita incomes reported, an anomaly thought to be due to inter-REE commuting. This difference is perhaps more starkly present as the calculated mean annual payroll per ADM. This mean number is $151,430 in the higher achieving school corporations versus $96,430 among the lower achieving group. This reflects a difference between the mean value of $57,670 or 60% of the lower achieving group mean.

The mean annual payroll may also reflect the watershed populations, numbers of businesses and/or numbers of SIC codes present within the watershed area. However, there exists no statistically significant difference in watershed populations of the two groups of corporations studied, though the mean watershed population of the lower achieving group is noticeably lower (27,600 versus 22,480).

No significant difference exists in the mean numbers of SIC codes present among the business and industry entities within the communities of the studied watershed areas. Those higher achieving corporations report a mean number of 688 SIC codes in their watersheds while those lower achieving corporations report 511.

There exists a significant difference ($P < 0.05$) in the numbers of businesses reported within the watershed areas. Those lower achieving corporations report a mean number of businesses within the watershed areas of 123, roughly one-half the reported 243 reported by the higher achieving corporations. This may be reflective, however, of the somewhat higher mean reported populations of the watershed areas of the higher achieving school corporations.

## Discussion

Children without role models in the home and parental assistance and support are deprived of nurturing resources, a consequence of living as single parent families. Absence of the parent as a care giver in the home removes a source of life structuring skills like wise decision making in the face of uncertainty, self-discipline, and self-motivation. The absence of a parent in the home in critical time periods often leads to the child being occupied by other activities than those conducive to completeing school assignments. These data indicate that high numbers of single parents within the REE do not accurately predict low scoring on standardized tests. However, when considered as a element in the REE that impacts the ability of the schools to sustain the efforts to produce quality graduates, high percentages of single parent families are a portion of the indicators for lowered performance on standardized tests. Removal of the adult from the presence of the child thus lowers the quality of family life

for children in the home and therefore lowers the quality of the human capital in the watershed population of the REE.

Economic forces impinge on the resources available to children not only by removing the parent physically from the home, but also by depriving the child of adequate financial resources. The children are often dependent on the school as a resource for adequate nutrition, health care, and referral to other social service organizations. One reflection of the condition of inadequate financial capital available to the student as a resource is the calculated socioeconomic status of the children who need assisted or paid for meals at school. Schools with high numbers of students under the aegis of free and assisted school breakfasts, lunches, day care, and other social services are expending resources, both human and financial, to support these disadvantaged students. By placing additional burden on the human and financial capital of the schools, students with lowered resources in the home lower the general amount of resources available in the community. In this way, the general quality of the human capital and quantity of financial capital within the REE are both reduced by the absence of financial resources in the home (Epstein, Simon, and Salinas, 1997).

Several authors (Reagor and Rehm,1998; Smith, Beaulieu, and Israel, 1992) have noted the relationship of socioeconomic status, educational attainment of parents, and single parent families with school achievement. Data collected in this study indicate that among those school corporations consistently exhibiting high scores on standardized tests percentages of single parent families and socioeconomic status (as measured through the free and assisted lunch programs) are lower than those school corporations scoring lower. The general education levels (as indicated by the percentage of population without a high school degree) of the watershed populations are lower among the schools consistently lower on standardized tests

This information illustrates a clear performance difference among the student populations of the two groups of school corporations with regard to percentages of single parent families, percentages of children with low socioeconomic status, and percentages of adults in the community with less than a high school education. One can infer from these data that the populations of students in the lower achieving school corporations have lower resources available to

them with regard to parental presence, financial resource, depth of parent understanding of children and learning, and positive attitude toward the educational system within the rural educational environment.

In general, the lower achieving rural school corporations reported higher numbers of assisted and free lunches (and therefore lower socioeconomic status rankings), higher percentages of single parent families, and persons with less than high school degrees within their respective REE's. The differences in mean reported values for each of these three demographic elements were found be statistically significant different between the populations of higher and lower achieving school corporations for each of these elements. These data indicate that in rural school corporations where the mean quality and quantity of human capital at the household level is decreased mean student scores on standardized tests are lower, but does not support the thesis that any of these elements are singularly indicative if failure to advise on standardized tests.

Information relating to the quality human capital available to children within the REE would be incomplete without the parallel information about the financial resources available to them at the household level. Financial information in the form of mean per capita (PCI) and per household (PHI) incomes may illustrate the quantity of financial resource available to children within the REE. The percentages of families (FIP) living in poverty also illustrates the general condition of the family financial capital of the REE.

Per capita income data indicate the general community wealth, but may not provide adequate information to describe the financial capital directly available to the students. Statistically, there exists a significant difference ($P < 0.05$) with regard the reported mean values of PHI and PCI between the groups of higher and lower achieving school corporations. These differences are parallel to the reported mean percentages of families in poverty among the school corporations studied.

Education is frequently not valued among adults who have not completed high school (Reagoe and Rehm, 1998). As well as a high percentage of voters with lowered perceptions of the value of education, school corporations with high percentages of persons without a high school degree are thought to attract teachers of lower quality because the emphasis placed on the recruitment and

retention process for teachers is more monetary than teacher quality. Additionally, high percentages of persons without high school degrees in the citizen pool leads to enhanced representation of the political goals of this group in the civic sectors of the REE. The presence of high numbers of groups without a vested interest in high quality education may lead to decreased resources available to the schools, particularly funding· The presence of increased percentages of persons not attaining a high school degree can therefore have consequential impacts on the quality of the human capital within the REE.

Because· of the close relationship between the political entity of the community and the schools within the REE, there is often pressure placed on school boards to 'hold down' taxation rates. While Indiana communities may levy taxes to support schools, the property tax is the general source of funding for the schools. There is relationship between assessed value per ADM and levy per ADM, but the wealth of the REE as indicated by annual payroll does not correlate with the levy per ADM many, however, Titus indicates the will and/or ability of tax corruption to levy taxes to support the schools within the REE. These data do indicate, however, that the total annual income within the REE is consistent with student achievement because there is a statistically significant ($p < 0.05$) difference in annual payroll means of the two groups of school corporations.

Higher tax levies per average daily maintenance (ADM), a measure of community financial support, may be the reflection several issues of financial and human capital. One scenario could be that the community within those REE's with high achievement can literally afford to spend more on the schools while those school corporations within REE's with lesser financial capital may not be able to expend as much capital . The second possibility is that politically the communities within the lower achieving REE choose not to fund at higher levels of support because the REE does not having the carry capacity to support the schools or they choose, for some reason, not to fund the schools at a higher level. In either case, the community wealth, and therefore the quantity of financial capital available to support the schools, is not a factor as reflected either by property assessment per average daily maintenance or watershed annual payroll. The amount of levy per ADM may be considered as a measure

of either the will of the community to support education, the ability of the community to support education, or some mixture of both.

The data illustrates that there is little, if any, relationship between watershed annual payroll and property assessed value per average daily maintenance, both of which are measures of REE financial capital. Because those school corporations with lower scores on standardized tests exhibit higher percentages of individuals without high school degrees, lower per capita and per household incomes, and higher percentages of at risk mothers and children/families in poverty there is clearly a relationship of educational attainment, perception of the worth of education, performance on standardized tests, and quality of human and financial capital within the REE.

The financial capital within the REE is related to the relative health of the business and industry community. The human and financial capital available to the schools is related to both the quantity and diversity of business and industrial entities within the REE. While not illustrating a statistically significant ( $p = .17$ ) difference in mean reported numbers, those watershed areas carrying higher achieving school corporations have a higher mean number of standard industrial classification codes and a greater number of businesses within the REE's.

This is in some ways related to the quantity of the annual payroll, but those school corporations with higher scores have a greater number and diversity of business entities. The diversity contributes to the buffering capacity and insulates the REE from economic lightning strikes. A high buffering capacity protects the carrying capacity of the REE from degenerating under demographic or financial pressure in that the greater the diversity of robust business and industry entities the less the impact of a single industrial failure.

## Conclusion

There are demonstrable and statistically significant differences between the two groups of school corporations studied with regard to student performance on standardized tests as reflected by reported mean test scores. Reported scores on SAT, ISTEP, and ESS are closely associated with reported measures of the quality and quantity of human and financial capital with a local ecosystem: the Rural Education Environment (REE). Among those demographic measures of human and financial capital were the percentages of single parent families, at risk mothers, low socioeconomic status (as measured by assisted school lunches) families, children and families in poverty, per capita and per household incomes, and adults with educational attainment of less than a high school degree. The elements of the financial community studied were the reported numbers of businesses, the diversity of the SIC codes, and the annual REE payroll. School corporation elements studied were the reported the percentage of graduation, suspension and expulsion, and special/exceptional education as well as the assessed value, levy, and total expenditure per ADM.

Because of the interconnected elements of the Rural Education Environment, the rural school corporation enjoys greater support than it's urban and suburban counterparts.This is, in part, because of the traditional interconnected nature of the population, business and industry elements, and the schools. As an ecosystem, the condition of the community is dependent on the health of all three contributing elements of the REE. With regard to measurement systems, the performance of students on standardized tests such as the SAT, ISTEP, and ESS may be considered to be a result of the quality and quantity of human and financial capital available to the school corporation as resources.

Measurement of the quality and quality of human and financial resourcesindicates that the REE has the characteristics of a natural ecosystem with regard to carrying capacity and buffering capacity within the community.It is reasonable to consider members of the population contributing to the quality and quantity of the human and financial capital as productive and those not doing so as nonproductive. Nonproductive members of the REE are a burden to the carrying capacity in that they cause the capital distribution pattern within the REE to change. Higher levels of special/exceptional

students, single parent families, low socioeconomic status families, children in poverty, and decreased educational attainment within an REE reflect a diversion of energy from the schools to combat the lowered levels of human capital. Lowered levels of business and industry activity as reflected by lowered annual payrolls, SIC codes, and numbers of businesses within the REE indicate a lowered quantity of financial resources available to the schools.

Symptoms of the degeneration of the quality and quality of human and financial resources are lowered graduation rates, higher suspension and expulsion rates, and higher percentages of assisted school lunches as indicators of lower qualities of human resources and decreased assessed values and levy per ADM as indicators of decreased quantities of financial resources available to the schools. Those school corporations exhibiting lower mean scores on standardized tests of achievement are those exhibiting higher burdens on the carrying capacity and less resources to alleviate those burdens. The higher the burden placed on the carrying capacity, the lower the level of resources available to the schools becomes. These data illustrate that among the lower achieving school corporations the burden placed on the community is higher. In other words, resources within the REE have been dispersed in a different pattern in the lower achieving school corporation REE's than in their higher achieving counterparts, thus lowering the resources available to schools and their students.

The rural educational environments studied may be sorted into two models: those in which the carrying capacity and buffering capacity at least match the burden of the watershed and those for which the burden has exceeded the threshold value and the ecosystem cannot sustain the schools. The prototypical image of the sustained school corporation is one where all of the indices studied are positive, that is to say where the quality and quantity of human and financial capital as resources for the schools within the REE are all high. Similarly, the scenario for the lower achieving schools would be where all of the indices are negative the capital stocks are low. This is hardly the case. Many of the higher achieving school corporations with regard to performance on standardized tests have select human and financial capital indices at least as low, and often lower, than the mean reported index values of their lower achieving

counterparts. This observation has two possible impacts on model construction.

If the anomalous mean index value is always the same, or at least from one of a similar group (demographic, school, or financial), then the model must consider that index value or group of values to be critical within the structure of the model. This is not the case because the ranges of index values reported by individual school corporations are not consistent with regard to the value lies beyond the range of values. Thus, the model must reflect not the weight of critical values, but the weight of all the values within all the groups. This implies the burden among those schools scoring higher on standardized tests is somehow manageable within the REE carrying capacity while the carrying capacity of the REE's supporting those lower achieving school corporations cannot manage and sustain their schools. In this model it is the weight of all elements within the REE that exceeds the threshold value and impacts the schools by altering the distribution of resources within the REE.

By rank ordering the index values, a clearer picture of position of each REE within the two groups may be obtained. Among those indices deemed positive (high per capita income, high graduation rate, etc.) the higher rank orders were assigned (21,20, etc.). For those indices where lower reported values were considered positive (low percentage single parent families, children living in poverty, etc.) the lower values were assigned the higher rank orders. For each REE, greater numbers of higher rank orders would indicate the relative ability of the carrying capacity to sustain the schools. Thus, the sum of the index rank order values would indicate in a singular manner the sustainability of the REE with regard it's school corporation.

In assessing the information obtained from the rank order sums it is clear that those higher achieving rural school corporations with regard to mean standardized scores all exhibit higher sums. In fact, the ranges of sums do not overlap. The range of sums for those higher achieving school corporations begins 183 and extends to 215 while the range of sums for those lower achieving schools is 61 through 181. To determine the diagnostic use of the sum of rank orders, the values of the sums were graphed and their relationships to mean reported SAT, ISTEP, and ESS values were tested by

comparing the correlation coefficient of variation between the two sets of paired values. The correlation coefficients for SAT, ISTEP, and ESS scores and sum of ranked scores were 0.79, 0.80, and 0.83 respectively,indicating that knowing the sums one could predict the test scores with a level of cofidence of eighty percent.

To test the diagnostic use of each index value, each set of values was studied. Among the best indicators of high standardized test scores were those of community and family financial capital: assessment (> $38,500) and levy (> $2000) per average daily maintenance and per capita (> $11,300) and per household (> $27,000) income. The single demographic index value associated with high standardized scores is a low percentage (< 33%) of the population with less than a completed high school education. Among the best indicators for low achievement were low per capita income, high percentages of the population with less than a completed high school education, high percentages of special education students, high percentages of low socioeconomic status students, and high percentages of families living in poverty. The least diagnostic of all indices studied was the percentage of single parent families.

Among those higher achieving school corporations several reported high numbers of at risk mothers and single parent families, along with low graduation rates and high expulsion and suspension rates. Other indices were revealed to be equally ambiguous with regard to diagnostic value. Some lower achieving REE's reported high assessment and levy per average daily maintenance, low percentages of students with low socioeconomic status and special education students. In these REE's the weight of the combined indices would appear to overcome the REE's deficiencies with regard to carrying capacity by substituting quantity and quality of financial capital where human capital is diminished, thus buffering the effects of the lowered human capital while sustaining the schools. Similarly, the lower achieving schools are noteworthy for not being able to do so. Illustrating these results perhaps more dramatically is a salient fact: no school corporation reporting consistently high scores for all three standardized tests reported an REE exhibiting any of the following index values; low assessment and levy per average daily maintenance, low per capita and per household income, or high percentages of the population with less than completed high school education. Further, no high achieving high school reported more than

two high percentages for those indices considered negative (families in poverty, at risk mothers, special education students, etc.). When these data are considered along with the fact that among the higher achieving schools the REE's reported higher numbers of businesses, SIC codes, and annual payrolls, a profile of REE's able sustain the efforts of school corporations to produce quality graduates as measured by standardized test results becomes more clear.

The Rural Educational Environment able to sustain the efforts of the schools has high numbers of SIC codes and businesses and is thereby able to act as an economic buffer because of the diversity and numbers of businesses. The quality of the financial capital is further demonstrated by the assessed value of the REE per average daily maintenance: the success of the economy may be equated to the success of the schools. The carrying capacity of the REE is high, as demonstrated by the willingness and/or ability of the population to levy taxes for the schools. Lowered quality of human capital in the REE is more than offset by the financial capital. The low percentage of the population with less than a completed high school education implies that the REE places a high value on education.

Those Rural Education Environments unable to sustain the efforts of the schools do not universally exhibit low assessments and levies per average daily maintenance, low per capita and per household incomes nor do they report universally low annual incomes and numbers of SIC codes and businesses. However, they report no less than four and as many as seven negative indices from the following: percentage at risk mothers greater than 2.0, percentage population with less than a completed high school education greater than 30.0, percentage single parent families greater than 12, percentage families living in poverty greater than 9.0, graduation rate less than 95, suspension/expulsion rate greater than 12.0, percentage special education students greater than 14, and percentage students with low socioeconomic status greater than 15. The cumulative burden placed on the REE is not balanced by the financial capital of the REE in these cases. For example, three of the low achieving school corporations are within REE's with reported high assessment and levy per average daily maintenance. However, none of these three cases has high per capita and per family incomes and all of three REE's report at least six high values of negative indices with regard

to the quality of human capital. In these REE's high quantities of financial capital cannot offset the effects of the lowered quality and quantity of human capital. There is an apparent threshold value for the lower achieving school corporations with regard to index values. Among those REE's unable to carry their schools there are none reporting less than five negative indices. Compared to those school within REE's with high carrying capacities, no REE reported more than three. For the REE's in this study, the threshold value is a total of four or more negative indices. To offset as many as three negative indices, mean per capita and per household incomes must exceed $11,000 and $27,000 respectively. These values are often reflective of high annual incomes (> $170 million) within the REE and generally coupled with high assessment and levy per average daily maintenance. These financial indices are either a consequence of or sequel to the higher educational level of the population of the REE.

### *Summary*

The model for the ecosystem of the Rural Educational Environment is complex because of the interconnected nature of the elements within the environment. The impact of these elements in rural area influences the quality of students with regard to their performance on standardized tests. The carrying capacity, a measure of the quality and quantity of human and financial capital with the Rural Educational Environment, is a measure of the ability of the environment to sustain the school corporations efforts to produce quality graduates. The buffering capacity of the Rural Educational Environment is a measure of the environment's capacity to sustain the schools financially.

Student performance on standardized tests is linked to two factors: the buffering capacity and the carrying capacity. A model for predicting pupil, and therefore school, failure with regard to performance on standardized tests is illustrated. The model is statistically valid with regard to the differences between the two populations of school corporations studied. The model predicts performance on standardized tests from data readily available from a variety of sources. Further, the model proposes that the environment may sustain the school corporation in the face of some number of cumulative negative impacts but that no singular rejection element within the REE may predict the success or failure

of the school corporation with regard to achievement on standardized tests. The REE is analogous to a natural system when the burden on the system must be balanced by the system's ability to solve in the efforts of the schools to produce high quality graduates. The schools as a part of the interconnected system may contribute to the burden within the system. Exceeding the threshold, in this case, four or more of the negative indices studied, destabilizes the environment by causing the distribution patterns of resources to be altered, thus rendering the REE incapable of sustaining the efforts of the school corporation to produce quality students and graduates as measured by performance on standardized tests.

| ›ol | SAT | ESS | ISTEP |
|---|---|---|---|
| | Score | % | Score |
| 1 | 1010 | 65.2 | 65.5 |
| 2 | 1020 | 64.9 | 64.8 |
| 3 | 1007 | 70.5 | 65.7 |
| 4 | 1002 | 63.5 | 65.3 |
| 5 | 1004 | 76.3 | 71.5 |
| 6 | 1043 | 61.2 | 64.1 |
| 7 | 1014 | 64 | 64.2 |
| 8 | 929 | 49.8 | 58.4 |
| 9 | 933 | 45.4 | 57.5 |
| 10 | 898 | 52.9 | 58.4 |
| 11 | 866 | 45.4 | 57.6 |
| 12 | 945 | 47.2 | 56.9 |
| 13 | 961 | 40.9 | 56 |
| 14 | 934 | 44.8 | 56.2 |
| 15 | 884 | 43 | 57.5 |
| 16 | 954 | 46.2 | 57.8 |
| 17 | 972 | 46.2 | 57.3 |
| 18 | 943 | 48.1 | 56.2 |
| 19 | 933 | 48.5 | 56.9 |
| 20 | 893 | 45.3 | 56.8 |
| 21 | 917 | 43.6 | 51.1 |

Figure 1: Test Scores

| Schools | ARM | PCI | PHI | <HSEL | SPF | F<P | SES |
|---|---|---|---|---|---|---|---|
| | % | $ | $ | % | % | % | |
| 1 | 0.6 | 13692 | 31261 | 20.7 | 12 | 3.9 | 92 |
| 2 | 1.8 | 11331 | 28792 | 29.1 | 13 | 17.7 | 86 |
| 3 | 0 | 11472 | 28792 | 25.8 | 6.3 | 8.3 | 92 |
| 4 | 2.5 | 12549 | 28500 | 20.5 | 21.1 | 8.2 | 90 |
| 5 | 0.5 | 11899 | 31277 | 32.9 | 8.9 | 4 | 93 |
| 6 | 0.4 | 11488 | 27708 | 29.1 | 11.9 | 5.7 | 87 |
| 7 | 2.4 | 11447 | 28773 | 25.6 | 12.8 | 7.5 | 88 |
| 8 | 3.9 | 9646 | 26237 | 38.1 | 26.4 | 11.6 | 75 |
| 9 | 5.1 | 8756 | 20367 | 39.8 | 18.5 | 20.2 | 65 |
| 10 | 5.6 | 10434 | 21723 | 33.8 | 22.3 | 18.9 | 76 |
| 11 | 6.3 | 9775 | 21550 | 40.7 | 26.4 | 17.8 | 72 |
| 12 | 1.4 | 11522 | 25985 | 30.8 | 19.1 | 11.5 | 77 |
| 13 | 1.9 | 11114 | 22940 | 24.8 | 12.8 | 13.6 | 68 |
| 14 | 1.7 | 10460 | 23404 | 31 | 19.3 | 13.9 | 71 |
| 15 | 1.8 | 10857 | 22784 | 30.6 | 18.2 | 10.3 | 71 |
| 16 | 7 | 9842 | 22784 | 41.7 | 22.1 | 16.9 | 78 |
| 17 | 2.3 | 10333 | 24614 | 34.6 | 15.7 | 12.2 | 80 |
| 18 | 3.5 | 11544 | 27708 | 31.5 | 25.8 | 12.3 | 79 |
| 19 | 4.5 | 9383 | 23139 | 30.6 | 22 | 18.9 | 75 |
| 20 | 3.2 | 11240 | 26618 | 27.8 | 21.9 | 11.1 | 87 |
| 21 | 1.2 | 8706 | 25767 | 42.2 | 29.6 | 24.3 | 71 |

Figure 2: Demographic Data

| | GrRt | Su/Ex | SpEd | ASS | Levy |
|---|---|---|---|---|---|
| | % | % | % | $ | $ |
| 1 | 87.1 | 34.4 | 13 | 39896 | 2040 |
| 2 | 97.5 | 0.2 | 10.9 | 48701 | 2347 |
| 3 | 98.8 | 5 | 10.7 | 47502 | 2209 |
| 4 | 90.5 | 7.2 | 11.2 | 53372 | 3066 |
| 5 | 95.2 | 1.8 | 10.1 | 41996 | 2188 |
| 6 | 82.4 | 5.5 | 15.1 | 38763 | 2352 |
| 7 | 95 | 9.1 | 11.9 | 46609 | 2209 |
| 8 | 96 | 17.2 | 14 | 44424 | 2408 |
| 9 | 76.9 | 27.1 | 14.9 | 28337 | 1437 |
| 10 | 96.9 | 29.2 | 19.1 | 38129 | 1821 |
| 11 | 82.3 | 34.9 | 15.6 | 29367 | 1641 |
| 12 | 92.2 | 15.2 | 13.3 | 33074 | 2000 |
| 13 | 90.2 | 12.5 | 20 | 40154 | 2575 |
| 14 | 82.6 | 24.1 | 16.9 | 27470 | 1653 |
| 15 | 77.5 | 3 | 17.4 | 31973 | 1915 |
| 16 | 80.7 | 27.3 | 17.7 | 26383 | 1657 |
| 17 | 83.3 | 48.9 | 16.9 | 37997 | 1403 |
| 18 | 95 | 42.2 | 14.3 | 27984 | 1575 |
| 19 | 96.7 | 30.6 | 14.7 | 24583 | 1255 |
| 20 | 93.9 | 18.6 | 13.8 | 66207 | 3830 |
| 21 | 100 | 6.7 | 14.5 | 29239 | 1808 |

Figure 3: Schools Data

| Schools | Anln $ Mil | Firms # | SIC codes # |
|---|---|---|---|
| 1 | 258 | 725 | 258 |
| 2 | 258 | 645 | 258 |
| 3 | 82 | 1139 | 82 |
| 4 | 537 | 725 | 537 |
| 5 | 170 | 601 | 170 |
| 6 | 198 | 383 | 198 |
| 7 | 198 | 601 | 198 |
| 8 | 14 | 142 | 14 |
| 9 | 153 | 733 | 153 |
| 10 | 325 | 655 | 325 |
| 11 | 125 | 979 | 125 |
| 12 | 257 | 390 | 257 |
| 13 | 4.5 | 1013 | 4.5 |
| 14 | 48 | 64 | 48 |
| 15 | 96 | 280 | 96 |
| 16 | 57 | 645 | 57 |
| 17 | 57 | 415 | 57 |
| 18 | 91 | 390 | 91 |
| 19 | 189 | 390 | 189 |
| 20 | 170 | 401 | 170 |
| 21 | 103 | 658 | 103 |

Figure 4: Economic Data

| | Cum Ran Indices | SAT | ESS % | ISTEP Score |
|---|---|---|---|---|
| 1 | 204 | 1010 | 65.2 | 65.5 |
| 2 | 186 | 1020 | 64.9 | 64.8 |
| 3 | 213 | 1007 | 70.5 | 65.7 |
| 4 | 206 | 1002 | 63.5 | 65.3 |
| 5 | 215 | 1004 | 76.3 | 71.5 |
| 6 | 183 | 1043 | 61.2 | 64.1 |
| 7 | 206 | 1014 | 64 | 64.2 |
| 8 | 122 | 929 | 49.8 | 58.4 |
| 9 | 86 | 933 | 45.4 | 57.5 |
| 10 | 112 | 898 | 52.9 | 58.4 |
| 11 | 77 | 866 | 45.4 | 57.6 |
| 12 | 159 | 945 | 47.2 | 56.9 |
| 13 | 162 | 961 | 40.9 | 56 |
| 14 | 119 | 934 | 44.8 | 56.2 |
| 15 | 115 | 884 | 43 | 57.5 |
| 16 | 61 | 954 | 46.2 | 57.8 |
| 17 | 103 | 972 | 46.2 | 57.3 |
| 18 | 114 | 943 | 48.1 | 56.2 |
| 19 | 95 | 933 | 48.5 | 56.9 |
| 20 | 118 | 893 | 45.3 | 56.8 |
| 21 | 112 | 917 | 43.6 | 51.1 |
| Reg Co | | 0.79 | 0.93 | 0.80 |
| Slpe | | 0.79 | 0.18 | 0.08 |
| Intcpt | | 843 | 28 | 49 |

Figure 5: Test Score and Summed Rank Order Data

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