Effects of School Size: A Review of the Literature with Recommendations

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Abstract

In this article the literature on the effects of school size is summarized to describe what is currently known about its relationship to economic efficiency, curricular diversity, academic achievement, and related variables. Two curvilinear relationships are identified: one for economic efficiency and one for educational outcomes. In both cases, increasing size initially brings positive effects but these trends are reversed as size continues to increase. The point of diminishing returns for educational outcomes occurs with fewer students than is the case for economic efficiency. Optimal school size can be defined by a range in which economic efficiency and educational outcomes both show positive relationships to larger school size. Recommendations are made to guide future research and to help educational decision-makers.

Effects of School Size: A Review of the Literature with Recommendations

For many years school consolidation was a popular approach to school reform among many legislators and school board members (Walberg, 1992), but enthusiasm for consolidation seemed to be waning in the 1980s (Guthrie & Reed, 1986). Current economic pressures on state governments, however, appear to be reviving interest in school consolidation. For example, the governor of Arkansas recently proposed an extensive reform plan that would reduce the number of school districts in the state from 310 to between 107 and 116 (Blomeley, 2003). In addition, rising enrollments are projected for the early part of this century (National Center for Educational Statistics, 1998) which should continue to strain educational budget and, thereby, create increased pressure toward consolidation as states seek greater economic efficiency.

Proponents of school consolidation have based their recommendations on two major claims: greater economic efficiency and increased curricular offerings (Fox , 1981; Walberg, 1992). In spite of the face validity of school consolidation as a solution for educational problems, the research on school size indicates that the economic and curricular advantages of large schools are often exaggerated and that a variety of factors influence the relationship between school size and students' academic achievement. Thus, educational decision-makers need to develop reform plans based upon a balanced consideration of all the important factors related to school size. In this paper, we provide an overview of the most important research on school size and a list of recommendations to help both researchers and local school officials in their consideration of this issue.

Before proceeding to the review, two caveats are in order. First, as is often true of studies conducted in schools, studies of school size are fraught with methodological problems. In most instances experimental designs with random assignment of students to schools of various size is not possible. As a result, decisions about the effects of school size must be based on the preponderance of the evidence, rather than on the basis of definitive studies. This approach to decision-making is based on the assumption that the strengths of some studies will ultimately compensate for the weaknesses in other studies and vice versa. As a result, our purpose in writing this paper is not to perform a critical analysis of individual studies. Rather, our purpose is to identify the general trends and concerns in the current literature on school size that are relevant to educational decision-making.

The second caveat is that school size per se is not a direct causal factor affecting school quality. Rather, school size is indirectly related to academic outcomes through its relationship to a variety of other variables. As a result, the relationship between school size and various indicators of school size is likely to be very complex. Unfortunately, sophisticated studies addressing complex relationship are currently lacking in the literature. Academic decision-makers, therefore, must guard against making simple decisions based upon studies relating only one, or a few, mediating variables to a limited number of outcome measures. Appropriate decisions must involve complex consideration of all relevant variables and with awareness of Monk and Haller's (1993) caveat that size affects different schools in different ways.

Economic Efficiency

<u>Business Model: Economies of Scale</u>

One common assumption In the business world is that larger organizations can operate more efficiently than can smaller organization so that increasing size decreases per unit costs (Jewell, 1989). The term *economies of scale* is used to refer to this concept. When applied to schools, this reasoning implies that larger schools will be more cost effective than are smaller schools (Mullins, 1973; Sybouts & Bartling, 1988). Advocates of consolidation have argued that the ideal high school should have between 1000 and 2000 students because schools with fewer than 1000 students are unable to purchase in quantity and have high per pupil administrative costs (Fox, 1981).

Unfortunately, the assumption on which the economies of scale argument is based may not be true even for businesses. Gooding and Wagner (1985) conducted a meta-analysis of 31 studies of the relationship between organizational size and economic efficiency. Though overall production was positively correlated with greater size, per unit cost did not necessarily improve with organization size. That is, increasing the size of a business increased total output but the ratio of output to input typically remained the same. Gooding and Wagner (1985) attributed this to counteracting diseconomies that occur when the size of an organization is increased. These costs, which include coordination costs and the need for an increased workforce, can offset the production efficiencies produced by increased size. Furthermore, in labor-intensive service organizations such as county governments Gooding and Wagner (1985) actually found a negative relationship between size and efficiency. In other words, when productivity depended

primarily upon human effort rather than machinery, increasing size tended to decreased economic efficiency.

Opponents for school consolidation have argued that the findings of Gooding and Wagner (1985) in the business world will generalize to schools (Walberg & Walberg, 1994). For example, McKenzie (1983) and Haller (1992) argued that additional administrative costs in large schools can undermine economies of scale just as they do in the business world. In fact, if schools follow the same pattern as other labor intensive organizations, creating larger schools would decrease in economic efficiency. In research supporting this assumption, Meier (1996) found that having more than 20 teachers in a group caused loss of attention and lack of participation in governance. In addition, educational and fiscal accountability were more likely in smaller faculties because teachers and administrators were more visible and organization could be kept simpler. Similarly, Gregory (1992) argued that a school staff quickly reaches a point of being too large. He asserted that the point of diminishing returns is reached when faculty size exceeds 12 teachers.

Research on Economies of Scale in Schools
Given that arguments can be made both for an against the economies of scale in schools, educational decision-makers must ignore argument based in common sense and examine the actual empirical literature. Early research was generally supportive of the assumption that the economies of scale operate in favor of larger schools. For example, Morris (1964) found that high schools with fewer than 500 students paid higher per student costs than did larger schools. Similarly, McGuffey and Brown (1978) related school size to the operational cost of facilities utilization. They found that larger schools had higher facilities utilization and experienced lower operational costs per student than did smaller schools.

Support for the economies of scale, however, has not been universal. Monk (1987) found that after school enrollment reached 400 students, no benefit was realized from the economies of scale. Turner and Thrasher (1970) studied schools with a wide range of enrollments including schools with more than 3000. They found that decreases in cost per student were minimal once enrollments passed 1000 students. Most important, however, was Fox's (1981) finding that cost curves actually take the shape of a U, so that increasing school size beyond an optimal level increases rather than decreases per pupil cost. Thus, schools are similar to the other labor intensive organizations studied by Gooding and Wagner (1985) in that increased size can result in increases in per unit costs.

Following Fox's (1981) finding, a number of researchers have explored the causes of this U-shape relationship between school size and per pupil cost. Monk (1992) found that savings projected for a number of expenses simply did not occur with large school size. For example, savings for central office administrative staff were not realized because that category represented such a small proportion of the overall system budget. Fox (1981) noted that as long as increasing school size results in larger pupil/teacher ratios, per pupil expenditures will drop. Once maximum class size is reached, however, no additional savings are possible, but continued increases in school size will continue to increase administrative costs. That is the need for additional administrative staff continues to grow with increased school size even after maximum

student-teacher ratios are reached (Haller, 1992; McKenzie, 1983). Thus, both very small schools and very large schools tend to be very expensive to operate (Alspaugh, 1994). McGuire (1989) concluded that schools with an enrollment above 2000 students were located on the upward slope of the cost curve and that their combination of teaching personnel and course offerings could be made available in a smaller and more economical setting. Finally, Fox (1980; 1981) noted that population density is an important factor. Creating large schools in rural areas with low population densities can greatly increase the cost of transporting students whereas such additional cost may not be incurred in urban areas.

Thus, the assumption that larger schools are more economically efficient than are smaller schools has considerable face validity, but this conclusion is overly simplistic. In deciding whether or not school consolidation is advisable, factors such as class size, administrative costs, and transportation costs must be considered. When school size is considered in isolation, schools between 500 and 1,000 students are probably operating at peak economic efficiency already (Turner & Thrasher, 1970). Thus, with regard to economies of scale, current research does not support school consolidation of schools that already have 500 or more students. Nor does this literature support consolidation that would result in a school of more than 1000 students. Before consolidating schools with fewer than 500 students, educational decision-makers need to consider additional factors such as transportation costs in determining the likely cost effectiveness of this action.

Curricular Diversity

The second major rationale for school consolidation is that it increases curricular comprehensiveness and diversity (Jackson, 1966; Howley, 1997; Roellke, 1996; Unks, 1989). That is, educational decision-makers who favor consolidation often argue that large schools can offer a broader range of courses, including more advanced courses, than can small schools.

Conant (1959, 1967) studied high schools in 18 states to determine whether secondary schools could simultaneously provide a quality general education for all students, courses for college preparation for students seeking higher education following high school graduation, and vocational courses for students seeking employment following high school graduation. He concluded that small high schools could provide this type of comprehensive education only at great expense. Thus, he recommended consolidation of schools with graduating classes of less than 100 students (i.e, four-year high schools with fewer than 400 students). Similarly, Jackson (1966) found that large schools had a significantly more varied curriculum than did small schools. Walberg and Walberg (1994), studied National Assessment of Educational Progress data from 38 states, and concluded that smaller school districts were less likely to offer a wide variety of specialized courses.

On the other hand, Barker and Gump (1964) collected data in secondary schools ranging in size from 35 to 2287 students. They found that increases in school size did not necessarily translate into large increases in curricular programming. The largest schools had 65 times as many students as did the smaller schools but offered only twice as many courses. In addition, they found that much of the material covered in specialized courses at large schools was also

being taught within regular courses at small schools. Similarly, Pittman and Haughwout (1987) reported that a 100% increase in enrollment corresponded to only a 17% increase in curricular offerings. Monk (1987) found that increases in school sizes were associated with more varied course offering, but only up to 400 students. Increasing enrollment over 400 students generally did not enrich the curriculum greatly, and Turner and Thrasher (1970) found that programs in schools with as few as 500 students were sometimes as comprehensive as were the programs in schools serving 3000 or more students, The results of several additional studies have documented the adequacy of an enrollment of 400 students (Forbes, Fortune, & Packard, 1993; Fowler & Walberg, 1991; Howley, 1994; Monk, 1992). In other words, large school will have additional sections of courses to accommodate the greater number of students, but do not necessarily add a variety of new courses simply because there are more students.

Monk (1992) argued that increases in the quantity of course offerings does not necessarily translate into improved quality of the curriculum. That is, size alone does not guarantee an adequate curriculum, let alone a superior one (Haller, monk, & Tien, 1993). For example, Howley (1994) argued that the value of offering a wide range of specialized courses might be overstated, and that a small school with a strong required core curriculum could produce student achievement at high levels. In fact, an excessive number of elective courses can detract from the basic curriculum. One of the weaknesses described in A Nation at Risk (1984) was the dilution of the curriculum by elective courses. Indeed, Walberg and Walberg (1994) found that the course offerings available in small schools served the students well because almost all students took a strong core curriculum, and that small schools were less likely to continue ineffective programs than were large schools. Furthermore, students will not necessarily register for the specialized courses offered by large schools or enrollment in these courses may be limited to specific student populations (e.g., gifted students or remedial students. For example, Barker and Gump (1964) found that few students took advantage of specialized courses that were offered at larger schools. Although the number of students taking specialized courses varied somewhat across schools, no more than 12% of students at larger schools enrolled in courses that were not taught at the smallest schools.

Thus, the proposed curricular benefits of large schools may be more apparent than real. Increasing school size, especially beyond 400 students, does not typically result in a large increase in curricular offerings. Furthermore, few students are likely to take advantage of any additional courses that are offered. Finally, by offering a smaller, more focused curriculum, small schools may actually be more able to maintain quality control than are larger schools.

Student Achievement

Although educational researchers and policy-makers consider a number of variables in operationalizing school effectiveness, the community holds schools most accountable for students' academic achievement (Bossert, 1988). Thus, the ultimate criterion for assessing the effectiveness of any school reform is the extent to which it improves the actual academic achievement of students.

A major assumption of the economies of scale argument is that reduced per pupil expenditures translate into greater student achievement because the money saved can be invested in improving the school. An early study by McGuffey and Brown (1978) did find that reduced per pupil expenditure was associated with greater achievement, but . subsequent studies have not replicated this finding., Burrup, Brimley, & Garfield, 1988; Monk 1987).

Sergiovanni (1995) argued that, even if small schools do cost slightly more per student than do large schools, small schools could still be more efficient if they were more productive. Thus, he urged educational decision-makers to go beyond simple per student cost and consider the ratio of productivity to cost. Support for Sergiovani's argument comes from research showing that increases in per student costs, not decreases, are generally associated with increased academic achievement. For example, Greenwood, Hedges, and Laine (1996) conducted a meta-analysis of 60 primary studies relating input factors relating to student achievement, including per pupil expenditures. They found that per student expenditure was positively related to student achievement, and that a 10% increase in per pupil expenditures was related to an increase in student achievement of one standard deviation over 12 years of schooling. Thus, increased cost efficiency per se does not automatically translate into a better education for students. Cost efficient schools may simply be given less money to operate, or the actions that lower per student costs could actually undermine students' achievement. For example, colleges and universities often apply economies of scale by having class sizes in the hundreds of students. Although this greatly reduces the cost of salaries and fringe benefits for faculty, thus lowering the per student costs substantially, increasing class size beyond an optimal level will have a negative educational impact. To illustrate, Smith and Glass (1980) calculated that a student performing at the 50th percentile in a class of 30 students would drop to the 38th percentile if class size were doubled to 60 students.

Unfortunately, the results of studies relating school size to students' achievement have produced conflicting results, the relationship tends to be small. For example, Harnisch (1987) found a correlation coefficient of .13 between size and achievement which indicates only 1.7% shared variance.

Ramirez (1992) conducted a review of the literature relating school size to student achievement and concluded that little difference in achievement was present between large and small schools. Cotton (1996) reviewed 31 studies of the relationship between school size and achievement and found them about evenly divided between studies favoring small schools and studies showing no differences in achievement based on school size. None of the studies reviewed by Cotton yielded results in favor of large schools. Greenwald, et al. (1996) conducted a meta-analysis of 60 studies and found that student achievement was negatively related to school size. That is, achievement was better in small schools. Because many of the studies in this analysis had been conducted in the 1960s, Greenwald et al. preformed a second meta-analysis including only the 26 studies that had been conducted since 1970. The results of this internal analysis also showed greater achievement in smaller schools. A recent analysis of academic achievement in Texas high schools also found a lower academic achievement in larger schools (Texas Education Agency,1999).

Although the major literature reviews have found lower achievement in larger schools, or no difference, a number of individual studies have found lower achievement in smaller schools (Friedkin & Necochea, 1988; Harnisch, 1987; Huang & Howley, 1993). Similarly, Forbes et al. (1993) analyzed students' grades in individual high school courses and found that students in larger schools were more likely to have higher grades in biology and physics than were students in smaller schools. Thus, the preponderance of the evidence indicates that students' academic achievement is better in small schools, but there is sufficient evidence in favor of large schools to suggest that mediating variables play a role in the relationship between school size and achievement. Researchers have been particularly interested in two mediating variables: social class and grade level.

Social class as a mediating variable of the school size academic achievement relationships.

Social class (SES) has been found to be a strong moderator of school size effects. Indeed, Howley (1995) argued that the association between school size and academic achievement is governed entirely by SES. He estimated that increased school size produced an effect equivalent to an extra .25 years of school for middle and upper class students, but for low social class students the effect was equivalent to a loss of .67 years of school. Franklin and Crone (1992) and Kearney (1994) also found that large schools benefit affluent students whereas small schools benefit economically deprived students. Although Caldas (1993) found that achievement was not related to school size when all schools in Louisiana were analyzed, when only central city schools (i.e., predominantly low SES schools) were analyzed, however, larger size was linked to lower achievement . Similarly, Cotton (1996) found that the benefits of small school size were greatest for students from the lower social classes. In the Texas Education Agency (1999) study, on the other hand, a negative effect of increased school size on achievement occurred regardless of social class, but the negative effects were most pronounced for middle and upper class students. In addition, several students have showed negative effects of school size across all social classes (Fowler & Walberg, 1991; Lee & Smith, 1994; Walberg & Walberg, 1994). Thus, the literature supports the conclusion that students from disadvantaged backgrounds tend to do better in small schools. As a result, Fowler and Walberg (1991) argued that school size must be addressed as a social equity issue. The relationship between school size and the academic achievement of middle and upper class students, however, remains unclear.

Grade level as a mediating variable of the relationship between school size academic achievement.

The other mediating variable that has attracted considerable attention from researchers is students grade level in school. Friedkin and Necochea (1988) studied students in the 3rd, 6th, 8th and 12th grades in all California schools. They found that large schools were associated with greater achievement for 12th grade students, but small schools were associated with greater achievement for students in the 3rd, 6th, and 8th grades. Similarly, the results of the Texas Education Agency (1999) showed that students in the elementary and middle school grades were more adversely affected by school size than were students at the high school level. Thus, students in the primary, intermediate, and middle grades are likely to benefit academically from smaller schools, whereas secondary school students may benefit from the advantages offered by large schools. That is, any potential benefits of large school size may be negated until students have acquired foundational academic skills, such as reading and arithmetic, and have become

capable of independent learning. Until then, the smaller class sizes found in small school appear to be beneficial to students' academic achievement. This interpretation is supported by Hoagland's (1995) study in which the negative relationship between school size and the academic achievement of low income students was greatest for reading scores.

Other Important Variables Related to School Size

Although economies of scale and curricular diversity are the most commonly cited justifications for school consolidation, school size can be expected to affect a number of other variables that are related, directly or indirectly, to school effectiveness. Research has addressed a number of these variables including teacher quality, dropout rates, daily school attendance, teacher and student morale, discipline problems, student participation in voluntary activities, and parent involvement.

School Size and Teacher Quality

With regard to teacher quality, Jackson (1966) found that larger schools had more highly qualified teachers than did smaller schools, and that some small schools did not provide all teachers with planning periods. In a study of schools in Georgia, Pethel (1978) found that small schools had fewer teachers with a Master's degree, fewer special education teachers, and more teachers teaching out of their certified fields than did large schools. Thus, large schools appear to have a clear advantage in terms of teacher qualifications.

School Size and Dropout Rates

Cotton (1996) reviewed ten studies of the relationship between school size and dropout rates. Small schools had lower dropout rates in nine of the ten studies with no difference found in the other study. Another review of the literature by Gladden (1998) also found that students were more likely to graduate from small schools than from large schools. The difference between large and small schools was quantified by Pittman and Haughwout (1987) who studied the connection between dropout rate and school size in 744 public high schools. In schools with a graduating class size of fewer than 667 students, the average dropout rate was 6.4%. On the other hand, in the schools with a graduating class size of greater than 2091 students, the dropout rate averaged 12.1%, or nearly double than of the smaller schools. In high schools with graduating classes between these two sizes, dropout rates increased as school size increased. Thus, one unintended outcome of consolidation may be an increase in dropouts.

Daily School Attendance

The relationship of school size to daily attendance is important because attendance has been linked to a number of important school outcomes. For example, Carruthers (1993) linked better attendance to increased participation in school activities, increased academic achievement, and increased graduation rates. Barrington and Hendricks (1989) also found that decreased school attendance was related to an increased probability of dropping out. In addition, low attendance has been linked to increased disciplinary problems (Crone, Glascock, Franklin, & Kochan, 1993; Frederick & Walberg, 1980).

Researchers have consistently found that daily school attendance rates are higher in small schools than in large schools (Cotton, 1996; Fetler, 1989, 1997;Fowler, 1995; Fowler & Walberg, 1991; Gregory & Smith, 1987; Howley, 1994; Jewell, 1989; Lindsay, 1982; Viadero, 1998). Lindsay (1982) determined that this effect of school size on attendance was independent of both school location and students' academic ability. Thus, lower daily attendance may also be an unintended effect of school consolidation.

Teacher and Student Morale

Major reviews of the school size literature have found that both teacher satisfaction and student satisfaction tend to be lower in large schools (Cotton, 1996; Goodlad (1984); Swanson, 1988). Lowered morale may result from the fact that increased school size has a negative effect on school climate (Brookover, Beady, Flood, Schweitzer, & Wisenbaker, 1979; Gregory & Smith, 1987; Schneider, 1980 Stolp & Smith, 1995). For example, students and teachers in small schools were characterized as being more personable and caring than were their counterpart in large schools. Fowler & Walberg (1991) reported that increased school size also negatively affects students' ability to identify with their school. Meier (1996) found that in large schools of over 400 students about 30% of the students feel a sense of belonging whereas in small schools about 70% feel a sense of belonging. This increased sense of belonging occurred in small schools because (a) people in small schools are more likely to know and respect each other, (b) the anonymity of large schools increases anger and physical violence, and (c) small schools were less intimidating for parents. Similarly, Wynne and Walberg (1995, p. 531) noted that established relationships are "more intense and enduring" at smaller schools than at larger schools. In addition, Edington and Gardener (1984) found higher degree of cooperation among teachers and students in small schools than in large schools. in their study. The lack of personal satisfaction and connectedness experienced by students and teachers in large schools has been a major component of the schools-within-schools movement (Cotton, 1996; Walberg, 1992).

Discipline Problems

In a study of schools undergoing consolidation, Haller (1992) found fewer disciplinary problems in rural schools that had an average size of 443 students when compared to urban and suburban schools that had an average size of 1200 students. As these rural schools were increased in size through consolidation, discipline problems increased correspondingly. Stockard and Mayberry (1992) reviewed the literature on school size and discipline problems and concluded that the increase in behavior problems in larger schools was sufficient to nullify any benefits that might accrue from having larger schools.

Although increased disciplinary problems in large schools is a problem in and of itself, such increases also tend to produce negative changes in administrators' behavior. That is, Gregory (1992) found that the control of student behavior becomes a primary concern of administrators in large schools. As a result, school policy tends to become restrictive and disciplinary actions highly punitive (Meier, 1996). These types of policies and practices have been associated with above average dropout rates (Damico & Roth, 1993). Thus, the higher dropout rates already noted for large schools is probably caused in part by the administrative efforts to maintain control over the expanded student population.

Student Participation In Voluntary Activities

In their seminal study of school size, Barker and Gump (1964) found greater participation in small schools than in large schools. They argued that large schools were overmanned (sic) in that there are far too many students for the limited number of positions available. For example, athletic teams tend to be limited to a certain number of players regardless of school size and excess students are typically cut from the team. Thus, many students in large schools are reduced to spectator roles at best. Small schools, on the other hand, are undermanned (sic). That is, there are more positions than there are students to fill them so there is at least one place for every student who wants one. As a result, students in small schools are more likely to be involved in student activities, have a greater sense of belonging, and are less likely to drop out than are students in large schools. This effect of school size has been replicated a number of times (Finn, 1998; Holland and Andre, 1994; Lindsay, 1982; Schoggen & Schoggen, 1988; Sergiovanni, 1995; Stevens & Peltier, 1994).

Parent Involvement.

Parental involvement in the schools is generally considered to increase the effectiveness of the educational process. For example, Berlin and Cienkus (1989) argued that education is more productive when parents, students, and teachers are bonded in their educational goals. Research has supported this conclusion. For example, Thomas (1987) identified strong parent-teacher relations as being positively correlated with students' achievement scores.

Researchers have found that parental involvement tends to be greater in smaller schools than in larger schools (Meier, 1996; Walberg, 1992). Walberg (1992) argued that small schools tend to have greater physical and psychological proximity to students' homes than do larger schools, and that such proximity increases parental involvement because parents feel more comfortable approaching a smaller school. Meier (1996) took a similar approach arguing that a culture of respect between parents, students, and teachers was necessary for parental involvement. This culture comes from parents and teachers knowing each other personally, and is, therefore, more likely to develop in smaller schools. In support of this explanation, Green and Barnes (1993) reported that administrators in small schools relied more heavily on verbal communications and held more conferences with parents than administrators in large schools.

Methodological Concerns

Before recommendations can be made based upon the school size literature, a number of major methodological problems need to be addressed. As already mentioned, large scale studies employing random assignment of students to schools are not available. As a result, any causal conclusions are tentative at best. Although researchers are trained not to draw causal conclusions from correlational data, decision-makers are often forced to do so based upon the best evidence available—even though this evidence is less than ideal.

A second major methodological problem is that a large number of researchers studying school size have used an advocacy research style (Johnston & Pennypacker, 1993). That is, they have conducted the research to advocate either for against school consolidation. The danger of this research style is that researchers can intentionally or unintentionally bias the research design

or data analysis to support the desired conclusion, For example, Sher and Tompkins (1977) noted that many of the studies used to support consolidation were conducted for the specific purpose of providing evidence in favor of consolidation. In these studies, the researchers did not include changes transportation costs in calculating the economic impact of consolidation even those these costs are substantial in school districts with large service areas. Thus, there is no way to know if the larger schools were more economically efficient than the small schools or, instead, the results were simply biased in favor of large schools. Similarly, Fox (1980) and McGuire (1989) identified several studies in which the researchers claimed savings from central purchasing programs in large schools, but the calculations did not include either the cost of distribution or the cost of administrative manpower to manage the programs. Again, ignoring these factors greatly underestimates costs and biases the results in favor of consolidation. Fox (1980; 1981) also noted that research supporting consolidation often did not include population density as a variable although this variable could have a profound effect on the results.

A third major concern is that the definition of large and small schools has often varied greatly from one study to the next. Conant (1959; 1967), for example, was an advocate of large schools but his definition of large school size was total school population of roughly 400 students. In the Barker and Gump (1964) study, on the other hand, the largest school 2287 students. Thus, Conant's large school would be less than one-fifth the size of the largest school in the Barker and Gump study. Furthermore, many advocates of school consolidation have called for schools of at least 1,000 students (Fox, 1981) which is two and a half times the size of Conant's large school. Thus, two people talking about a large schools and small schools may be talking about a very different entities.

Summary and Recommendations

Summary

Although the results of research on the effects of school size are often contrary, they are not really contradictory. Contrary simply means to be different. Different studies of school size often produce contrary (i.e., different) results because the effects of school size are complex and vary depending upon a number of factors. Contradictory, on the other hand, means that if one finding is true, the other finding must be false. The differing results on school size are not contradictory. Rather, they simply represent differing aspects of a complex phenomenon. Both of the contrary results are often, in fact, true. For example, Huang and Howley (1993) found a positive relationship between student achievement and school size in Alaskan schools. Although this seems to contradict the recent trend toward negative relationships, these researchers noted that the small Alaskan secondary schools had very high poverty levels. Thus, their results are actually consistent with the general trend in the research that the effects of school size are mediated by social class. The relationship of school size to educational quality remains controversial only because too many researchers and policy-makers seek a simple yes-no answer to the question, "Are small schools better than are large schools?"

The research shows that both very small and very large schools are negatively related to school quality. In both cases, the school will lack appropriate resources to serve students effectively. Small schools often have few resources because they tend to be in poor rural areas. Even with more resources, however, small schools are economically inefficient, so increased

resources are likely to be squandered by the economies of scale. Larger schools also tend to lack resources because they are located in lower social class urban areas. Even with more resources, however, very large schools would still suffer from bureaucratic inefficiency which would more than squander any potential increase in the economies of scale. In addition, there appears to be an upper limit to increases in curricular offerings that can be generated by large schools, and this limit appears to have a relatively low ceiling. Furthermore, many students will not take advantage of the increased activities available in large schools.

Based upon this review of the literature, we conclude that economic efficiency and educational outcomes represent two sets of variables each of which has its own curvilinear relationship to school size. The specific shape of these relationships is determined by others factors such as social class. In general, however, Turner and Thrasher's (1970) research indicates that increasing school size initially results in a decrease in per pupil expenditures, but that increases beyond 1000 students are unlikely to result in further gains. If per pupil expenditures were the only consideration, this would cap optimal school size at 1000 students. Educational outcomes, however, do not follow the same curve. Turner and Thrasher also found that that maximum curricular diversity is reached with approximately 500 students, or, viewed from Conant's (1959; 1967) perspective, the argument that optimal for curricular diversity is reached at approximately 100 students per grade level is well supported in the literature. Other outcome measures also seem to be optimized between 300 and 500 students. These outcome variables, however, are strongly affected by the social class of the student body. Thus, optimal school size cannot be described by a magic number, but must be determined by the range in which increased school size has a beneficial effect on both expenditures and educational outcomes for a particular school.

Recommendations for Researchers

A number of problems with research on school size were identified in this review. We make the following recommendations to researchers who wish to address school size issues in the future.

1. The advocacy research style that has often dominated research on school size should be avoided. This style too easily generates bias in both the design of studies and the interpretation of data (Johnston & Pennypacker, 1993). Researchers should remain open to whatever results emerge from well designed studies. Although most researchers have been trained to test explicit hypothesis about relationships between variables, Johnston and Pennypacker argue that this approach tempts a researcher to conduct the study so as to prove that he or she is right. They suggest that asking open-ended research questions such as "How is the relationship between school size and academic achievement moderated by school size?" Such questions make any answer acceptable and are, therefore, less likely to turn research into an exercise to prove a predetermined conclusion.

2. Researchers should avoid using the terms "large school" and "small school" in ambiguous ways. Confusion has been abundant in the literature on school size because the labels large and small have been applied to the same size school by different researchers. Johnston and Pennypacker (1993) recommend that researchers always select the verbal labels for variables that

have the least possibility of misinterpretation. With regard to school size, there are two ways that researchers can clarify the meaning of their terms. First, researchers could establish a standard nomenclature similar to the Carnegie classifications used for research on colleges and universities. Second, researchers could avoid the terms large and small altogether and discuss their findings strictly in terms of the actual size of the schools.

       3. Because the relationship between school size and educational quality is curvilinear and determined by several variables, future research should be multivariate and data should be analyzed with statistical techniques that can describe nonlinear relationships. Research that examines the relationship between school size and educational quality should, at very least, include statistical controls for the social class of the schools. Ideally, more than one measure of educational quality should be investigated so that the multiple effects of school size can be delineated more precisely than has been done to date. Furthermore, statistical tests for differences between groups of schools designated as large versus small, or simple correlations between actual school size and outcome measures, cannot possibly capture the relationships involved. Some researchers have already used multiple regression to examine the relationship of school size to economic efficiency (Sabulao, 1971) and academic achievement (Friedkin & Necochea, 1988; Howley, 1995). Friedkin and Necochea (1988), for example, developed a regression equation for the effect of school size on students' academic achievement with social class controlled.

       4. Researchers need to develop comprehensive theories of the effects of school size to guide their work. To date, most of the research on school size has not been based on theoretical models and, as a result, the literature consists of piecemeal studies that lack integration. To the extent that theory has been used, the economies of scale model has been dominant. Unfortunately, this has focused much of the discussion of school size on purely economic issues. The ecological approach taken by Barker and Gump (1964) has the potential to provide an integrated framework because it can relate the environmental impact of changes in school size to the behavior of students. This approach to research, however, never became popular beyond a small group at the University of Kansas (Barker, 1968).

       Until satisfactory theoretical models of the effects of school size are developed, a comprehensive understanding of how educational quality is affected by school size will not develop because many important variables will be overlooked. For example, several commentators have noted that affective variables have been largely ignored by researchers in this area (Fox, 1981; Guthrie, 1979; Sher & Tompkins, 1977). In addition, without a comprehensive theoretical model, researchers will often fail to account for important moderating variables. For example, the possible moderating effects of social class have often been ignored by researchers. Failure to do so has important implications for the relationships obtained in these studies. The study by Friedkin and Necochea (1988) illustrates this point. They found a positive relationship between school size and achievement for high school seniors when social class was not statistically controlled, but a negative relationship when they included this variable as a moderator.

Recommendations for School Boards and Administrators

        Although historically school size has been determined primarily by local school boards (Campbell & Mazzoni, 1976), current efforts to consolidate schools from the state level in Arkansas (Blomeley, 2003) suggest that this may not be the situation in the future. Thus, our recommendations about how to use the literature on school size are directed primarily to superintendents, but with the understanding that these recommendations may become increasingly important to governors and state legislators.

        1. In dealing with school size issues, educational decision-makers should avoid simplistic notions of economic efficiency based upon perceived economies of scale. Advocates of the economy of scale often perceive a linear relationship in which larger schools are automatically more efficient. Research does not support this view. Beyond 1000 students, the inefficiency of large bureaucracies is likely to waste more resources than can be gained by increasing size. Furthermore, decision-makers must be careful not to confuse expenditures with costs (Wiles, 1994). Expenditures refer to the total amount of money that is spent, whereas costs refer to the amount of money needed to produce a particular outcome. Research indicates that when a school grows beyond 100 students per grade level, more money must be spent to attain the same level of academic achievement. Thus, increases in school size between 400 and 1000 students may result in decreased per pupil expenditures, but per pupil costs are likely to rise. As Goodlad (1984, p. 309) stated, "It is not impossible to have a good large school, it is simply more difficult." One of the difficulties is sustaining quality in spite of higher per pupil costs. To put it colloquially, educational decision-makers need to consider how much bang they get for their bucks, and not just bucks per se.

        2. In making decisions about school size, educational decision-makers should keep the characteristics of their community and school in mind. As Monk and Haller (1993) noted, size affects different schools in different ways and one optimal school size does not exist. The most important factor is the socioeconomic status of the community. School size is more important for lower social class students than for other students, and the effects on these students of increasing size beyond some optimal limit will be very negative. These schools have no surplus resources, and cannot, therefore, compensate for rising per student costs. Although more affluent schools will see rising per student costs as well, these schools are more likely to have the resources that can offset these costs. Thus, educational decision-makers in low social class school districts must be more conservative when determining school size because they have less margin for error.

        School size is also related to dropout rates and school climate. Schools that already have high dropout rates are likely to aggravate this problem with consolidation. Similarly, schools with low student satisfaction and extensive discipline problems are likely to see these problem increase following consolidation. Finally, schools with problems involving parents in the school, such as those with large immigrant populations, are likely to see such problem exacerbated by consolidation. Schools already confronting these problems should consider alternatives to consolidation whenever possible.

        The ability of a school to deliver an adequate curriculum in an effective manner should also be considered. For example, small schools often have fewer teachers with a master's degree

than do larger schools, fewer specialists to teach students with special needs, and more teachers teaching out of their certified fields (Pethel, 1978). Consolidation is more likely to be an effective option when such conditions exist than when the school already has adequate resources to provide appropriately trained teachers.

      3. Educational decision-makers should also consider what benefits are likely to accrue to students as a result of increasing school size. If a very small school is unable to provide either the basic curriculum needed by all students, then the increase in curricular diversity that can be generated in a larger school is an advantage. On the other hand, a school that already provides a sound basic curriculum and a reasonable number of electives is unlikely to see a worthwhile increase in curricular diversity. Furthermore, the fact that only a small number of students actually take advantage of increases in curricular diversity must be taken into account. If the majority of students in a school are failing to meet basic standards, then increasing school size to increase curricular diversity is unwarranted. Resources needed to help low performing students will be diverted to curricular luxuries. On the other hand, increasing curricular diversity may be an appropriate goal when the vast majority of students in a school are already meeting basic standards.

      4. Educational decision-makers should use statistical models of school size with great caution, if at all. Johnston and Pennypacker (1993) noted that statistical decision models have a great deal of appeal because they are simple to apply and appear objective. They also note, however, that statistical models that are appropriate under some circumstances are not necessarily appropriate in other situations. Furthermore, Chambers and Parrish (1994) warned that quantification of every factor in the educational process is neither possible nor desirable.

      Statistical models can be major advantages when dealing with the politics of school consolidation. Mathematical calculations are perceived as being free of human bias, and the calculations are often beyond the understanding of school officials and the public alike. This provides a strong defense against people who might oppose school board decisions. Thus, school boards often utilize such models. For example, the Kansas City, Missouri, schools employed a research organization to develop a decision model for use in determining whether to close, consolidate, or retain elementary schools (Midwest Research Institute, 1974). The result was a formula that produced an index based upon ten factors. Student academic achievement of the school and facility cost per pupil were the two most highly significant factors in the formula. The other factors, in order of importance, were space per pupil, teacher load, racial balance, age and general condition of building, auxiliary facilities, commuting distance, number of pupils, and fuel requirements were also included.

      Such formulas have several major problems. First, in the absence of a comprehensive, empirically validated model of the effects of school size, selection of the variables to be included in the formula is problematic. The variables used in Kansas City were derived through correspondence with other metropolitan school districts, local policy statements, the research literature, and discussions with individual school board members. Second, the weighting of each factor is a value judgment, not an empirically derived weight. For example, the Kansas City formula weighted per pupil space more heavily than racial balanced was weighted. This is a

value judgment with which social justice advocates may disagree. The research on school boards indicates that the values included in the formula and the weights assigned to them are likely to be heavily influenced by the ideologies of board members and the ambitions of superintendents (Newman & Brown, 1992; Wiles, 1994). Thus, statistical models are objective only to the extent that, once they have been created, they will always yield the same result given the same numbers. That result, however, is actually derived through political processes that are far from simple or objective.

Even if the formulas were truly objective, the problem of quantifying variables in a valid and accurate way remains. Fox (1981) noted the difficulty of assigning values to costs, and questioned the validity of the units of analysis in some studies. For example, he noted that researchers often used system level costs rather than school level costs. This may yield misleading results when the data are used to draw conclusions about effects at the individual school level.

5. Educational decision-makers should look for creative solutions to school size problems. For example, schools with more than 100 students per grade level may benefit from size reductions. In many school districts that already have large schools the building of additional facilities typically is not a viable option. In these situations, educational decision-makers should consider the development of schools-within-schools (Walberg, 1992). Reorganization of space within existing buildings can lessen the negative effect of large school size by providing students with a smaller school unit within which to function (Cotton, 1996).

Conclusion

We hope that readers have a deeper understanding of the current literature on school size and educational quality. Although a great deal of research has been conducted on school size, and a great deal about its relationship to a number of variables is known, a great deal remains to be done. The major need is for a comprehensive theoretical model to guide research efforts, integrate the results, and facilitate decision making. One of our purposes in writing this paper was to stimulate discussion among researchers that will lead to such a model. In addition, what is currently known about school size is not well utilized by educational decision-makers. Conflicts in the literature that are more apparent than real have, unfortunately, decrease the perceived usefulness of the existing knowledge base. In addition, there has been an overemphasis on reducing expenditures rather than a focus on how school size affects the quality of students' education. Thus, a second purpose was to stimulate discussion among educational decision-makers as to how the current knowledge base can be utilized more effectively. If we have stimulated your curiosity, and created the desire to address the issues involved, we have fulfilled our purposes.

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