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CONCEPTUALIZING AND MEASURING SCHOOL SOCIAL NETWORKS*

Comment on Morgan and Sørensen

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Coleman (1988) claimed that one form of social capital stems from intergenerational social closure, that is, a social network in which the parents of friends are also friends. In a high school context, Coleman predicted that intergenerational social closure would have a positive effect on students' academic achievement. He argued that social closure was linked to student performance through shared parental norms and values, knowledge about school-related matters, and social control.

Coleman used the notion of social closure to explain the Catholic school advantage evidenced in many empirical studies. He characterized Catholic schools as being closed functional communities in which the religious ideology of the school and a student's social capital, in the form of dense social networks of students, parents, teachers, and administrators, support student learning.

Morgan and Sørensen (1999) (henceforward M&S) have challenged Coleman's social capital explanation of the Catholic school advantage. They distinguish between two kinds of schools: norm-enforcing schools and horizon-expanding schools. According to their definition, a norm-enforcing school is one containing a high incidence of intergenerational social closure—a school in which many parents know the parents of their children's friends. A horizon-expanding school is one with few socially closed networks—a school in which a student's parents are friends with adults who are not the parWarren N. Kubitschek University of Notre Dame

ents of their children's friends. M&S claim that horizon-expanding schools channel new learning opportunities to students through expanded social networks, while norm-enforcing schools limit access to these kinds of learning opportunities through the boundaries imposed by socially closed networks.

CONCEPTUAL ISSUES

M&S's conceptualization of these two kinds of schools raises several concerns. Three concerns relate to the definition of a normenforcing school. First, to call a school norm-enforcing with respect to academics because it contains a high degree of intergenerational social closure seems inappropriate. Parents may be friends with the parents of their children's friends without sharing educational norms. Friendships have different bases of attraction, many of which are unrelated to education. Parents and students in socially closed networks may have norms that are unrelated to academics, favorable to academics, or hostile to school norms and practices. Thus, a school with a high incidence of intergenerational social closure is not necessarily characterized by shared parental norms about academic interests and concerns. Even if parents share academic norms, such norms may favor or oppose academic values. M&S point this out early in their article, but subsequently discuss norms by school sector, as if all Catholic norm-enforcing schools support academic values and all public norm-enforcing schools oppose academic values.

Second, even when parents in socially closed networks share academic norms, the effects of these shared norms on their children's school performance may be negligible. The impact of parents' shared academic norms depends in part on the content, intensity, duration, and interaction pattern of par-

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ents' friendships. Unless parents interact frequently about school matters, their shared norms are not likely to have a pronounced effect on student behavior.

Third, to describe an entire school as norm-enforcing on the basis of the network ties of a subset of parents and students in the school is unreasonable. Even a high degree of intergenerational closure in a school could exclude many students. If socially closed networks have a positive effect on student achievement, it is the higher test scores of the networked students that raise the school mean, not a school-wide improvement. The mechanisms linking closed networks to student achievement would not be expected to influence the academic performance of students outside the network. Because schoollevel variables typically depict characteristics of an entire student population rather than a subset of the student body, intergenerational closure should not be conceptualized as a school-level characteristic.

A fourth concern relates to M&S's conceptualization of a horizon-expanding school. Parents have many avenues for contact with other adults, including friendships with the parents of their children's friends, participation in school activities, neighborhood contacts, and church involvements. None of these types of friendships precludes any other type; friendship is not a zero-sum game. Moreover, some parents will have many friends while other parents may have few friends. Parents with many friends may be involved in both socially closed networks and horizon-expanding networks while parents with few friends may be involved in few networks of either kind. To assume, as M&S do, that schools with few intergenerational social networks are characterized by many horizon-expanding networks is not logically sound.

Generally, M&S's conceptualizations of norm-enforcing and horizon-expanding schools are ambiguous and confusing. If the sole basis for the definition of these terms is the density of internal and external parental networks, one should find schools that are both norm-enforcing and horizon-expanding and schools that fit neither description. One should find schools in which most of the internal parental networks support academic achievement, schools in which most of the internal parental networks work in opposition to achievement, and schools in which networks have mixed effects. Consequently, the concepts of norm-enforcing and horizonexpanding schools are not adequate in specifying the mechanisms that link networks to student outcomes or in explaining sector differences in student achievement.

METHODOLOGICAL ISSUES

M&S's lack of conceptual clarity affects their analysis and conclusions, and their methodology exacerbates these problems. Their key empirical finding appears in Table 4, Model 6, in the effects of parents know parents and parents know parents × Catholic school on changes in mathematics achievement scores between tenth and twelfth grade. The authors claim that the statistically significant, negative effect of parents know parents shows that intergenerational social closure decreases achievement in public schools. They interpret this finding as support for their proposition that horizon-expanding schools promote learning. They further claim that the positive effect of the interaction term *parents know parents* × *Catho*lic school suggests that intergenerational social closure promotes achievement in Catholic schools. Their earlier and subsequent models lead to and/or elaborate on these results.

To evaluate M&S's findings it is necessary to examine how they constructed their variables. They create three variables to measure school networks and social closure: *friends in school, parents know parents*, and *social closure around school*. Unfortunately, as we will demonstrate, these three variables do not measure three distinct social concepts or processes. Owing to the nature of the parental responses and M&S's construction of the variables, all three of these variables are primarily measuring the same phenomenon.

The NELS variables M&S use to construct their indicators are parental responses to a series of 10 questions about a parent's twelfth-grade child's friends. First, each parent in the sample was asked to list the names of up to five of their child's friends. The parent was next asked to indicate whether each friend named was in the same school as their child. M&S counted the number of positive responses for each parent; the within-school mean of this number produced the *friends in* school variable. Parents also were asked whether they knew a parent of each of the named friends. The within-school mean of the number of positive responses yielded the parents know parents variable. The social closure around school variable is the geometric mean of these two variables.

The substantive variation in M&S's variables friends in school and parents know parents comes from two sources. One source of variation in these variables is the variation that M&S wish to measure. For the friends in school variable, this is the likelihood that children's friends are in the same school: for parents know parents, it is the likelihood that parents know the parents of their child's friends. The second source of variation in these variables is the number of names that parents list. Survey respondents could and did name anywhere from zero to five friends. The number of friends named puts an upper bound on both the number of same-school friends the parent can name and on the number of parents of their child's friends they say they know. This second source of variation is not something M&S wish to measure. Unfortunately, this is the primary source of the variation in their variables.

We examined the responses for the completed NELS parental questionnaires in 1994, restricting the sample to parents whose child was enrolled in school, children who were in the same school in both 1992 and 1994, and schools whose 1992 school identification number was not missing. We excluded respondents if any of their answers to the 10 key questions were missing. We excluded schools that had two or fewer students remaining in the sample. The final subsample contained 10,602 cases in 972 schools. This sample is not identical to M&S's; moreover, unlike M&S, we use unweighted statistics: Our results are meant to illustrate variable construction, not to replicate their analyses.

We computed M&S's measures of *friends* in school and parents know parents. We also computed the within-school mean number of friends named by parents, which we call named friends. These three variables have considerable variation across schools. The values of parents know parents range from 0 to 5.0: In some schools, the typical parent knows no parents of their children's friends, while in other schools the typical parent knows the parents of all the child's friends named. The range of *friends in school* is nearly as large (.3 to 4.8). Although the range of *named friends* is somewhat restricted (1.5 to 5.0), all three of these measures vary together. The correlation between *friends in school* and *parents know parents* is strong (r = .66), and the correlation between each of these terms and *named friends* is even stronger (approximately .75).

Friends in school and parents know parents do not measure precisely the same thing, obviously, but they have a reliability (α) of .80. If we wished to combine friends in school and parents know parents into a single variable, we would have more than sufficient empirical support to feel justified in doing so, by the usual standards of reliability. In addition, the reliabilities of named friends with friends in school and with parents know parents are both greater than .84. From these results, we conclude that both *friends* in school and parents know parents are primarily measuring the same phenomenon: the typical number of children's friends listed by parents in a school. Because social closure *around school* is the geometric mean of these variables, it also primarily measures the typical number of child's friends listed by the respondent.

What underlying social concept do *friends* in school and parents know parents measure? A number of factors may enter into the number of child's friends named on the parental questionnaires, but the primary determinant is likely to be the individual sociability of the child. A count of number of friends is the usual operationalization of sociability. (Of course, a better measure of sociability would be obtained directly from the child, and would not be limited to a maximum of five friends.) A child who has many friends is likely to have parents who will name five friends (about 55 percent of our sample). Children who have fewer friends are likely to have parents who will name fewer than five friends (about 45 percent of our sample, with 4 percent naming zero friends). When calculated at the individual level, the values of the correlations and the reliabilities among number of

friends named, number of same-school friends, and number of parents known are high. Indeed, these values are almost identical to the values at the aggregate level.

At the aggregate level, then, we would argue that the typical parent in a school will name some number of friends depending on the typical sociability of children in the school. Because most of the variability in friends in school, parents know parents, and social closure around school is a result of this typical number of friends named, these variables are better interpreted as measures of student sociability than as any other factor. Thus, the conclusion we would draw from M&S's results in Models 1, 3, and 5 is that the friendliness of a school's student body, as measured by their social closure around school, does not significantly affect an individual's mathematics achievement, although there is the suggestion that studentbody friendliness is related to achievement in Catholic schools.

One need not agree with our contention that these variables measure sociability to concur with the more general point-the variables friends in school and parents know *parents* are primarily measuring the same factor. This means that either friends in school is not measuring the density of sameschool student networks, parents know parents is not measuring the density of sameschool parental networks, or both. Therefore, social closure around school is not measuring intergenerational social closure as defined by Coleman and by M&S. As a result, M&S's results tell us little or nothing about social capital, social closure, or the effects of these factors on achievement.

It is true that *friends in school* and *parents know parents* do not share all of their variability with each other, nor all their variability with *named friends*. Some variability is probably associated with same-school student and parental networks, and for this reason, the variables might yield some information about social closure and achievement. Even though this is the case, these measures and analyses have other methodological difficulties that should prevent one from drawing M&S's conclusions.

One difficulty is that school means of simple counts should not be interpreted as measures of density, because these measures fail to take school size into consideration. If the typical senior at a school has three named friends, those students will be more closely linked to other students in the school if the school contains 3,000 students than if the school contains 3,000 students. What M&S have measured with *friends in school* is typical number of friends, not the degree of interconnection or density of student networks. This problem of counts versus densities is also present in their construction of the *parents know parents* variable.

A second methodological difficulty is that the high correlation between friends in school and parents know parents may affect M&S's coefficient estimates, with certain statistical implications that they rarely acknowledge in their interpretations. There is some evidence that these estimates are affected by collinearity. The bivariate correlations of friends in school and parents know parents with twelfth-grade mathematics test score are both positive. Yet the coefficient estimates for friends in school in Model 4 and for public schools in Model 6 are positive while the coefficient estimates for parents know parents are negative. This change in sign of the association between parents know parents and mathematics test score may indicate collinearity effects.

M&S note this warning sign when discussing the results of other variables in Model 5. They correctly point out that the "high level of collinearity" between the variables parents work together and parents have adequate say, especially for Catholic schools where the correlation is .706, "... contributes to the large standard errors [and] ... likely has produced the nonsensical coefficient estimates of opposite sign" (M&S, p. 672) in the estimates for Catholic schools. Yet the correlation between *friends* in school and parents know parents is also high, and M&S do not mention possible collinearity effects for these coefficient estimates. Furthermore, the correlation between friends in school and parents know parents is higher in public schools (in our data, r =.69) than in Catholic schools, which makes it more likely that collinearity effects will appear in the public school estimates. Note that the estimated coefficients for public schools friends in school and parents know parents are of opposite sign, while the estimated coefficients for Catholic schools are of the same sign. It is true that the coefficient estimates for *friends in school* and *parents know parents* do not exhibit the large standard errors often brought on by multicollinearity. However, it is incautious of M&S to dismiss coefficient estimates from one pair of highly correlated variables as nonsensical, while using coefficient estimates from another pair of variables with an equally high level of correlation to support their theory. These effects require a much more detailed investigation.

Coefficient estimates from collinear variables can be usefully interpreted, but M&S's interpretations are also incautious. Their primary conclusion for public schools is "the density of student friendship networks increases mathematics learning while the density of parental networks decreases it" (M&S, p. 674). This is a statistically accurate representation of the model results on the condition that the other factor is held constant. But given the high correlation between friends in school and parents know parents, we know that, in reality, increases and decreases in *friends in school* are most likely to be accompanied by similar increases and decreases in parents know parents. In our data, the values of friends in school and parents know parents differ by less than .5 in 67 percent of schools and by less than 1.0 in 89 percent of schools. Morgan and Sørensen's estimated coefficients for these variables are typically of opposite sign and similar magnitude; thus, in the vast majority of schools, the joint effect of these variables is near zero. In terms of social processes, as measured by M&S's variables, the story the reader should take from these results is one of no meaningful network effects.

M&S do acknowledge this: "In combination, differences in social closure among public schools have no association with differences in learning" (M&S, p. 674). But most of their arguments do not remind the reader of this joint variation and its consequences. Their discussions of the negative effects of norm-enforcing public schools fail to mention that in most of these schools, these negative effects are balanced by the positive effects of student networks. Their discussions of the positive benefits of horizon-expanding schools fail to mention that student networks in such schools are typically weaker and provide little or no achievement benefit. By focusing on the individual effects of these jointly varying variables, M&S present a misleading picture of the underlying social processes.

It is, of course, the purpose of multivariate analyses to separate out specific effects, to hold constant all other factors so we can examine the effects of one factor. This is an immensely powerful technique, but it must be remembered that such results are always sociologically artificial. We are reminded of a result sometimes found in status attainment research. When both father's and mother's education are included in linear models predicting attainment, it may be the case that the estimated coefficient of the former is positive while the coefficient of the latter is negative. We should not conclude from such estimates that more poorly educated mothers have children with higher attainments. The sociological effects of parents' education, or student and parental networks, or any other group of highly correlated variables, are usually better understood jointly than individually.

A third methodological difficulty is that M&S's parents know parents measure is constructed incorrectly. The primary purpose of this variable is to indicate norm-enforcing schools in which "parents establish ties with the parents of their children's school friends" (M&S, p. 663). From their description of the construction of this variable (M&S, pp. 666-67) and from the empirical results, however, it appears that M&S have counted the number of parents of their children's friends that they know, regardless of whether the friends are in the same school or not. In our data, the mean of parents know parents is about 3.0, quite close to the mean of 3.1 for M&S's variable. The mean of our *parents know par*ents when only same-school friends' parents are counted is about 2.5. We would not expect this error in variable construction to greatly affect M&S's empirical results, although it does increase the measurement error in the variable.

However, this error in construction clearly illustrates one of M&S's incorrect conceptual assumptions previously mentioned. This assumption is that the densities of

within-school and out-of-school parental networks are necessarily inversely related. A high value of *parents know parents* is taken by M&S to indicate a dense within-school parental network and thus a norm-enforcing school. A low value of parents know parents is taken to indicate a dense out-of-school parental network and thus a horizon-expanding school. But their school descriptions do not follow from the variable definitions. If a high value of parents know parents is interpreted as a dense within-school parental network, then a low value of parents know parents must be interpreted as a less dense within-school parental network, not as a measure of the density of out-ofschool parental networks.

Our data show a small negative correlation between *parents know parents* counting only the same-school friends and *parents know parents* counting only the not-sameschool friends (r = -.27), but this is far from an identity. And although this correlation is negative in part by construction (the sum of the two variables cannot exceed 5.0), investigation of specific cases shows schools with low values on both these measures. In M&S's terms, these are schools that are neither norm-enforcing nor horizon-expanding.

The appropriate mean shows the error in attempting to measure the density of out-ofschool parental networks using only the parents of children's friends. As noted above, we expect parental networks outside of schools to be far broader than ties associated with their children. (In this regard, we also differ from Coleman in that we would expect norm-reinforcing parental networks inside of schools to include parents whose children are not friends.) In our data, the mean of *parents* know parents counting only the parents of the child's named friends that are not in the same school is approximately .5. It is entirely incorrect to conclude that this indicates that the typical parent at the typical school has an out-of-school network consisting of one-half of one adult. Unfortunately, the latter conclusion is consistent with M&S's construction and use of their variables.

CONCLUSION

M&S take on an important task in examining Coleman's proposition that intergenerational social closure explains the Catholic-school achievement advantage. They conceptualize the issue as one of intergenerational social closure versus more open or expansive networks, of norm-enforcing schools versus horizon-expanding schools. They claim that intergenerational social closure incurs information costs for students but that in certain circumstances it may also bestow academic benefits. Based on their analysis, they conclude that intergenerational social closure has a negative effect on achievement in public schools, and that while it may have a positive effect on achievement in Catholic schools, it fails to account for the higher test scores of students in Catholic schools.

Unfortunately, conceptual ambiguity in M&S's arguments raises serious concerns about whether their analyses even address these issues. The absence of clear and convincing definitions of norm-enforcing and horizon-expanding schools and the social networks that characterize them leads to logical gaps in their reasoning and raises questions about the fit between their propositions and their analyses. The conceptual limitations of M&S's research create problems with variable construction that significantly affect what they are actually analyzing. Inattention to careful interpretation of the effects of collinear variables leads them to questionable conclusions that, even when statistically accurate, are overly detached from the social processes they purport to examine. As a result, we cannot determine, on the basis of their study, whether social capital and intergenerational social closure behave in the fashion presented by Coleman, in the manner represented by M&S, or in some other way.

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