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The Economics of Education: A Case Study of Wachusett Regional High School

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Introduction

Over two thousand years ago, Aristotle said, "the fate of empires depends on the education of youth." (Peter 1977: 173). This study will attempt to determine some of the important factors about the economics of high school education in the United States. Schools exist to serve children, their parents, and society at large, and these three groups do not always have identical interests. Therefore, education has many goals besides the obvious one of increased cognitive ability, and the best methods for achieving the desired effects have not been agreed upon. Economists label the process by which education creates these outcomes the education production function; this model attempts to predict the effects of a given change in resources on student outcomes. However, the educational process involves many inputs and outputs, and economists have not been able to specify all of them yet. Another area of contention in the economics of education is economies of scale. Economists have been arguing for years that economies of scale exist in the provision of high school education, but the fear that these large schools do not provide the same quality of education as their smaller counterparts has spurred a new debate.

This paper will attempt to clarify various educational theories and elucidate research findings. Chapter One is about the economic and social effects of education, Chapter Two discusses economies of scale in high schools, and Chapter Three explains the education production function. The last chapter, Chapter Four, is a case study of one

school district in central Massachusetts, the Wachusett Regional School District. By focusing on Wachusett, we will see that the findings of researchers are not the only factors voters consider when making decisions that will affect the youth of their area. Because of all the factors that vary from school to school, it is difficult to specify exactly what is important for providing education.

Chapter 1: Economic and Social Effects of Education

Education affects the economy, and the society at large, in many ways. After exploring what researchers believe to be the most effective ways to provide education, it is interesting to see why researchers have devoted so much time to this subject. This chapter is essential because it legitimizes spending time and money on educational research. Education affects everything from a person's health to the nation's GDP growth rate, both of which will be discussed in this chapter. Researchers, lawmakers, and voters are all interested in finding the most effective ways to increase the various effects of education. Future chapters will mainly discuss the inputs of education; this chapter will discuss education's outcomes.

The American educational system began not only as a means to educate youth, but also as a means to internalize the ideological and social stability of the existing social order. For the immigrant families which made up the United States, school was the primary location for learning American values and traditions. Schools are still used to teach children not only academic skills, but also the importance of hard work, perseverance, and obedience which will lead to the ultimate American goal of economic success (Apple 1990: 43-61). Schools concurrently serve children, parents, and society, a factor that contributes to the controversy over the exact effects of education (Walker et al.. 1999: 172).

For the 2002-03 school year, the United States spent an average of $8,019 per pupil enrolled in public pre-kindergarten through twelfth grade. Massachusetts put even more resources into each child, spending $10,223 per pupil. The total elementary and secondary school expenditure in the United States was $440,316,023,000 for the same time period, and Massachusetts invested $11,484,596,000 in their young residents. With 46,632,643 children enrolled in public elementary or secondary schools and spending on education from local, state, and federal sources reaching an amount equal to 4% of GDP, it is important for taxpayers to know that their money is being spent on a worthy cause (Public Education Finances Report 2003).

Most laypeople would agree that educating youth is a creditable use of their tax dollars, but they may not know the myriad ways education shapes children. The most often-discussed economic impact of education is that it has been proven to increase future wages. It is also correlated with future occupation, it is an important determinant of income, and it acts as a signal to employers. But education has other profound effects on society. It can decrease crime, socialize youths to prepare them for work, increase their ability to deal with new situations, decrease dependency on welfare, and even increase health. Another important impact of education is the output of education itself: increased cognitive skills. As Harbison and Myers wrote, "Education is both the seed and the flower of economic development." (Krueger & Lindahl 2001: 1131).

The extent of the importance of education has been debated by economists and education experts for years. There are returns to schooling on both the micro and macro level. The private level includes increased earnings and cognitive ability, and the public returns to schooling include an increased GDP growth rate and positive social

externalities. Krueger and Lndahl surveyed past data and found that an additional year of schooling will raise earnings by 10% in the United States (Krueger & Lindahl 2001: 1101). Estimates of this sort usually range from 5 to 12 percent (Burtless 1996: 13). In international comparisons, a very strong causal relationship has been found between test performance and national growth (Hanushek 2003: F65).

ECONOMIC EFFECTS OF EDUCATION

Completing high school has a large impact on future earnings. Economists think of education as an investment in hopes of earning a higher income later in life. The effectiveness of this investment is measured by the labor market (Card & Krueger 1996: 97-98). In 1999, men without a high school degree earned 22.9% less than men with a high school degree, and the corresponding figure for women was 20.9%. In 1999, this wage differential affected 10.8% of the workforce. This high school wage premium has only increased about 2% since 1973, which implies that changing wage differentials have not been strongly correlated to changing education differentials. In 1999, the high school premium affected 18% less of the population than it did in 1973 because increasing numbers of students were continuing their education through high school and beyond (Mishel et al. 2001: 145-153).

The wage-determination model, like the educational production function discussed in Chapter 3, measures the effect of educational inputs on a measure of student outcomes. This method is able to use career accomplishment as the measure of student achievement instead of other proxies, but there are also some drawbacks to the approach. Students' academic experience is often obtained from state-level data. There is a large, systematic variation in expenditures among states, which makes aggregated data less

reliable. This problem will be further discussed later in this chapter. Since most of the studies compare people who lived in different states, the educational policies of different states will have an effect on students' earnings. Also, the wage-determination model generally does not account for the influence families have on student achievement, which tends to result in an upward bias of the effects of education on future income (Hanushek 1996: 62-64).

Completing the same level of education does not guarantee earning the same wages. Factors such as sex, race, occupation, geography, and socioeconomic background all influence income. Although occupation depends on education levels, there are variations in earnings among occupations within each education level. One study that compares the effect of education on the distribution among occupations and the range of incomes within an occupation finds that increased education leads to increased income within occupations. For men who do not go to college, increased education leads to increased income within the occupation they would have engaged in anyway. For college graduates, increased education leads to increased incomes through better-paying occupations (Mayhew 1971: 216-225). Although education is not the only determinant of income, it is one of the major factors, even within occupations.

Different states have different standards for both the quality of education provided and the length of time students are in school. Card and Krueger found that after holding IQ, parental income, and parental education constant, a 10% increase in the quality of schooling led to a 1-2% increase in annual earnings (Card & Krueger 1996: 133).

Studies measuring school spending across an entire state find a positive relationship between expenditures and student achievement, but studies that measure

actual school inputs on a less aggregated scale find only weak links between school spending and both average earnings and educational attainment. Although the quality of individual schools differs, conventional methods of school quality do not capture these differences. This suggests that although spending money on education is important, it is equally important to make sure the money is used effectively (Betts 1996: 146-148, 178). Hanushek finds similar results in a survey of 307 observations from the High School and Beyond data from the 1980s: teacher-pupil ratio and teacher salary have 4-5 times more effect at the state level than at the school level (Hanushek 1996: 64-66).

SOCIAL EFFECTS OF EDUCATION

Haveman and Wolfe find that the total annual value of non-marketable effects of education is roughly equal to estimates of the economic returns to an additional year of schooling, or $4,500-$5,000 in 1975 dollars. This implies that traditional reports of the economic impact of an additional year of education only report half of the actual value of education because there are so many benefits to education that are harder to put a price on (Haveman & Wolfe 1984: 400-401).

There are mixed results regarding the social returns to education. One social effect is that it has a positive causal effect on good health, (Stacey 1998: 55-56) and better private and familial health creates positive externalities such as reducing the spread of contagious diseases. (Haveman & Wolfe 1984: 381). Krueger and Lindahl conclude that it is unclear whether investment in higher education leads to technological externalities. They also find that education reduces crime and welfare dependency for disadvantaged groups more than it does for advantaged groups (Krueger & Lindahl 2001: 1130). Another researcher reconciles contrasting findings about the effect of time spent

in school on an individual's criminal activity by stating that if education leads to decreased crime it because of its socializing and supervisory effects. Communities with low social capital, for example, communities with a large percentage of uninvolved residents and unsupervised teenagers, have high crime rates (Stacey 1998: 60).

Since children spend so much of their time at school, schools become a major part of the socialization of American youth. The educators and peers whom students meet at school set the norms of behavior and achievement children will aspire to for the rest of their lives (Haveman & Wolfe 1995: 1834). However, these outcomes are hard to measure because the effects are not visible in the short run, and many policies demand immediate results. Agreed upon socialization effects include decreased rates of poverty, childbearing outside of marriage, early family formation, and child abuse and neglect when comparing high school graduates with drop-outs. Increasing education can lead to better familial decisions, which have long term benefits to society (Stacey 1998: 56-57). Haveman and Wolfe find that education reduces the number of desired children and also increases the likelihood of people attaining their ideal family size (Haveman & Wolfe 1984: 384).

Peers have a very strong influence on children. In one study, in neighborhoods where roughly 60% of 18-25 year olds had failed to graduate from high school, about the same percentage of children will drop out of school, whereas in neighborhoods where 90% of young adults have graduated, 90% of children graduate from high school (Haveman & Wolfe 1994: 117). Children emulate the big kids on the playground. Judith Rich Harris writes, "In societies where education is compulsory, children rank 'being left back in school' as the third most scary thing they can think of, beaten out only by 'losing

a parent' and 'going blind.' 'Wetting my pants in school' comes in fourth." (Harris 1998: 267). After compulsory schooling ends at the age of sixteen, dropping out of school is not such a scary event. When high school students see that their peers and the young adults they look up to did not graduate from high school or college, it signals to them that education is not important, which is why poor education can result in a vicious cycle.

An interesting finding is that changing test scores do not correspond to wage trends. Wages tend to perform the same for people with the same amount of schooling who went to school in different eras, which would not be the case if wages reflected school quality (Mishel et al. 2001: 163-164). For children who were educated before 1960, evidence shows that increased school resources led to increased earnings. However, after 1960 there is evidence of decreasing returns to education, but this is most likely due to increased bureaucracy in schools and changing social conditions outside of the classroom (Betts 1996: 163-166).

The importance of schools providing an authoritative and socializing role in youths' lives has increased since the 1960s, which increases the cost of schooling and makes the returns to education less clear. Being raised by a single parent or a working mother reduces the amount of parental time available to a child, which reduces the social capital available to that child. From 1950 to 1990, the percentage of children with mothers in the work force has risen from 16% to 59% and the percentage of children living with only their mothers has increased from 6.4% to 20.0%. This substantial change in family structure may account for the seemingly small increase in academic achievement, especially for Hispanics and African Americans, because schools have

invested more in their students to offset the decreased social capital available to them at home (Hedges & Greenwald 1996: 79-80).

Another way to look at the positive results of education is to examine what happens to kids who do not regularly attend school. A study of the long-term effects of truancy in Great Britain found that "truancy is a predictor of multiple problems in early adulthood" (Hibbett and Fogelman, quoted in Walker et al.. 1999: 171). They found that truants were more likely to have more children at a younger age, and were prone to divorce, heavy smoking, and experiencing depression, even after controlling for social background characteristics (Walker et al. 1999: 171). If anyone doubts the importance of education, this study clearly demonstrates the negative social consequences of not attending school.

CONCLUSION

Education in the United States has been funded mostly on the state level. Having literate citizens who can participate in the democratic process is a concern for the federal government, but having literate citizens does not benefit only the national government. An explanation for increased federal involvement in educational funding is the increased migration of citizens. Since increasing numbers of people do not stay in the school district that educated them, the district's incentive to put a lot of resources into educating children is diminished (Monk 1990: 270-274).

The importance of education is a seemingly undisputed fact. But not for economists. They know that it is important to question the current educational system in order to keep it socially and economically efficient. Schooling has been proven to have positive social and economic effects – increased cognitive skills, health, future earnings,

and GDP growth rate, and decreased poverty and crime rates – but it is important to study these effects to ensure that education policy is helping children, and society, as much as possible. Without explicitly knowing all the possible effects of education, voters in the Wachusett Regional School District spent years debating the best educational option for the adolescents of their region. One of the major issues they were debating was the extent to which economies of scale exist in high school education. The next chapter will focus on this important debate, because if researchers can determine the ideal high school size, they will be able to offer to the youth of America the best education possible.

Chapter 2: Economies of Scale in High Schools

Economies of scale in education and the ideal high school size are highly debated topics with serious policy implications. Economies and diseconomies of scale both exist in education; the key is to find the balancing point or a compromise. The results of empirical studies on economies of scale vary due to several limitations and variations in method and measurements.

In order to discuss economies of scale, it is important to define what this term means. Economies of scale exist when producing more reduces the cost per unit because the average fixed costs are declining faster than average variable costs are increasing. This is the downward sloping portion of the U-shaped average total cost curve. Once the increase in AVC is greater than the decrease in AFC, the average total costs curve begins to slope upward and eventually there are decreasing returns to scale (Schiller 2003:135-144). Another way to think about returns to scale is as an elasticity: the percent change in output resulting from a 1% increase in all outputs. In education, returns to scale can be represented by the elasticity $(dS/dN)(N/S)$, where S represents student outcomes and N represents school enrollment. A school will experience economies of scale if a 1% increase in N leads to a >1% increase in S (Andrews et al. 2002: 247). There is a considerable interest in finding out if and where this point of minimum unit cost exists.

POSITIVES

There are numerous reasons why the field of education does not experience constant returns to scale (when a one-unit increase in production results in a one-unit increase in cost). One is natural physical laws that result in non-linear relationships. For example, larger numbers result in less fluctuation over time, so a school with a higher enrollment will not have to worry as much about small year-to-year fluctuations in class size or enrollment in specialized classes. Since there is less fluctuation, shortages and surpluses of teachers and physical resources are less likely to occur, which simplifies planning (Monk 1990: 394-397).

Another time when constant returns to scale may not occur is when output is incorrectly measured. This happens when there are by-products of the factor you are studying which cannot be measured or are unknown. Some examples in education would be the various social skills that are learned at school but hard to quantify. In this case, the observed cost per unit is increasing faster than the true cost because output is higher than observed. The measured output underestimates the real output, which means returns to scale may be more likely than one would think from a peripheral glance at the numbers (Monk 1990: 397).

An aspect of larger schools that definitely contributes to economies of scale in education is that supplies can be obtained at a lower unit cost (Lee & Smith 1997:207). Technical economies of scale may exist in education if a large school is able to buy materials in bulk at a cheaper price than their small counterparts (Andrews et al. 2002: 247).

The indivisibility of some school resources may lead to economies of scale in administrative costs. In larger schools, specialized, administrative, and support staff can be shared by a larger number of students (Andrews et al. 2002: 247). Although the student-teacher ratio is one factor affected by school size, this ratio does not seem to affect students' achievement, which supports the argument for the productivity of larger classes and therefore schools (Fowler & Walberg 1991:189-190). Studies in the last decade used a U-shaped cost curve derived from a log-linear cost function with the log of enrollment and its square. They found that most cost savings observed in larger school districts are due to declining per pupil administrative costs, but unfortunately their studies focused on district size, not individual schools (Andrews et al. 2002: 251).

The final major source of economies of scale in education is returns to specialization. When a school grows, teachers are able to focus on more specialized areas of instruction. These could include subject areas, grade levels, or special learning needs. Specialization increases the productivity of the teachers so that students are receiving more resources for the same cost (Monk 1990: 399-400). A larger student body can also bring an increased efficiency in the delivery of services because as enrollment increases, the number of students with the same levels of needs and abilities also increases (Lee & Smith 1997: 207). Using data from Project TALENT, Kenny finds increasing returns to school inputs: when instructional, parental, and school inputs are held constant, students actually learn more in larger schools (Kenny 1982: 11).

NEGATIVES

Although administration has the potential to be more efficient in larger schools, studies find that administrative costs often increase due to the costs associated with

transportation and a larger support staff (Lee & Smith 1997: 207). Most studies have not evaluated the effects of consolidation on increased transportation costs, which may offset any savings realized from economies of scale (Andrews et al. 2002: 251, Monk 1990: 404). Callan and Santerre find that short-run economies of scale do exist for public high schools. However, diseconomies of transportation costs may exist, which would offset some of the savings accrued through larger schools (Callan & Santerre 1990: 478). Another negative aspect of the administrative costs of larger schools is that they spend more money on supervision and less on instruction and other pupil service (Fowler & Walberg 1991: 191). The increased number of adolescents in one building increases potential for violence and problems (Lee & Smith 1997: 208).

Another cause of scheduling and administrative problems is specialization. If a very specialized teacher is asked to teach outside of her/his area of focus, productivity will decrease (Monk 1990: 400:-402). One would think that a diversified curriculum would increase academic achievement, but there is some research that suggests that average achievement is higher when all students follow the same curriculum. This is because when the curriculum is more unified, it consists of more core academic subjects and fewer courses in nonacademic interests or personal development, and therefore leads to a more equitable distribution of academic success Lee and Smith warn of differentiation in educational experiences leading to social stratification (Lee & Smith 1997: 207). Although one of the major arguments for larger schools is that they can offer a more comprehensive curriculum, Fowler and Walberg found that most small schools offer a curriculum that is competitive with those of their larger counterparts (Fowler & Walberg 1991: 200).

Oakes finds an abundance of evidence to dispute the commonly held belief that students learn better when grouped with other students of equal ability. No group has consistently been found to achieve more when placed in homogenous groups: a minority of high achieving students learn more when placed with students of equal ability and average or low-achieving students have been found to learn less when grouped with homogenous peers (Oakes 2005:7). Highly differentiated high schools are sometimes referred to as shopping mall high schools. "They [educators, students, and parents] judge the health of a consumption-oriented educational enterprise in the same way they judge the health of a consumption economy: by the sheer variety of goods and services available for purchase." (Powell 1985: 12). One aspect of this shopping mall-esque high school is placing students in "tracks" based on their ability. Tracking has been found to have a negative effect on low-tracked students' attitudes and perceptions of themselves. Lower track students score lower on self-esteem measures and are less likely to apply and be accepted to colleges (Oakes 2005:129).

There are other factors that affect returns to scale in education, such as attitudes and identifying with the school. Students' attitudes have a strong positive effect on academic achievement, and curriculum differentiation is negatively correlated with attitudes. Fowler and Walberg cite sources who found that increasing the size of high schools had a negative effect on factors other than academic achievement, such as extracurricular participation, student satisfaction, identification with the school, and parental participation. They found that students who are dissatisfied with their education, don't identify with their school, or don't participate in extracurricular activities will achieve less academically and score lower on post-schooling measures (Fowler &

Walberg 1991: 191). In any organization, interactions become more formal as it grows. This consequence occurs in larger high schools and leads to a decreased sense of belonging among the students (Lee & Smith 1997: 208). Larger schools are also notorious for low parental and student involvement. If students do not identify with their school, they are less likely to feel like they belong and to have a positive experience. Parents are more likely to participate in the educational process of a smaller school because they feel that their contributions have a greater effect. Also, in a smaller school teachers are more likely to know their students and to identify when they are having trouble (Andrews et al. 2002: 247).

A final reason for a non-linear cost curve that may lead to diseconomies of scale is that the price of inputs may vary. This is based on simple supply and demand: doubling demand for school buses from a relatively fixed supply will bid up the price, which will increase the costs of production (Monk 1990: 399). Average cost could be affected by an inability to vary all inputs in the same proportion. For instance, when enrollment drops it is easier to get rid of books, desks, and other materials than it is to reduce the supply of "indivisible" inputs such as teachers or classrooms. A reduction in the number of students per teacher or classroom will lead to decreased productivity and an increase in the costs of production (Monk 1990: 397-399).

CONCLUSION

Akerlof and Kranton see the dilemma about ideal high school size as an educational trade-off between offering students more choices, which leads to more students identifying with the school and feeling engaged, and offering a single ideal that will lead to higher average academic achievement (Akerlof & Kranton 2002: 1169).

Since high schools can be too large and can also be too small, it is important to find a balance between offering enough courses to cater to students' needs, but not too many that the curriculum becomes differentiated (Lee & Smith 1997: 219).

EMPIRICAL STUDIES/HOUSES

Educational researchers are not simply concerned with decreasing costs. A school is said to be more efficient if it reduces cost without reducing outcomes. Empirical evidence controls for this dilemma by treating education as a factor of the quality and quantity, the two aspects of the outputs of education. Quantity is generally measured by enrollment. Quality is measured either by inputs, such as teacher or building quality, or by outcomes, such as average test scores in math and reading and drop-out rates (Monk 1990: 402-403, Andrews et al. 2002: 248). Another measure of academic achievement is the percentage of students continuing their education after graduating high school (Callan & Santerre 1990:470).

Lee and Smith note that their ideal high school size relates to academic achievement, which is generally considered to be the goal of high schools. However, high school size does affect many other outcomes, such as social relations, extracurricular activities, and even successful sports teams. Also, although school size and academic achievement seem to be linked, the relationship may not be a direct link because enrollment affects so many other factors which may directly affect learning, such as the organization of the school (Lee & Smith 1997: 218-219). Fox sees this as a limitation in studies of economies of scale because academic achievement is not the only goal of educators. Enrollment and test scores have been used as output measures of quantity and quality, but they are only substitutes for the true outputs: cognitive learning, instilling

social values, and other results of education. Measures of input such as student and family ability and the school inputs of labor and capital are often disregarded in studies of educational economics of scale because of a lack of reliable data. Capital inputs such as square feet of building space and building value are often ignored for the same reason. Expenditure is most often used a proxy measure for inputs. This is problematic because production techniques are divergent in differently populated areas, and variation in expenditure due to variations in production techniques does not explain economies of scale (Fox 1981: 281-283).

Compared to studies of his time, Cohn was quite innovative when he decided to measure the quality of the students in his study by looking at academic achievement instead of only using educational inputs. The Iowa Tests of Educational Development are administered twice in high school, so Cohn used the difference in scores as his measure of academic achievement. He measured quantity by average daily attendance (ADA) (Cohn 1968: 422-424). The school in Cohn's study with the lowest cost per pupil had an ADA of 2,913 students. However, this number says nothing of the quality of the school. Cohn found that the school paid lower salaries, had larger classes, and offered fewer courses than the other schools. In general, he found a definite existence of economies of scale in high schools: larger schools can spend less money per pupil while providing the same level of education, ceteris paribus. However, some factors, such as transportation cost, do increase as the size of schools increase, so these costs must be carefully considered. He found the optimal school size to be an ADA of 1500 students (Cohn 1968: 434).

Lee and Smith measured the effects of high school size on academic achievement growth using math and reading cognitive test scores as their dependent variable (Lee & Smith 1997: 209). However, they do not include any measures of school inputs in their literature, apparently assuming that the size of the school is the only factor in an education production function. Although they do not mention other inputs, Lee and Smith do mention other possible factors affected by the size of a high school. These include social relations, self-esteem, belonging, and leadership: qualities that they did not quantify. They concede that correlation is not causation, and size could have an indirect effect on learning by acting as a facilitating or debilitating force on other factors that affect learning such as organization or the curriculum (Lee & Smith 1997: 219).

The curvilinear relationship between enrollment and math or reading achievement both peaked between 500 and 1000 students. Lee and Smith placed high schools into groups for every additional 300 students enrolled, for example 0-301 students, 301-600, and so on. After dummy-coding these categories, they found that outcomes were highest in both math and reading in schools with 601-900 students; schools that were smaller or larger than this range had smaller gains in academic achievement. It is important to note that the schools with 601-900 students had the lowest percentage of minority students and the highest average socio-economic status (SES). The schools with the highest ability (but not gains) were the 1501-1800 student schools. In their study, Lee and Smith found that the ideal size did not vary for different types of students, but those students in schools with high minority enrollment and/or low socio-economic status (SES) students learned comparatively less in schools that were not 600-900 students, and large schools were particularly troublesome for these students. This implies that schools with high

minority enrollment or low average SES should be most concerned with achieving the ideal high school size. This study also showed that size affects equity more than it does achievement (Lee & Smith 1997: 211-217). Fowler and Walberg also found that SES had a large effect on student outcomes. Low achievers seemed to benefit most from being in small high schools (Fowler & Walberg 1991:190).

Despite some flaws in their research, Lee and Smith did utilize a curvilinear equation to represent the relationship between cost and size, which some other researchers did not employ to describe economies of scale in education (Lee & Smith 1997: 210). Lee and Smith recommend an optimal enrollment of 600-900 students, but they omitted school inputs from their production function, which could have seriously flawed their results (Andrews et al. 2002: 255). As Fox wrote, "Factor inputs are necessary elements in both production and average cost equations." (Fox 1981: 282).

The Carnegie Foundation's influential report on educating adolescents *Turning Points: Preparing American Youth for the 21st Century*, which was published in 1989 and updated in 2000, states that "smaller is better" (Jackson 2000: 123). Although the study focused on middle schools, the authors believe their results should be seriously considered at the high school level. In general, small schools are safer, have higher attendance and participation, and lower dropout rates. They also foster a sense of community and belonging that benefits students. For large schools that cannot easily be converted into smaller schools, Turning Points recommends a compromise of creating smaller learning communities by dividing into "houses" or "schools-within-schools", two similar systems. These systems create smaller communities that bring the benefits of smaller schools to a larger school that cannot be broken down for financial or political

reasons. Houses tend to be smaller and often have separate disciplinary systems which combine to form one school. Schools-within-schools are more autonomous, with multiple schools in one building under one administrator but separate governance systems. Students stay together for the length of time they attend the school and take their core classes in their unit (Jackson 2000: 123-124). It is important that the houses reflect the demographics of the entire school population and that they are not viewed as a way to put students on a track based on ability or vocation; this could lead to social tiers and segregation. The size of each house is also important. Lee and Smith find that houses smaller than 600 students will actually hurt academic achievement. Another report sponsored by the Carnegie Foundation, *Breaking Ranks*, reiterates the idea of breaking high schools into houses. It suggests units of 600 students, a number that appears frequently in research on the economies of scale of secondary education (Lee & Smith 1997: 218-220).

Since tracking and class differentiations exacerbate the differences that students already possess when they enter school (Oakes 2005:111-112) the Coalition of Essential Schools recommends eradicating tracking through structural changes. One possibility for larger schools is to break down into smaller heterogeneous houses with team-taught classes. Other important changes could include a theme-based curriculum and more personalized relationships between adults and students (Oakes 2005:218).

In a study on the effects of attending a restructured high school, Lee and Smith found that students in restructured schools and in smaller high schools learned more in reading, math, history, and science than students in schools without any reform measures. Of course, students in restructured schools were also more likely to have a higher SES

and less likely to be minority-group members. Schools with restructured practices have more course taking and less curriculum variation than schools without reform measures. Variation in course-taking is negatively related to social equality and student engagement. Students are more engaged in their studies in smaller schools, and restructured schools have a higher and more equalized distribution of engagement. Since restructured schools have a greater academic emphasis and less variation in curriculum, they are significantly more equitable than other schools. Restructured schools use practices aimed at shifting schools from a bureaucratic to a more communal organization by reorganizing instruction, authority, and personal relationships. Schools-within-schools are one method for making school relationships more personalized and creating smaller learning environments (Lee & Smith 1995: 247-259).

There is evidence against differentiated curriculums, but schools are financed by property taxes, so they should reflect the desires of the local citizens. "The solution ultimately settled upon was the comprehensive high school – a new secondary school that promised something for everyone, but, and this was important, that did not promise the *same* thing for everyone." (Oakes 2005: 21). Although differentiated schools may not be the most equitable solution, they are often the solution that taxpayers are willing to fund. Similarly, Monk states that even if scale economies exist, taxpayers should be able to have a smaller school if they are willing to bear the extra costs (Monk 1990: 499). It is important to keep in mind that school size is ultimately the decision of the taxpayers.

FINAL THOUGHTS

Although there is extensive research on economies of scale, there is not a real consensus among the studies. Monk points to many possible explanations. Since the

input-output relationship in the economies of educations is not yet fully understood, the cost equation, an essential part of studying economies of scale, has not been perfected. A second problem is that researchers often don't account for the costs that would occur if schools were consolidated. Transportation cost is a potentially large cost that is not often fully considered. Another incongruence of the studies is that some investigate economies of school district size and others evaluate school size. Although answering similar questions, the results of a study on school size can not be generalized to school district size, and vice-versa. Also, economies of scale seem to be larger in secondary schools than the elementary level. Finally, even though economies of scale may exist, there is no guarantee that schools will take advantage of them. Most studies do show that economies of scale exist, but do not agree on the extent to which this is true. (Monk 1990: 404-405).

It is obvious that a relationship between school size and academic achievement exists, but there is a lack of consistent evidence to explain what the exact relationship is (Fowler & Walberg 1991: 200). Although there are many state programs that provide incentives for school and district consolidation, the empirical evidence on which the policies are based is not conclusive. Research from the 1960s and 1970s pointed towards large economies of scale in education. In urban high schools, enrollments of 1400-1800 students were recommended, and economies of scale were found in rural areas too, though at lower numbers. Extensive economies of scale in capital costs were found in one study of the per pupil cost of building and maintaining gymnasiums (Fox 1981: 284, 291-292). However, more recent research is leading experts to believe that smaller schools lead to an increase in achievement. The balancing point between possible economies of scale and potential decreases in student outcomes seems to be between 600

and 900 students per school. (Andrews et al. 2002: 245). Although there are mixed results for school district size, studies regarding returns to scale at the school level generally find a negative relationship between size and student achievement. However, since these studies assume a linear relationship between enrollment and performance, it is possible that the decreasing returns to size may begin when high school enrollment is greater than 1000. Therefore, a review of the literature suggests to Andrews that moderation is the key to finding the optimal school district size (Andrews et al. 2002: 255).

The equations used for determining economies of scale are very closely related to the economic production function. "A production function relates inputs to outputs and a cost function shows the cost of providing various output levels. Applications of duality theory to production and costs have shown that under certain conditions a particular production function implies a given cost function and vice versa." (Fox 1981: 275-276). Like economies of scale in high schools, the exact equation to describe the production function is unknown, for many of the same reasons that the research on economies of scale is inconclusive: neither inputs nor outputs are easily measurable in the economics of education (Hanushek 1986: 1149-1150). Multiple studies have found economies of scale in education. However, few of the studies that found economies of scale assessed the effects of school size on academic achievement (Fowler & Walberg 1991: 199). Chapter Three will examine these issues in more detail.

Chapter 3: The Education Production Function

DEFINITION

President Nixon once asked, "What makes a good school?" Finding an answer to this query has been the focus of hundreds of studies of the education production function. This is an economist's method of discovering the answer to Nixon's question (Bieker & Anschel 1973: 515). We have seen why the government, society, and parents are concerned with educating the country's youth; this chapter will focus on the best methods of producing that education.

A production function is a relationship that expresses the capacity of a firm to produce a single good from different combinations of inputs. In other industries, economists determine the best combination of resources to produce a given output most efficiently. The factors of production used to produce education include the land on which the school is built, the labor of faculty and staff, and the capital of books, chairs, chalk, rulers, and everything else used in a school (Schiller 2003: 124-125). Production functions and the cost functions in Chapter Two both relate inputs to outputs, but differ because production functions do not include input prices (Fox 1981: 275-278). Of course, the idea of units of land, labor, and capital producing education is a very simplified view of the education production function that economists have spent years researching.

Starting in 1966 with the "Coleman Report", education researchers have been trying to find the relationship between school inputs and educational outcomes, which economists later named the education production function. This term implies that researchers are looking for the maximum output available from a given set of inputs. Input and output misspecification is a pitfall of educational research. The production function of most industries includes a few inputs of capital and labor, but in educational research, learning theorists do not have a fixed set of inputs. Although there is a generally accepted model, problems arise when economists try to specify the exact inputs (Hanushek 1979: 352-353, 362).

In other sectors of the economy, researchers are able to look at the total output, as measured by the market price. However, no such market price exists for education. There are more outcomes of education than are typically measured in education production function studies, especially in the later grades (Hanushek 1979: 362-363). Unlike most industries, the output of schooling is not simple to define or quantify. Therefore, it is not easy to judge whether or not teachers, the labor that creates educational outcomes, are productive. This adds to the problem of model misspecification (Greenberg & McCall 1974: 483). Hanushek addresses this problem by noting that economic theory usually focuses on varying quantities of output, but in education the focus is on both the quantity and the quality of this output. Also, student achievement is a cumulative educational process, but is measured at discrete points in time (Hanushek 1986: 1150).

In general, production function estimates do not account for the decisions of actors in the production. Some of the "macro"-level choices of school organization are

observable, such as class organization or curriculum. However, decisions of individual teachers are a large part of the educational process, and these "micro"-level factors are harder to observe. It is also difficult to separate these decisions from the innate characteristics of the teacher, which are often considered to be a different input (Hanushek 1979: 367-368). Michael Apple explains this difficulty by saying that economists think of education as a "black box": they measure inputs and outputs, but are less interested in the actual educational process. As economists collaborate with educators and sociologists, they will begin to understand what goes on inside this "black box" of education (Apple 1990: 26). Within research of the education production function, there is an interesting divergence from normal production function studies: production functions are estimated for individual firms while educational research is often at the district, state, or even national level instead of at the individual school level (Hanushek 1979: 354).

The education production function shows the relationship between an educational output, like standardized test scores, and a set of inputs. The list of inputs reflects the fact that students learn in and out of the school building by including characteristics of the family, student, and school. Each of the included inputs is expected to have a positive effect on learning. A basic example of such a production function might be $L = f(S, t_L, E)$ where L represents how much a child learns, S the quality of the school system, t_L the amount of parental instruction given to the child, and E parental educational attainment (Dewey et al. 2000: 27-29). The goal of estimating education production functions is to formulate a quantitative model that will be able to predict the effect of a change in resources on student outcomes. The broad guidelines are widely accepted, but

researchers disagree on the exact specifications of this production function (Hedges et al. 1994: 5-6).

EDUCATIONAL THEORIES

Of course, just saying that education is a function of various inputs is not enough. Economists and other researchers have developed various theories to explain exactly how these inputs influence the educational output. These theories include the economic model, the human capital theory, the role model theory, the theory of heterogeneous income effects, and the working mother hypothesis.

In the economic theory, parents divide their income between current consumption and investment in their children because they are concerned with the development of their children's human capital and future standard of living. Parents decide how much to invest in their children by considering their individual skills, childhood endowments, and market luck. Childhood endowments are how a certain family's culture facilitates future earnings. Market luck is the macroeconomic conditions of the economy. The skills and endowments are assumed to be known, while market luck is not. The economic model is essentially the parents' demand equation for the future income of their children. This model does not distinguish between different kinds of income, assuming that any increase in parental income will have a positive effect on the child's skill development (Hill & Duncan 1987: 47-48).

Economists Robert Haveman and Barbara Wolfe view the economic theory of producing education as an aspect of the theory of human behavior. The adults in the family make decisions regarding both the labor supply and the ways the family will use the economic resources it produces. The amount of resources the parents decide to invest

in their children, along with parental income and genes, will influence the future income of their children (Haveman & Wolfe 1995: 1832-1833). Parental investment is thus constrained by human wealth, such as parental education and time spent with children, and nonhuman wealth, such as parental income or assets, and is assumed to increase as the value of parental resources increases (Haveman et al. 1991: 134).

This model of human capital was developed by Gary Becker and concerns "the transmission of earnings, assets, and consumption from parents to descendants." (Becker & Tomes 1986: S1). In Becker's original model, parental income had a major influence on future earnings of children, but his subsequent models place a greater importance on the influence of childhood endowments. Parents affect the economic welfare of their children not only by passing on their own genes, but by investing in the education, health, and skills of their children, and by introducing their children to certain social contacts. If there were a perfect capital market, parental income would not matter because the child's human capital would be collateral for any loan. However, since lenders are concerned about the imperfect information regarding human capital and the moral hazard problem of children not working to the best of their ability, parents are not able to use their children's future earnings as collateral for loans. This means that parents must finance investments in their children through selling assets or reducing consumption, so wealthier parents do tend to invest more in their children, but the indirect effect of endowments is still important (Becker & Tomes 1986: S5-S11). In this economic model, parental income is not the sole determinant of a child's future income, but simply a resource which, along with education and child-care time, will affect the cognitive skills of their child (Stafford 1987: 972).

Sociologists believe that parents' work influences children for reasons other than simply the income they obtain from this work. In this model, income reflects the kind of role models that parents will be for their children. Parents can provide models for self and models for objects. Models for self are examples of how the child should act as an adult, and models for objects are values, like "success," that parents define for children through their own actions. Parents are expected to be better role models when they have higher incomes or have completed more schooling. This theory is complicated by the fact that the child's identity is most strongly linked to the parent of the same sex, so the role model effect is supposed to have a stronger mother-daughter and father-son link. Also, role model effects are generally only thought to be effective if the parent is living in the same household as the child, but absent parents may also be a role model for their children. Unlike the economic model, in the sociological model parental income is not viewed as a resource, but as a signal of the underlying conditions in the family (Hill & Duncan 1987: 40, 48-49).

This sociological model states that the behavior, aspirations, and values of a child's closest role models (their parents and older siblings) will directly affect their cognitive development (Haveman & Wolfe 1995: 1834). This creates incongruence between the economic and social models for sources of income such as welfare. According to the role model theory, which assumes that parents set examples for their children, growing up in a family that depends heavily on welfare will have a negative effect on high school completion. This is because children who view their parents as dependent on welfare will be less motivated to be economically independent (Haveman et al. 1991: 134). Welfare is also a source of income, and according to the economic model,

which assumes that all parental income will increase their children's future income, families on welfare will have more wealth to invest in their children and thus children's education will benefit (Hill & Duncan 1987: 64).

Welfare culture is an example of the theory that income is a signal of heterogeneity: different kinds of income will produce different effects. The reason they will have different effects is because the income is actually a signal of parental characteristics. For example, parents who accumulated their wealth for themselves may be more farsighted than parents who are wealthy because of inheritances. On the other side of the economic spectrum, parents may be supported by welfare if they possess negative characteristics regarding financial planning or motivation (Hill & Duncan 1987: 50).

Another theory that provides many possible explanations for the academic achievement of children is the working mother hypothesis. If income is heterogeneous, additional dollars earned by mothers will have a negative effect on development because the mother will have less time to supervise and train her children. This "mother absent" hypothesis sees a mother's work outside the home as a source of developmental problems in children (Hill & Duncan 1987: 49). However, Stafford argues that the choice between working and spending time with children is an equivocal choice for mothers because they will either increase their family's income or increase child-care time, both of which augment children's academic achievement (Stafford 1987: 972). Because of these offsetting effects, the working mother hypothesis does not predict one outcome regarding the effects of a mother's decision to work outside the home on her children's educational outcomes (Haveman et al. 1991: 134). Another ambiguity of the absent mother

hypothesis is that mothers with careers may have fewer children than mothers who stay home, so the amount of time spent with each child will be equalized. Better educated mothers indirectly influence children's cognitive development through decisions regarding number of children, child spacing, and family income (Stafford 1987: 974-978).

INPUTS

Economists have studied many different factors in their quest to determine what the important elements of education are. At the most basic level, the process of education involves two inputs of labor and capital: there is one teacher per classroom and small variance in class size. Since these factors are basically fixed across schools, they do not imply much about their effectiveness. A generally accepted model of educational achievement includes family background influences, peer influences, school inputs, and innate abilities; all but the last are cumulative over time. However, once researchers attempt to specify these models and measure the variables, they encounter controversy (Hanushek 1979: 363).

Hanushek's rather skeptical view that economists choose their inputs based on availability of data seems to be accurate (Hanushek 1979: 363). In Fox's review of past research, he notes that even though factors of the student's home environment may be important, reliable data are not often available and therefore researchers omit these variables. Accurate proxies of the students' intelligence and the school inputs are much easier to obtain. Student inputs are measured by IQ scores, attitudes, and family attitudes about education. Labor inputs are measured both by the quantity measure of pupil/teacher ratio and quality measures like education, experience, and salary. Capital

inputs can be measured by square feet of building space or building value (Fox 1981: 282-284).

Studies that are concerned with which model is the most appropriate often focus on family background characteristics including ethnicity, number of siblings, parental time spent with the child, parental education, stressful events during childhood such as moving, whether or not the family relies on welfare, and other economic conditions (Haveman et al. 1991: 138). Other possible family inputs include whether or not the mother has a job, the mother's child care time, and the number of children in the family (Stafford 1987: 972).

Sociologists are concerned not only with student and familial inputs, but also with inputs from the community. An important part of schooling is the social capital it builds through changes in the relationships among people. The social capital of each student is affected by all the parents and members of the school community. These relations among community members can affect the productivity of a school because they affect the attitudes of the students toward their education as well as norms and expectations in the community (Coleman 1988: S100-S101). The social capital of a community produces human capital. Human capital is the value of a person's capacities, and it is another important input to the education production function. Since human capital is affected by the investment parents put into each child, parental income and the number of children in a family will influence each child's human capital (Becker & Tomes 1986: S6-S8).

Other studies rely solely on the labor inputs of education. Some researchers simplify the input-output analysis to only one input – teachers – while others include instruction services, administrative services, and support staff personnel (Callan &

Santerre 1990: 468-469). Within the labor inputs, there are many possible factors that economists have considered, including different ways of measuring teacher quality (Fowler & Walberg 1991: 190). Measuring the differences in different teacher skills is not easy, and proxies such as education, experience, salary, or verbal ability may not fully reveal a teacher's true skill set (Hanushek 1986: 1164). While studying factors of teacher inputs, we think of good teachers forming good students. However, the causality may be running in the opposite direction of our intuition: good students attract the good teachers. Since teachers with more experience – who are generally more effective – have more power to choose their schools, they are able to work in schools that enroll students with higher socioeconomic status and intellectual potential (Greenberg & McCall 1974: 484-485).

Some researchers study the effects of an increase in school expenditures (Akin & Garfinkel 1977: 460). One problem with measuring the resources that may affect achievement is that they may be correlated with other, unobservable characteristics. For example, since schools are mostly funded by local taxes, poor districts are unable to have high per pupil expenditure rates, but the low achievement of their students may be the result of some other factor such as their home environments. Hakkinen, Kirjavainen, and Uusitalo note this problem of correlation, but still use expenditure as a measure of school resources. The major input measured was the average teaching expenditure per pupil during the three years the student was at the school (Hakkinen et al. 2003: 330-332).

Hanushek argues that measures of quality are much more important than measures of quantity, and the two are not necessarily synonymous. He defines high quality teachers as those whose students consistently perform higher than expected.

Although per pupil expenditures more than tripled in real terms from 1960 to 2000 and the pupil-teacher ratio has been steadily falling, student achievement has only increased slightly. Although this statistic seems to say that educational inputs are unimportant, this finding may be due to changes in students or school requirements that have made education more expensive over the years (Hanushek 2003: F64-F69).

OUTPUTS

After conducting a study sponsored by the National Association of Secondary School Principals and the Commission on Educational Issues of the National Association of Independent Schools, Theodore Sizer concluded that the goal of education is to produce self-propelled learners. Although this may be hard to quantify, Sizer believes "The focus of high school should be on *the use of the mind* [emphasis in original]." (Sizer 1984: 216). This is the goal of many educators, but it is hard for economists to quantify. Therefore, studies have used various measures of academic achievement to measure the effectiveness of education.

Although traditional production functions show the relationship between inputs and a homogenous output, education does not have only one output. Many studies measure output with standardized achievement test scores. Others use measures of student attitudes, attendance rates, and college continuance to measure the educational output. Education also produces outputs in the form of improved labor market performance and socialization effects (Hanushek 1979: 355-356). Some of the socialization goals of educators include inculcating students with the attitudes, values, and social relations of the community and country (Fox 1981: 281).

Test scores, which are readily available and easy to compare, are often used as a measure of achievement, but whether or not these are accurate measures of cognitive development is questionable (Hanushek 1979: 378). Standardized test scores may not be a perfect measure of cognitive development, but some researchers think they are more appropriate than other possible measures. Outcomes like future earnings may be influenced by events that occur after official schooling has ended (Dewey et al. 2000: 30). Using standardized test scores as a measure of output may be more appropriate for younger children because the curriculum is focused on the same basic skills the tests measure; in later grades, the problem of multiple outputs becomes more of an issue (Hanushek 1979: 355-356). For this reason, some researchers use test score as a measure of output for primary education and the percentage of students going on to postsecondary education as the output measure for secondary schools. Postsecondary education (including everything from educational programs to four year colleges) is used instead of standardized test scores or percent entering college, because it is not biased towards only those students planning on attending a four year college (Callan & Santerre 1990: 471). One output that is even less biased is high school completion, which is used by some education researchers (Haveman et al. 1991: 133; Coleman 1988: S95).

Sociologists often use the type of production function that looks at the socioeconomic attainment of children, as measured by future occupation, occupational prestige, or future earnings (Haveman et al. 1991: 135). One reason that future earning may be a more accurate measure of the output of education than test scores is that tests only measure cognitive development, but that is not that only output of education. In this

way, income flow is a more accurate measure of the human capital produced during formal education (Akin & Garfinkel 1977: 460-461).

Another alternative to using standardized test scores as a measure of cognitive development is to have teachers rate their students' school performance (Stafford 1987: 975). Of course, this is not an entirely objective measure of a child's development, so it is not a flawless approach.

EXPERIMENTAL FINDINGS

Ideally, a production function relates known outputs to a few, perfectly measured, inputs. However, Hanushek argues that in the real world, "the production function is unknown (to both decision makers and researchers) and must be estimated using imperfect data; some important inputs cannot be changed by the decision maker; and any estimates of the production function will be subject to considerable uncertainty." (Hanushek 1986: 1149). As we will see, the literature finds a variety of results of the effects of education on achievement. Part of this ambiguity is due to the uncertainty regarding specification of the education production function. Common errors include those of functional form, level of aggregation, and omitted variables (Krueger 1999: 497-498). These function misspecifications make it clear why there is a variety of findings in the literature. For example, Akin and Garfinkel found that future earnings were directly dependent on school expenditure, yet they found no strong relationship between achievement test scores and expenditure (Akin & Garfinkel 1977: 476).

A major misspecification error in the literature involves whether or not to include family income as an input. Including income in the production function confounds it with demand functions because the amount of education demanded depends on income.

Dewey, Husted, and Kenny found positive effects of expenditure per pupil, teacher-pupil ratio, and teacher education, experience, salary, and other characteristics on test scores when they corrected for this misspecification. This shows that inputs are more important than they are commonly found to be (Dewey et al. 2000: 27, 41-42). Stafford had teachers compare children's academic performance to the performance of their peers in seven areas. Through this rating system, Stafford found that parental income had a positive effect on cognitive development, even within districts, where the quality of schools does not vary (Stafford 1987: 975, 979).

There is also uncertainty regarding which educational theory lies behind the education production function. There are mixed results regarding the working mother theory because a mother's market time has been found to reduce teacher ratings, but this is negated because a mother's education and wage decrease the number of children, which increases the amount of time she can spend with each child. Siblings, especially those close in age, have a negative effect on teacher ratings (Stafford 1987: 979-980). A separate study by Haveman, Wolfe, and Spaulding also finds that large families have a negative effect on achievement, but it finds that the mother's work has a positive effect on educational attainment. These findings are consistent with the economic model of education even if the source of income is a mother's market work. Their findings are also consistent with the role model theories: parental education encourages similar achievement and welfare dependency has a negative effect on educational attainment (Haveman et al. 1991: 149).

Hill and Duncan were not as enthusiastic about the role model theory. Although they found support for the father-son role model hypothesis, the significance levels were

low. They found that a mother's work time negatively affected the educational attainment and future earnings of sons between the ages of 14 and 16. They qualified this by saying that a mother's income had a beneficial effect, but it was less beneficial than income from other sources. Also, they found that welfare dollars had the same positive effect as dollars from other sources (Hill & Duncan 1987: 65-66).

In a study of public school dropouts from 1980-82, James Coleman, the major researcher in the field of social capital, found that increased social capital decreases the drop out rate. Unfortunately, social capital is a public good and is therefore underproduced: there is an underinvestment in social capital because those who generate it only receive part of its benefits (Coleman 1988: S118-S119).

Every high school is different, and some experimental findings point to these differences as an explanation for why the education production function has not yet been specified. Bieker and Anschel used per pupil expenditure as a proxy for school quality in their study because it is easy to objectively measure. They thought it was reasonable to assume that the two were positively correlated in their study because there was limited variation in the pupil-teacher ratio of the schools they studied. The other resources this study included were student's innate ability, measured by the Otis-Lennon Mental Ability Test, parental grade attainment, a scale measure of student motivation, and the available stock of both plant and instructional equipment. Bieker and Anschel found that there is not one specific production function for high school education because the relationship between inputs and outputs varies with different curricula. They used both absolute and relative change in test scores over the educative period, but found that these scores are

not adequate measures of the product of education because the R^2 values for the curricula were very low (Bieker & Anschel 1973: 516-517, 519).

The idea that there are different production functions for various curricula in different high schools would explain why some researchers have not consistently agreed on one resource that consistently increases achievement (Fox 1981: 283). For example, Fowler and Walberg studied the effects of teacher experience, class size, the quality of the teacher's college, and whether or not the teacher held an advanced degree and they found little consistent evidence that an increase in resources leads to an increase in academic achievement. In failing schools, changes in school expenditures, staff attributes, and class size did not consistently enhance education (Fowler & Walberg 1991: 190, 200).

After reviewing 147 studies of education production functions, Hanushek found that teacher-student ratios, per pupil expenditures, teacher education or experience, and peer effects do not have the expected positive effect on student achievement. His well-known statement on this topic is: *"There appears to be no strong or systematic relationship between school expenditures and student performance* [author's emphasis]*."* (Hanushek 1986: 1159-1162).

There is little consistency among findings, but some studies do find that the estimated educational inputs of family and student characteristics have a positive effect on student achievement. One study noted that using standardized test scores from most states in the US will result in selection bias since these tests are not mandatory. Therefore, Hakkinen, Kirjavainen, and Uusitalo used scores from the Finnish senior secondary exam, which is a mandatory exam for all students going on to secondary school. This study used the GPA of youth before they entered secondary school as a

measure of academic ability. Gender and whether the student had a job during the school year were other included inputs. Family background is measured by parental years of education. They found that parental education and the student's past achievement positively affected results on a matriculation exam (Hakkinen et al. 2003: 329, 335). Another study showing the importance of parental socioeconomic status was a study of vocabulary acquisition where Hart and Risley found that race, gender, and birth order had no significant influence on the sociability of children, but relative economic advantage made a major difference. Higher SES parents consistently talked to their children more often and with a more varied vocabulary (Hart & Risley 1995: 53-74).

In a reanalysis of Hanushek's review of past literature, other economists find that there is a relationship between student-teacher ratios, administrative inputs, and teacher experience, education, and salary and student achievement, although these do not always affect achievement in the same direction. In general, per pupil expenditures matter, but it is important to figure out which resources matter for each situation (Hedges et al. 1994: 11). Dewey, Husted, and Kenny suggest that the high number of negative coefficients in many studies is an indication that schools are not effectively allocating their resources. Therefore, school inputs do matter, but it is important to consider how educational funds are spent (Dewey et al. 2000: 42). For example, spending money on new textbooks may be more effective than hiring a new administrator.

POLICY IMPLICATIONS

The education process applies a set of inputs to producing the outcome of student achievement. While some of these inputs can be controlled by policy makers, others cannot (Hanushek 1986: 1150). One of the major educational policy debates involves the

input of teacher-student ratios. One side of the debate says that students perform better in smaller classes. The largest randomized study of the effects of class size on the achievement of children is known as Project STAR, or the Tennessee Student/Teacher Ratio experiment. This experiment was for children in kindergarten through third grade, and various economists have interpreted the results in different ways. Past reviews of the experimental results find that students in small classes perform better than students in larger classes (Krueger 1999: 498). Mazzoni cites both Project STAR and class size reductions in California to show that class size reductions improves student achievement and the relationship between schools and their community (Mazzoni 1998: 26). Researchers are not the only people who favor smaller classes; the superintendent of the Wachusett Regional School District is fond of saying, "What matters in education is three things: class size, class size, and class size." (Pandiscio, 2006).

The increased social capital that results from a reduction in class size could have further positive effects on student achievement. Hanushek cautions that the increases in achievement decrease dramatically after the first year in a smaller class, which implies that the results from Project STAR should not be generalized to later grades. If the effects of smaller classes are mostly due to socialization and classroom behavior, perhaps policies inducing smaller kindergartens would be useful, but those reducing class size throughout a school would not be an effective use of resources. Also, Project STAR was not a flawless experiment. One flaw of the experiment is that only 48% of the students stayed in the experiment for the entire four years. Those who left the experiment were replaced with new students, who might have been in a differently sized class the year before (Hanushek 2003: F87-F88).

In a study of Norwegian schools, Bonesronning found that gains in achievement were dependent on the student's effort level. Class size changes were not found to have identical effects in all situations (Bonesronning 2003: 961). From his analysis of the Project STAR data, Krueger agrees that the achievement gains vary across schools and depend on student characteristics. He estimates that the cost of cutting the size of kindergarten classes by one third for all incoming students would be $7400 per student and that it is hard to estimate the positive effects on wages that reduced class sizes will have (Krueger 1999: 525).

Although class sizes have been decreasing for decades, there has not been an equivalent increase in achievement. One explanation is that teachers do not change their methods of teaching when they have a larger class. What is really important is hiring teachers who use effective methods, and they will use these methods whether their classroom has 20 children or 30. Decreasing class size is not only an expensive policy, it also requires hiring many new teachers, most of whom will be inexperienced and possibly less effective. It may also decrease the equity of education because the increased number of positions will allow more experienced teachers to leave poor school districts in favor of better schools. Therefore, some researchers believe we should be skeptical about reducing class size and should invest educational funding in improving the quality of teachers (Finn & Petrilli 1998: 27).

The effects of a reduction in class size depend on teacher quality. Hanushek concurs that inexperienced teachers are less effective, noting that new teachers lower achievement growth of their students by 0.12-0.16 standard deviations from the mean, holding teacher quality constant. After the first year of teaching, most of these negative

effects disappear, but it does create interesting policy implications. While only seven percent of white students are taught by first-year teachers, this figure is twelve percent for black and Hispanic students, which creates equity concerns (Hanushek et al. 2005: 29). Although an overall reduction in class sizes would not hurt students, the extent to which it would help depends on the quality of the newly hired teachers. Also, reducing class size leaves less funding for other policies that might be more effective (Hanushek 1999: 163).

Schools with good reputations are often ones that enroll good students, not necessarily schools that add substantial educative value to their students. In order to improve teacher quality and verify the quality of existing teachers, Hanushek recommends using output-based rewards. These performance incentives would ensure that teachers and administrators are not simply promoted due to experience, but due to their pupils' educational gains (Hanushek 2003: F92-F94).

CONCLUSION

Although there is conclusive evidence that different schools and teachers have different impacts on students, and that school resources interact with the students' background characteristics, decades of study have not clarified which characteristics are important for whom (Hanushek 1979: 377). Future earnings and mandatory exams are unbiased measures of the many outputs of education. Teacher experience, the amount that parents and the community are willing to invest in their children, and school resources have a positive effect on students, but there is still a debate over exactly which resources and how much investment are necessary. There is also debate about which teacher qualities are the most important. Two teachers with seemingly identical

qualifications and similar students may not be equally effective because of unmeasured personality characteristics. Also, although family resources have a major effect on children's future earnings, they must be controlled for in order to accurately understand the results of education production function research. This is because parental wealth influences school resources through the local taxes that fund their children's schools. Even though economists may agree that simply increasing school budgets will not improve the education system, the final say in the debate lies in the voting booth (Dewey et al. 2000: 27). The next chapter will put research reviewed in the previous chapters into the context of one region's debate over its high school.

Chapter 4: Wachusett Regional High School

BACKGROUND

In 1998, the residents of Wachusett Regional School District, in central Massachusetts, became concerned about the state of their regional high school, the oldest in the state. The "Mountaineers" hail from the towns Holden, Paxton, Princeton, Rutland, and Sterling, and the district covers 155 square miles, the largest area of any region in Massachusetts (Leith, 2005). At the time, the original building dated back more than 40 years, to 1954, and people had concerns about the antiquated facility. In October of 1998, the Wachusett Regional Building Committee voted 20-2 to build two new high schools in the region, one in Holden and another in an undetermined location. The committee believed that this would be a cheaper alternative to attempting to renovate the 46 year old building (Lehans 1998: 1).

The committee members saw the benefits of two brand-new schools for grades 9-12 in the region, but when the voters went to the polls in mid-December, they trounced the idea of building a 1300-student school in Holden and an 800-student "Wachusett North" in Princeton or Sterling. Sentimentality and tradition undoubtedly had an impact on the voters, who overwhelmingly defeated the proposal in every town except Sterling (Keogh 1998: 1, 32). And so began four years of controversy, public debates, and heated editorials in the region's newspaper, *The Landmark*.

The previous chapters of this thesis have outlined the rationale behind education policy: research findings on economies of scale, why we educate our youth, and the important inputs and outputs of education. But when citizens step into the voting booth, or speak out at a town meeting, overall cost and efficiency are not the only factors they consider. Residents of Holden, Paxton, Princeton, Rutland, and Sterling had been coming together and producing high test scores and winning athletic teams, as well as friendships and connections, for almost fifty years. Students and teachers had suffered together through the oil embargo, when students' hands were so cold that they wore mittens during class, and a severe space crunch, when study hall was held in the auditorium. They had rejoiced over state champion sports teams and the Grammy-winning music department. Some teachers have instructed two generations of young Mountaineers (Jacquith, 2006).

These factors could not be denied by voters, especially after reading Patrick Sarkisian's editorial in the Oct. 3rd, 2002 edition of *The Landmark*. He quoted a message from the 1960 Wachusett Regional School District Committee which stated "It seems to us the entire history of the Wachusett School District is not a case of their saying it could not be done but of our doing it…They will say 'It can't be done,' but the citizens of the district will reply, 'But we will do it.'" (Sarkisian 2002: 6). After four years of bickering over cost, tradition, educational quality, and taxes, the towns reached a final decision in November of 2002: Wachusett Regional High School would be renovated and remain the sole secondary school in the district (Lehans 2002: 1).

This decision was not based solely on sentimentality. As we will see throughout this chapter, people had varying reasons to vote for this proposal: it was the cheapest

estimate, offered the greatest variety of classes and extra-curriculars, and, for people who were concerned about the lengthy process, it was the proposal that seemed most likely to pass.

OPTIONS

Although the debate in the region was basically about the merits of one high school or two, there were many different options throughout the years. In the fall of 1998, the School Building Committee decided that it was in the region's best interest to split in two. They voted 20-2 to build two new high schools in the region. At the time their rough cost estimates led them to believe that building new would be less expensive than renovating the 46-year-old building. The committee's decision to split the growing region into two different high schools was most likely influenced by the educational trend of reducing the size of schools.

Districts were originally consolidated throughout the United States in order to take advantage of supposed economies of scale in education. However, as we have seen, the evidence on economies of scale is inconclusive. Although many studies have found economies of scale, these studies did not often take into account the quality of education that students receive in these size-efficient districts. More recent research suggests that academic achievement decreases in large schools, and it is important to find the balancing point between an economically efficient high school and one that provides a quality education (Andrews 2002: 255). One major diseconomy of scale for schools that cover a large physical area, such as Wachusett Regional High School, comes about through transportation. The cost of busing students almost 20 miles to and from school is an increasing concern for citizens of the region. Students in Sterling travel as much as half

an hour to get to school in the morning (Leith, 2005) time they probably feel would be better spent sleeping. The cost of transportation exists not only as the physical cost of gas, buses, and cars, but the opportunity cost of children and their parents for the time they spend commuting to the school (Monk 1990, 404).

Another justified reason to split the region into two high schools is the literature that finds that fewer students identify with larger schools. This is important because children's attitudes toward their education greatly affect their academic achievement. Another negative aspect of larger schools is that more adolescents in one building generally lead to more disciplinary problems and violence (Lee & Smith 1997: 208). In the wake of school shootings, and especially the tragedy at Columbine High School in 1999, the threat of violence in schools became a major concern for parents. One active advocate for two schools told me, "Columbine-like tragedies happen predominantly in larger schools" (Lowenthal, 2005).

The first vote on Wachusett Regional High School was on December 15, 1998. Voters were asked to cast ballots approving $2.5 mil for design fees to build a 1,300-student school at the current site and an 800-student "Wachusett North" at another location. The plan did not include cost estimates or an exact location for the second high school (Keogh 1998: 1, 32). This vote failed miserably, even in Princeton and Sterling, towns that would later turn into 2-school supporters. The average voter approval was 23% (Lehans 2001: 1, 26).

Voters were most likely responding to many different factors when they turned down this two-school proposal. Duncan Leith, a parent and long-time school committee member, told me that WRHS is viewed as a good school by parents and students of the

region. Its variety of academic, athletic, and co-curricular achievements would be hard to equal in a smaller school. The advanced placement, criminal justice, early childhood, music, and special education curriculums at WRHS are all considered outstanding, and parents did not want to lose this variety of opportunities for their children (Leith, 2005). It is hard to imagine that a school with 800 students could effectively run 39 extracurricular clubs and activities and 25 varsity sports teams (www.wrsd.net). In the spring of 1998, 10th grade students at WRHS had scored higher than the average state score in all three subject areas of the state-wide standardized tests, with a higher percentage in the "advanced" categories than the average state percentage (Mass. Dept. of Edu: Test Results).

A major reason for rejecting the two-school proposal, according to John Kilcoyne, a concerned citizen in support of two schools, was the fear of the unknown (Kilcoyne, 2006). The uncertainties about cost and location scared some people into voting for what they were accustomed to: one high school. Dr. Pandiscio, then the high school principal and now the region's superintendent, admits that the regional staff never put much time into formulating a viable two school option. The regional office found that there was no saleable option for a two-school model: if you had one large school and one small school, like the Dec. 15, 1998 vote, the large school would still need to be separated into houses, and the only feasible way to split the region into two equal schools was to split up the town of Holden, which parents would not approve. For these reasons, the central office focused their staff time on different regional high school options. The parents who proposed various two-school options were unable to afford the consultants and lawyers that would have validated their plans (Pandiscio, 2006).

The second vote took place in special town meetings on April 8 and 10, 2000. This vote was to approve building one new school on the current site, plus buying adjacent land for new fields, parking lots, and future expansions. Holden, Paxton, and Rutland strongly agreed with this plan, but the regional average was dragged down by Princeton and Sterling, voting only 31 and 43 percent in favor of the plan, respectively. The average for this vote was 64%, not quite the 2/3 majority needed to approve the plan. The school board proposed the same plan in a ballot vote on June 7th of the same year and it lost ground in every town but Princeton, earning 62% of the overall votes (Lehans 2001: 1, 26).

On December 19, 2000, voters were asked to hire architects to design a new school or a renovated high school, and spend a non-refundable $695,000 to buy 22 adjacent acres to the high school. This vote failed by one-tenth of one percent, less than a dozen votes. After this crushing defeat, the price tag of the high school continued to escalate, further incensing voters (Lehans 2001: 1, 2). Residents again voted down a plan to buy the adjacent land and build a new high school for $81,695,000 on April 5, 2001 (Lehans 2001: 1, 26).

It is not always easy to get five different towns to agree on what is best for their children, even when that would mean voting for more autonomy in making those decisions. Wachusett is the only district in the state that requires a 2/3 majority for votes involving construction and funding. Although the towns were often frustratingly close to this magic number, they did not reach it until the fall of 2002 (Leith, 2005). The final proposals were for a renovation/addition of the current 2100-student Wachusett at a cost of $70.5 million or one 1,525-student school for Holden, Paxton, and Rutland and one

575-student school for Princeton and Sterling, at a cost of $80 million (Lehans 2002: 1,30). This fifth vote finally won a two-thirds majority with the region's voters. Princeton selectmen had refused to schedule a town meeting on November 16th, but the other four towns approved the one-school option with such a majority that four towns were enough to pass the vote. Voters could vote to approve one, both, or neither plan, so the final figures were 81.7% in favor of one school and 25.9% in favor of two schools (Lehans 2002: 1, 28). Princeton finally gave their support to the one-school project on December 19, 2002, with a vote of 284-100. This vote brought the district-wide average to 80.7%, and finally allowed the region to move on and begin renovating WRHS (Booth 2002: 1, 9).

The final design plan for the renovated Wachusett includes Lower and Upper Houses that will separate the ninth and tenth graders from the eleventh and twelfth graders. With this system, freshmen will be randomly assigned to one of two Lower Houses of about 500 students each. They will attend freshman seminars and become oriented with Wachusett. Students will stay in their house for English, math, social studies, science and foreign language during ninth and tenth grade. Teachers will be assigned to a house and stay there to ensure that each one is a cohesive unit. For special interest classes, like music or art, and courses that need special equipment, like physical or technical education, students will leave their house and go to the appropriate area of the school. In the spring of sophomore year, every student in Massachusetts must take the Massachusetts Comprehensive Assessment System test, which determines whether they will be able to graduate high school. These tests are an important part of the

education system in Massachusetts, and will be a major focus of the Lower Houses (Pandiscio, 2006).

The Upper House for eleventh and twelfth graders will remain organized around departments, like WRHS is today. Every student will be on track to pursue some form of higher education. For students planning on attending a four-year college, there will be graduation requirements similar to the general education requirements of liberal arts colleges, with students taking an active role in planning their education. For those planning on attending a two-year or technical school, there will be about twelve different technical preparation programs, including criminal justice and culinary arts, where students will learn useful skills as well as fulfilling graduation requirements (Pandiscio, 2006).

The compromise of separating the school into houses was an important one for many two-school supporters, because houses enable a large school like Wachusett to keep a small-school feel. David Lowenthal told me that it was the right idea, but that he wishes the "cottages" of the first two years were going to be real houses for the entire high school (Lowenthal, 2005). One-school supporters point to the variety of peers from all five towns that children are able to meet through one large high school as an argument in favor of integrating everyone once they reach junior year (Leith, 2005).

DID THEY MAKE THE RIGHT CHOICE?

FOLLOWED THE LITERATURE

In some areas, the voters of the Wachusett Regional School District (perhaps unknowingly) followed the educational research. Larger schools do not have to worry

about small fluctuations in population size because large numbers make these fluctuations less problematic in the long run (Monk 1990: 394-397). Economies of scale exist in public education because it is cheaper to buy supplies and technical equipment in bulk (Lee & Smith 1997:207; Andrews 2002: 247). As schools grow, teachers are able to focus on their specializations and students are able to be grouped with other students who have the same interests and needs; this increases efficiency (Monk 1990: 399-400; Lee & Smith 1997: 207). Many parents of the district value the specialized curriculum at WRHS. Voters knew that one large school would be more able to hire expert teachers and run specialized programs and advanced courses (Leith, 2005). There are currently nineteen Advanced Placement courses offered at the high school (www.wrsd.net/highschool). Also, the number of schools within a district has a negative effect on resource allocation due to increased bureaucracy (Fowler & Walberg 1991: 200), which many voters in WRSD disapproved of and which led them to vote for one high school (Leith, 2005).

The final plan for the high school included a house system, which is also highly recommended by many academic researchers. The Carnegie Foundation recommends breaking large high schools into smaller learning communities in order to engage students in their academic environment and bring the benefits of a small school to a large one (Jackson 2000: 123-124). At the new WRHS, students will be able to reap the benefits of small schools – academic achievement, a sense of belonging, and higher participation and attendance – as well as those of a larger school – specialized teachers and a wide variety of courses and extra-curricular activities – all in the same building. Lee & Smith think it is important that houses are a cross-section of the student population and are not used to

put students on a track (Lee & Smith 1997: 220). They also report that houses are especially important for freshmen and sophomores (Lee & Smith 1995: 263). The plans for the new high school follow this advice.

STRAYED FROM THE LITERATURE

However, some researchers view houses as an imperfect solution to the problems posed by large schools. Such research suggests that children should attend small high schools of 600-900 students whenever possible (Lowenthal, 2005). Simply put, many educational experts find that "smaller is better" (Jackson 2000: 123). Although some voters in the region were willing to follow this advice, they were not nearly numerous enough to influence the majority's opinion.

The increased transportation costs that occur in larger schools, and certainly in the WRSD, can offset the cost savings associated with larger districts (Andrews 2002: 251). This is one area where the voters certainly strayed from the educational literature. Busing kids across the 155 square mile district is more expensive than splitting the district in two and only transporting kids half the distance. However, the district has the option of open enrollment: a child can attend any school in the district s/he would like, provided the parent can provide transportation. This means that parents living in Princeton or Sterling who wanted their children to attend a large high school would be able to send them to Wachusett if they could drive them there, regardless of the result of the vote. In these instances, the parents' transportation cost would actually be decreased by voting for one large high school because they would be able to put their kid on a bus instead of driving them all the way to Holden every day. These parents had an incentive to increase the transportation costs of the district in order to decrease their own personal

opportunity cost. For those living in Holden, Paxton, or Rutland who wanted their children to attend a small high school, neither of the proposed plans were in their best interest. Whether the region voted for two schools or one, their children would still be attending a large Wachusett in Holden. If the region voted for two schools and these parents opted to send their children to Wachusett North in Princeton/Sterling, they would have large transportation costs because they would be responsible for driving them to and from school every day.

The voters of the region also strayed from the literature in an interesting way: the proposed houses are actually smaller than the researchers' ideal size. The lower houses will each include roughly 500 students (Pandiscio, 2006), but research shows that houses with fewer than 600 students can actually be detrimental to their education (Lee and Smith 1997: 220). Hopefully this finding will be offset by the ability of students in the Lower Houses of WRHS to take electives outside of their house.

Another controversial issue in educational research concerns tracking. For many years, educators believed that putting students with others of the same ability would improve their academic performance. However, some researchers are now finding that this practice not only does not increase academic achievement, it also decreases equity in the schools. Schools with more diverse programs, like Wachusett, are actually less likely to provide an equitable education to all their students. In smaller schools, the focus of the curriculum is on basic academic courses that everyone must take. Larger schools are able to offer a more diverse set of programs, which allows kids who are not interested in the core academic subjects to take elective courses. This means that kids who are not academically strong will not be encouraged to take those classes, and their academic

achievement will decrease (Oakes 2005:111-112). Although some classes at WRHS, such as physical education, incorporate children from every academic background, the core subjects are organized in levels. If students earn proper grades and their guidance counselors agree, they can move up or down a level in any subject, but it is definitely a form of the tracking that Jeannie Oakes argues should be eliminated from the educational system. This organizational form will continue in both the Lower and Upper Houses after the renovation/addition. In the Upper House of WRHS, kids will be put on a track according to their future plans, and there is a possibility that those who choose to pursue a special program such as early childhood education will actually receive a lower quality education than their peers on the four-year college track taking Advanced Placement courses.

WACHUSETT-SPECIFIC

As we have seen in previous chapters, the size of the school and the curriculum offered are not the only factors that determine the quality of education students will receive. Every school in every community is slightly different. Fowler & Walberg found that it is very important for students to identify with their school, feel a sense of belonging, and participate in school activities. Parents and students are both more likely to participate in school events when the school is small (Fowler & Walberg 1991: 191). Since schools are social institutions with goals in mind, they construct an image of the ideal student who will fulfill these goals. Children who fit this image will identify with the school and put in more effort than those who do not identify with this image of the ideal student. This has been a serious problem for minority students, who may find it

harder to fit this ideal image and will therefore exert less effort to be a model student (Akerlof & Kranton 2002: 1169).

The Wachusett region currently includes 6,997 students; there are 1,872 at the high school. On average, the district has some educational advantages over the state. For example, 14% of the state's students do not use English as their first language, compared to 2.4% of the Wachusett District and 2.6% of the high school. Only 3.7% of students in the region come from low-income families; the state average is 27.7%. During the 2003-2004 school year, 100% of classrooms in both the high school and the district had internet access, compared to the state average of 95.5%. At WRHS, 98.1% of core academic teachers are classified as "highly qualified", while the state average is only 93%. The 9-12 drop out rate is lower than the state average. However, the school's attendance rate is slightly lower than the state average and the student/teacher ratio is 15.3 to 1, compared to the state average of 13.3 to 1. The district regularly spends less per pupil than the state average for regular day programs, but equals or exceeds the state average in per pupil expenditures for special education. Teachers in the district make more than the state average salary. Another important factor of WRHS is its homogeneous student population, which makes it easier for the vast majority of students to identify with the school. The state is 74.2% white, but the school has 95.1% white students. The highest minority population is Asian, and that is only 2% of the school's population (Mass Dept Edu: Enrollment/Indicators). The median household income ranges from $62,846 to $80,993 throughout the five towns of the regions, well above Massachusetts' median household income of $50,502. The population over 25 years (and therefore the parents and voters of the region) are also more likely to have graduated

from high school: from 91.7% to 97.7% have high school degrees compared to the national average of 80.4% (factfinder.census.gov). These citizens value education and have the means to fund their public schools.

Throughout this paper, it has been clear that educational researchers do not agree about much. However, there is a general consensus that more qualified and experienced teachers are more effective, more resources help, and that it is important to keep the community, student body, and parents involved in the school (Dewey et al. 2000: 27). According to the Massachusetts Department of Education, WRHS has a higher than average percentage of "highly qualified" teachers. However, researchers have not yet decided what exactly makes a good teacher. Their salaries, which are one indication of teacher quality and qualification, are higher than the state average. The student/teacher ratio is higher than the state average, but still low. The per pupil expenditure of the region is slightly less than the state average, but the amount of money you pour into schools is not as important as how you invest that money (Dewey et al. 2000: 42).

Another important consideration for voters of the region is that it is a suburban/rural area. The highest population density is 2298 people per square mile (parts of Holden) and the lowest is 67 people per square mile in parts of Princeton (factfinder.census.gov). Hal Lane, the principal at Wachusett for many years, said that he would never build a school for 2,000 students in Worcester (the nearest urban area). However, since WRSD has such a long history of academic excellence in a suburban community, Mr. Lane recommended one new school (Lehans 2001: 18).

Although the population of WRHS is fairly homogeneous, the diversified curriculum is supposed to allow everyone to find their niche. The general feeling at

WRHS is that most kids find a way to identify with the school. Perhaps this feeling comes from the long history of five towns coming together to form one school (Schakenbach, 2006).

MY OPINION

Every school is unique; Wachusett is no different. Given the options, I think that the voters of the Wachusett Regional School District made the right decision. The two-school plan included one small school of 800 students and one larger school of 1300 students, and educational research would suggest that the larger school should be split into smaller units. Since the larger school would be organized into houses either way, it is more equitable for all students in the district to be able to enjoy the benefits of both smaller and larger schools.

The house system for ninth and tenth grades is indispensable to the new high school plan. It will allow new students to slowly adjust to the big school, enable them to build strong relationships with teachers and fellow students, and give them the benefits of a wide array of elective classes. In the later grades, children will benefit from having specialized teachers in all disciplines. Of course, all students will benefit from a wide array of extra-curricular activities, which will help students identify with Wachusett and be happy to be there.

One school will also reduce administrative costs. Some of these costs may be offset by the increased transportation costs the region will incur with the one larger school. However, for the roughly one third of parents from Princeton and Sterling who did not want their children to attend a small high school, transportation costs are actually smaller in the one-school plan because the district will provide transportation.

My main problem with the decision is that it took so long. It took six votes over four years to come to the least drastic conclusion available: renovate and add on to the old high school. If they had decided sooner, the students could already be in one brand new facility, which I think would have been the best possible option for WRSD. The only benefit to waiting so long is that they have saved $10.4 million in interest because the district is being reimbursed by Massachusetts' School Building Assistance office eight years earlier than expected (Kilcoyne, 2006; Lehans 2005: 1). The students of Wachusett will soon be receiving a long-deserved new high school. And the voters of the region will get their wishes, which is what every educational dispute ultimately comes down to. From Patrick Sarkisian '60, to myself '02, and beyond, students of WRHS have a strong attachment to the school; this loyalty has built a community who believes in the educational prowess of their high school.

Conclusion

This study joins hundreds of others on the importance of education and the best ways to provide it for the youth of the world. After reviewing the literature and studying the problems facing one school district in Massachusetts, it has become clear to me that the only unambiguous aspect of education is that the voters will have the final say. Most people seem to agree that educating children produces many benefits, but teaching is still considered to be as much of an art as it is a profession. Researchers are still debating the existence and importance of economies of scale. The numerous outputs of education have not all been quantified. And very few people agree on which inputs to education are the most important.

Education has long-term economic and social effects other than an increased cognitive ability. The clearest measure of the effectiveness of education is the increased wages that people earn after additional years of schooling, but education affects more than just the individual. One of the reasons that the government is willing to invest in educating children is the macro-level effects that education has, such as increasing productivity and the GDP (Krueger & Lindahl 2001: 1101).

One of the complications of any study about the effects of education is that the outputs to the educational process are so varied. The government is also concerned with producing literate citizens to participate in the democratic process (Monk 1990: 270-274).

There are many other social outcomes of educating children, including decreased poverty, improved health, and smarter familial decisions later in life (Stacey 1987: 55-57). Due to their socializing and supervisory roles, schools have been found to decrease crime and welfare dependency (Krueger & Lindahl 2001: 1130), which have positive effects on the community. School is also the primary location for the transmission of cultural capital (Apple 1990: 43-60). Researchers tend to focus on the outputs of academic achievement and labor market success. They measure these using proxies such as standardized test scores, student attitudes, attendance, drop-out rates, college continuance, or future wages. However, the socialization goals of schools are often left unmeasured (Hanushek 1979: 355-356).

The education production function measures how certain inputs to the educational process produce the aforementioned outcomes of education. These inputs include factors found both at school and at home. Schools provide the two basic inputs to education: labor and capital (Hanushek 1979: 363). One of the characteristics of labor that has consistently made a difference is that more experienced teachers are more effective. Teacher quality and school resources also affect education, but researchers have not yet figured out exactly how to measure teacher quality or which school resources are most important (Dewey et al. 2000: 27). Research is also inconclusive regarding familial inputs to education, but most experts agree that parental participation and family background are important determinants of a child's academic achievement (Dewey et al. 2000: 27). Socioeconomic status is the most important familial characteristic to influence a child's academic achievement (Hart & Risley 1995: 53-74). Other important inputs are students' innate abilities and their peers (Hanushek 1979: 363).

Researchers use various theories to explain the educational process. These include the economic model, the human capital theory, the role model theory, the heterogeneous income model, the working mother hypothesis, and the social capital theory. These varied theories demonstrate that economists, sociologists, and educators all have different ideas about the way education works.

One of the major decisions facing policy makers is determining the ideal high school size for producing education. Although economies of scale exist, policy makers must look at both the cost equation and the quality of the students' education. There are benefits to both small and large schools, so finding the right enrollment for a certain area is a balancing act.

Economies of scale in education are often underestimated because the by-products of education, such as its socializing benefits, are hard to measure (Monk 1990: 397). In larger schools, the administrative costs are shared by more students, and supplies can be purchased in bulk, decreasing the cost per unit (Andrews et al. 2002: 247). Per pupil capital expenditures have also been shown to decrease with larger enrollments (Fox 1981: 292). In larger high schools, teachers are able to focus on their specialty, which increases their productivity (Monk 1990: 399-401). Large schools are able to offer something for everyone because there are more students at any given ability level (Oakes 2005: 21), which is something that parents in the Wachusett Regional School District were anxious to offer their children.

However, small schools also have advantages, and have been found to offer competitive curriculums (Fowler & Walberg 1991: 200). One advantage of small schools is their lower transportation cost (Andrews et al. 2002: 251). The cost of busing students

throughout a physically large district is something WRHS will have to deal with. Some of the factors that make small schools attractive are not related to prices. Small schools have fewer safety problems and lower drop-out rates (Jackson 2000: 123-124). The specialization that attracts parents and policy makers to large schools can also lead to scheduling and administrative problems (Monk 1990: 401-402). Small high schools are also more equitable because students are more likely to all follow the same curriculum. Children who go to smaller schools are more likely to identify with their school (Lee & Smith 1997: 208, 217) and parents participate more when their children attend smaller schools (Andrews et al. 2002: 247). Of course, these generalizations do not apply to all high schools, as WRHS, a large high school, has a low drop-out rate and a strong sense of school spirit.

A compromise between small and large high schools is the concept of splitting high schools with large enrollments into houses. These houses enable students to be engaged in a smaller learning community while receiving the resources available to large schools. Houses are a way for large schools to achieve what many researchers believe to be the ideal high school size: 600-900 students (Lee & Smith 1997: 207).

Breaking into houses is the approach that WRHS took to solving its size dilemma. Due to long-term community ties, the voters did not want to split up the region. However, residents and administrators were afraid that the high school had become too large. Their solution was to maintain one high school but split the 9th and 10th graders into two Lower Houses so they would be able to slowly become acclimated to their new environment while still receiving the benefits of specialized teachers and facilities (Pandiscio, 2006).

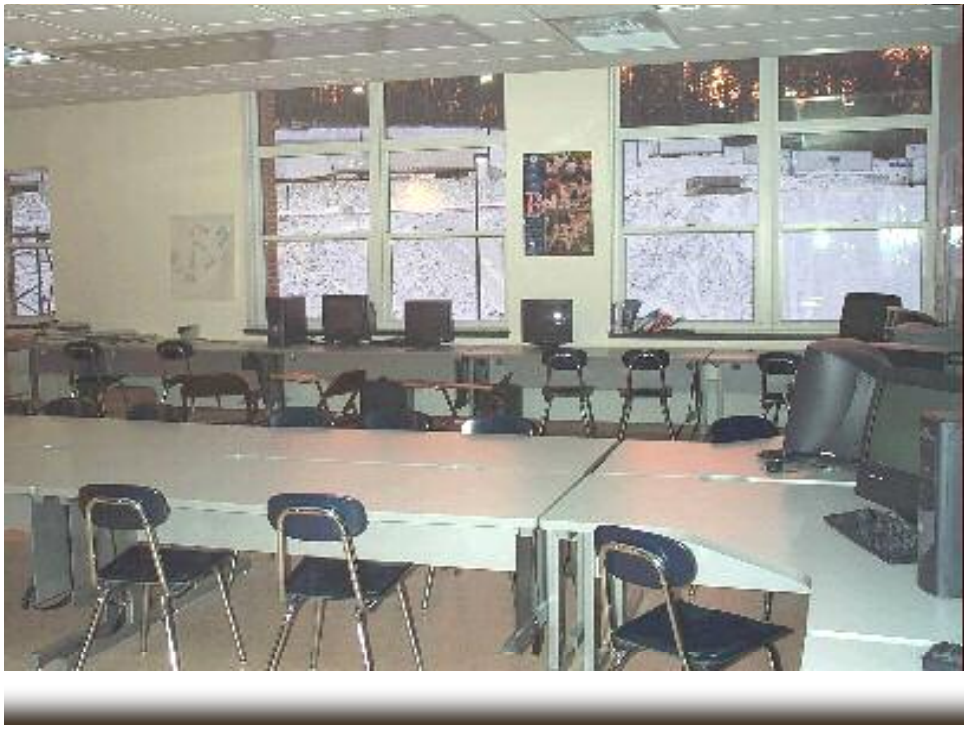
Hopefully, the transportation, administrative, and safety costs will not exceed the money WRSD is saving by keeping its high school regionalized. It will also be important for WRHS to strive toward providing an equitable education for all its students. The region must continue to put resources into the high school and to hire experienced, high quality teachers if parents expect continued academic success. If they can control these factors, based on my research I believe that the residents of Holden, Paxton, Princeton, Rutland, and Sterling made the right decision when they kept one high school but split it into Lower and Upper Houses. As Lindsay Schakenbach, class of 2002 and a future high school teacher, told me, "I will defend Wachusett over any small school any day." (Schakenbach, 2006).

Appendix: Photographs of WRHS

(http://www.wrsd.net/WRHSBC.htm)

Before Renovation

Looking North



A New Classroom

The New Field House

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