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ABSTRACT

The context of socialization in the second half of the 20th century is far different than any previous socialization environment. Children in the United States and in other industrialized countries grow to adulthood in an age of science and technology. Despite these Longitudinal Studies; *Mathematics Education; technological world on the formation of attitudes toward science and technology. The Longitudinal Study of American Youth (LSAY) is one effort to better understand the process of socialization. The LSAY will follow parallel national samples of seventh and tenth graders for four years, collecting data from the students and their parents, teachers, and school staffs. The base year for collection was 1987. This paper uses the preliminary results from the LSAY base year tenth grade data set to examine course enrollment patterns in high school mathematics to develop several log-linear models to predict the level of mathematics course enrollment during this period. Several path models are advanced and evaluated to help explain the relationship between variables which contribute to mathematics course enrollments. (CW)

Family and Peer Encouragement of the Study of Mathematics

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Socialization in an Age of Science and Technology

Children in the United States and other industrialized countries grow to adulthood in an age of science and technology. Satellites, television sets, microprocessors, microwave ovens are as common as the sun and trees. It is clear that the context of socialization to adulthood in the last half of the 20th century is far different in kind than any previous socialization environment. It is likely that the socialization environment for our grandchildren will be characterized even more strongly by science and technology.

Despite these changes in the socialization environment, there has been little systematic study of the effects of growing up in a scientific and technological world on the formation of attitudes toward science and technology. Some commentators have claimed to have found alienation toward science and technology, while others think that it has captured the imagination -- if not the mind -- of newer generations. It should be possible to resolve some of the confusion about the impact of science and technology on socialization through rigorous empirical study.

The Longitudinal Study of American Youth[1] (LSAY) is one effort to better understand the process of socialization and attitude development toward science and technology and citizenship. The LSAY builds upon a previous cross-sectional study by Miller, Suchner, and Voelker[2] and upon the relevant literature. The LSAY will follow a national sample of 7th-graders and a parallel sample of 10th-graders for the next four years, collecting data from the students, their parents, their teachers, and related school staff. The base year student data collection for the LSAY was completed in the Fall of 1987.

This paper will use the preliminary results from the LSAY base year 10th-grade data set to examine patterns of enrollment in mathematics courses in high school and to develop several multivariate log-linear models to predict the level of mathematics course enrollment during this critical period. The base year data set is still essentially a cross-sectional data set, but by building models that allow us to better understand the current distribution, we will be better equipped to conceptualize and monitor the patterns of change that will emerge over the next years of the LSAY.

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[1]The work reported in this paper is supported by National Science Foundation grant MDR-8550085. All of the analyses, opinions, and conclusions offered are those of the authors and do not necessarily reflect the views of the National Science Foundation or its staff.

[2]Citizenship in an Age of Science. New York: Pergamon Press. 1980.

The Selection or Rejection of Advanced Mathematics Courses

To a large extent, the study of mathematics -- as opposed to arithmetic -- has become elective in American secondary education. Many states still require two years of "mathematics," but this requirement can be met by taking course like general math, business math, consumer math, or vocational math. Recent data indicate that only 55 per cent of American high school graduates have completed a year of algebra and fewer have completed more advanced courses in algebra or calculus.

This pattern of mathematics course selection has serious implications for understanding many quantitative concepts and for the selection of a career. If a student completes the 10th-grade without completing a year of algebra, the possibility of a professional scientific or engineering career is nearly gone, since it will be virtually impossible -- without extensive summer school work-- to complete a sufficient level of high school mathematics to be admitted to a collegiate program in science, mathematics, or engineering. While it is conceptually possible to play catch up in college, that option would substantially elongate the student's baccalaureate career.

For the purpose of this analysis, a variable called mathematics program has been developed that divides 10th-grade students into those that are currently enrolled in geometry (which presumes a year of algebra in virtually all high school curricula), those currently enrolled in algebra, and those who are currently enrolled in either a lower math course or in no math course at all. The results indicate that 35 per cent of current 10th grade students are enrolled in a geometry course (see Table 1), suggesting that they have already completed algebra and are on the normal course for four years of high school mathematics if they continue the sequence. Another 38 per cent are currently enrolled in algebra, which -- combined with the 35 per cent in geometry -- is higher than previously reported algebra enrollments. About a quarter of all 10th-grade students are not presently enrolled in algebra. It is possible that some of these students were enrolled in algebra in the 9th grade. The spring 1988 LSAY attitudinal questionnaire is collecting information about 9th grade course experience and a final estimate of algebra enrollment should be available by summer.

An examination of the LSAY mathematics enrollment data by student gender indicates that young women are somewhat less likely to have enrolled in geometry than young men, but the margin of difference is smaller than has been reported in previous studies. These differences are significant at the .05 level.

As would be expected, the level of student educational aspiration (What is the highest level of school that you expect to complete?) is strongly associated with enrollment in advanced mathematics courses. Forty-three per cent of 10th-grade students expecting to complete a baccalaureate or more are currently enrolled in geometry and almost the same proportion are taking an algebra course. Enrollment is also strongly associated with the level of parental education, but parental education is also the best predictor of the student's own educational aspirations.

Table 1: Distribution of 10th Grade Students by Level of Mathematics Program and Parental and Peer Encouragement.

	Mathematics Program			
	Basic	Algebra	Geometry	N
All 10th Grade Students	27%	38%	35%	1993
<u>Gender</u>				
Male	24	39	37	1023
Female	30	37	33	970
<u>Student Educational Aspiration</u>				
Less than college	44	32	24	819
Baccalaureate	15	41	43	578
Graduate degree	11	42	43	611
<u>Parental Education</u>				
High school or less	33	35	32	709
Some college	30	34	37	531
Baccalaureate or more	14	44	43	611
<u>Parental Mathematics Push</u>				
Scores 0-1	34	34	33	632
2-3	27	38	35	1004
4-5	20	40	40	419
<u>Parental Academic Push</u>				
Scores 0-3	37	36	27	696
4-5	23	39	38	757
6-7	21	37	42	601
<u>Peer Mathematics Push</u>				
Scores 0	30	34	36	1105
1	28	35	37	467
2-4	21	46	32	482
<u>Peer Academic Push</u>				
Scores 0-1	40	32	28	628
2	21	37	42	538
3-4	22	41	37	888

In the model building reported in the next section of this paper, four additional variables are used that reflect the level and focus of parental and peer encouragement of the study of mathematics. It is useful to review those four measures now and to examine briefly their relationship to mathematics course enrollment.

Parent Academic Push refers to general parental encouragement to value education and to do well in school. For this analysis, this variable was measured by the number of student agreements to the following statements:

My parents: insist I do my homework.
tell me how proud they are when I make good grades.
expect me to complete college.
tell me how confident they are in my ability.
often help me understand my homework.
reward me for getting good grades.
ask me a lot of questions about what I am doing in school.

This variable is positively, but not strongly, associated with mathematics course enrollment in the LSAY data.

Parent Mathematics Push refers to specific parental actions focused on or closely related to mathematics, in contrast to the more general academic encouragement measured above. For this analysis, this variable was measured by the number of student agreements to the following statements:

My parents: want me to learn about computers.
have always encouraged me to work hard on math.
buy me math and science games and books.
expect me to do well in math.
think that math is a very important subject.

This variable is positively and moderately strongly associated with mathematics course enrollment in the LSAY data.

Peer Academic Push refers to peer encouragement of school and learning generally. It was designed to parallel parental academic encouragement, but obviously the items must be different to reflect the peer context. For this analysis, this variable was measured by the number of student agreements with the following statements:

Most of my friends: plan to go to college.
are really good students.
often help me with my homework.
think I am a good student.

This variable is positively associated with mathematics course enrollment.

Peer Mathematics Push refers to specific peer encouragements of the study of mathematics. For this analysis, this variable was measured by the number of student agreements to the following statements:

Most of my friends:
- like math.
- do well in math.
- hope to become scientists, doctors, engineers, or mathematicians.
- know how to write computer programs.

This variable is positively associated with mathematics course enrollment in regard to the taking of algebra rather than lower math courses, but appears not to be positively associated with enrollment in geometry.

In summary, the mathematics enrollment measure appears to be positively associated with all of the demographic and encouragement variables just noted. To better understand the combinations of demographic and other influences that foster student enrollment in advanced high school mathematics course, we will now turn to the task of constructing some models of this choice.

Some Models of Mathematics Course Selection

Models are abstractions of reality. Inherently, they are simpler than reality, but seek to abstract from the social world those forces, factors, actions, or attitudes that are related to -- causally or otherwise -- outcome attitudes or behaviors of interest to us. In this analysis, we are interested in better understanding the patterns of mathematics course enrollment display in Table 1 and we would like to understand the relative contribution of each of several parental and peer activities. For this purpose, we will utilize a set of log-linear logit models, using the techniques developed by Leo Goodman and described by Stephen Feinberg.

As a starting point, it is useful to look at the relative contribution of the student's gender, the parent's formal education, the educational aspiration of the student, and the level of parent academic push. These are four variables that are often noted in traditional explanations of students enrollment in mathematics courses.

The path model indicates that parental education and gender are associated with student educational aspirations (see Figure 1). The level of parental education is positively associated with the level of parent academic push. Both the level of student educational aspiration and parent academic push are positively associated with the level of mathematics course enrollment. The absence of a direct path from either gender or parental education to mathematics course enrollment indicates that the influence of these two variables is fully accounted for in the levels of student educational aspiration and in parental academic push and that there is no residual direct influence on mathematics course enrollment.

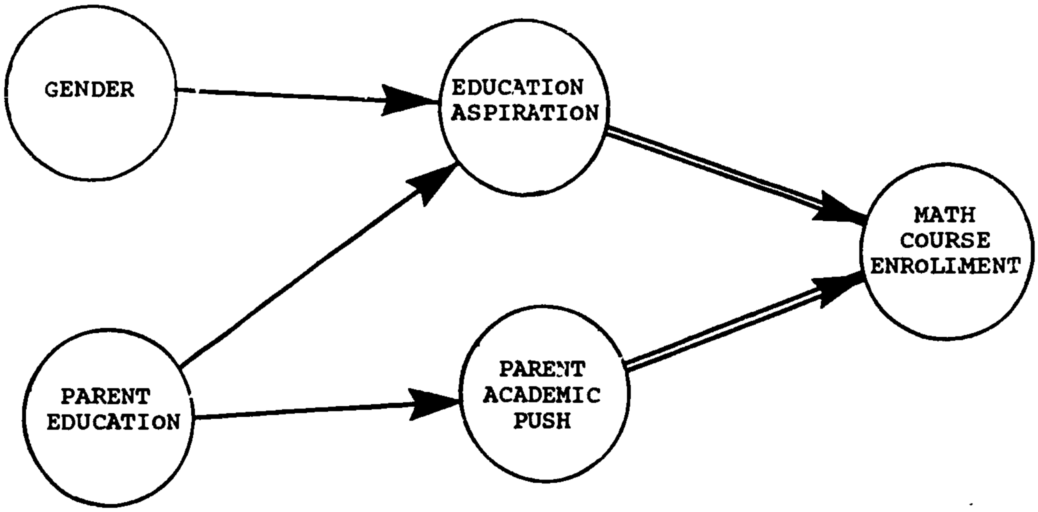

Figure 1: A Path Model to Predict Mathematics Course Enrollment among 10th-Grade Students.

Table 2: Some Logit Models to Estimate the Strength of Selected Paths.

Model	Terms	d.f.	LRX^2	CMPD	p
1.	Total mutual dependence in GP, E.	10	287.7	--	.000
2.	Mutual dependence accounted for by GE.	2	15.3	.055	.000
3.	Mutual dependence accounted for by PE.	4	261.3	.938	.000
4.	Total mutual dependence in GP, A.	10	261.3	--	.000
5.	Mutual dependence accounted for by GA.	2	4.3	.032	.115
6.	Mutual dependence accounted for by PA.	4	121.2	.901	.000
7.	Total mutual dependence in GPEA, Y.	106	415.3	--	.000
8.	Mutual dependence accounted for by GY.	2	3.8	.009	.152
9.	Mutual dependence accounted for by PY.	4	10.3	.025	.036
10.	Mutual dependence accounted for by EY.	4	130.0	.313	.000
11.	Mutual dependence accounted for by AY.	4	17.5	.042	.002
12.	MD accounted for by all 5 main effects.	14	233.5	.562	.000

Legend:
- d.f. — degrees of freedom
- LRX^2 — Likelihood-Ratio Chi-Square
- CMPD — Coefficient of Multiple-Partial Determination

While this general structural understanding is helpful, it would be more useful if we could estimate the relative strength of each of the paths in the model and, thereby, better understand the relative influence of these variables. Fortunately, it is possible to utilize a set of log-linear logit models to develop estimates of the relative strength of the paths and Table 2 includes a set of models relevant to the path model in Figure 1.

The total path model is comprised of three separate or submodels. Models 1, 2, and 3 estimate the paths from gender and parental education to student's educational aspiration. Model 1 calculates the total mutual dependence[3] available in that submodel and Model 2 calculates the mutual dependence accounted for by the relationship between gender and student's educational aspiration. Model 3 calculates the mutual dependence accounted for by the relationship between parental education and student's educational aspiration. The results indicate that parental education is substantially more influential in the development of student's educational aspirations than is gender.

Models 4, 5, and 6 estimate the paths from gender and parental education to parental academic push. The results indicate that parental education is positively and strongly associated with the level of parent academic push. There is no significant relationship between gender and the level of parent academic push, suggesting that parents push their sons and daughters toward general academic achievement without regard to gender.

Models 7 through 12 describe the relationships between each of the independent variables and mathematics course selection. The results indicate that student's educational aspiration is the strongest predictor of mathematics course selection, accounting for 31 per cent of the total mutual dependence in the model. In contrast, parent academic push -- the only other direct path -- accounted for only four per cent of the total mutual dependence.

In summary, this initial model points to the strong influence of parental education in the development of student's educational aspiration and in the level of general academic push provided by the parents. The level of student's educational aspiration, in turn, accounts for a significant portion of the variation in mathematics course enrollments. While the finding that college-bound students are more likely to take advanced mathematics courses is hardly news, this initial model does provide some useful insight into the structure of some of the major influences in mathematics course selection.

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[3]Mutual dependence is a term suggested by Leo Goodman and is analogous to variance in interval analyses. The mutual dependence is the sum of the residual likelihood-ration chi-squares (without regard to sign) obtained when the estimated cell frequencies (based on the marginal distributions of the dependent and independent variables and on the associations among the independent variables) are subtracted from the observed cell frequencies. It should be noted that, unlike interval models, the total mutual dependence in a logit model reflects only the variation in cell populations for the variables included in the analysis -- not for all possible explanatory variables.

To further explore the influence of parents in mathematics course enrollment, the parent mathematics push variable was added to the previous model (see Figure 2). In this model, the level of parental education is strongly associated with the level of parent mathematics push, but there is no relationship between gender and parent mathematics push. This is an important finding since it indicates that the level of parental encouragement of mathematics -- as perceived and reported by the student -- is not differentiated by the gender of the child.

This path model also indicates that, when parental education, gender, student's educational aspiration, and parent academic push are held constant, there is no significant residual relationship between parent mathematics push and mathematics course enrollment. This means that there is no direct path. Substantively, this result suggests that differences in mathematics course enrollment reflect primarily the student's educational aspirations and secondarily general parental academic encouragement and that there is no marginal or additive effect from a high level of parental mathematics push. In simple terms, given the sequential and hierarchical nature of high school mathematics courses, a commitment to seek a baccalaureate or graduate degree is sufficient to foster enrollment in the advanced courses. A high level of parent mathematics push may have some impact on either career choice or the quality of the student's involvement with mathematics, but those are subjects for future analyses and are beyond the scope of the current inquiry.

Turning to the issue of the influence of peers on mathematics course enrollment, parent mathematics push was removed from the preceding model and peer academic push was added to the model (see Figure 3). The path analysis indicates that gender is strongly associated with the level of peer academic push, with male 10th-graders reporting peer academic encouragement significantly more often than female 10th-grade students. Gender was also significantly associated with student's educational aspirations, with boys being significantly more likely to aspire to a graduate degree than girls. About 30 per cent of both boys and girls aspired to a baccalaureate, but girls were significantly more likely to plan not to complete a college degree than boys.

The level of parental education was significantly related to peer academic encouragement. This association reflects the tendency of better educated parents to live in school attendance districts in which a higher proportion of other parents and their youngsters value education. To a large extent, it is a reflection of general social class and of economic affluence. In any case, this result suggests that the 10th-grade students of better educated parents are significantly more likely to receive peer academic encouragement than the children of less well educated parents.

The path analysis indicates that student's educational aspiration, parent academic push, and peer academic push all have direct paths to mathematics course enrollment (see Figure 3). An examination of the strength of each of the direct paths indicates that peer academic push is a slightly stronger predictor of mathematics course enrollment than parent academic push, but that both are weak compared to the influence of student's educational aspiration (see Table 4).

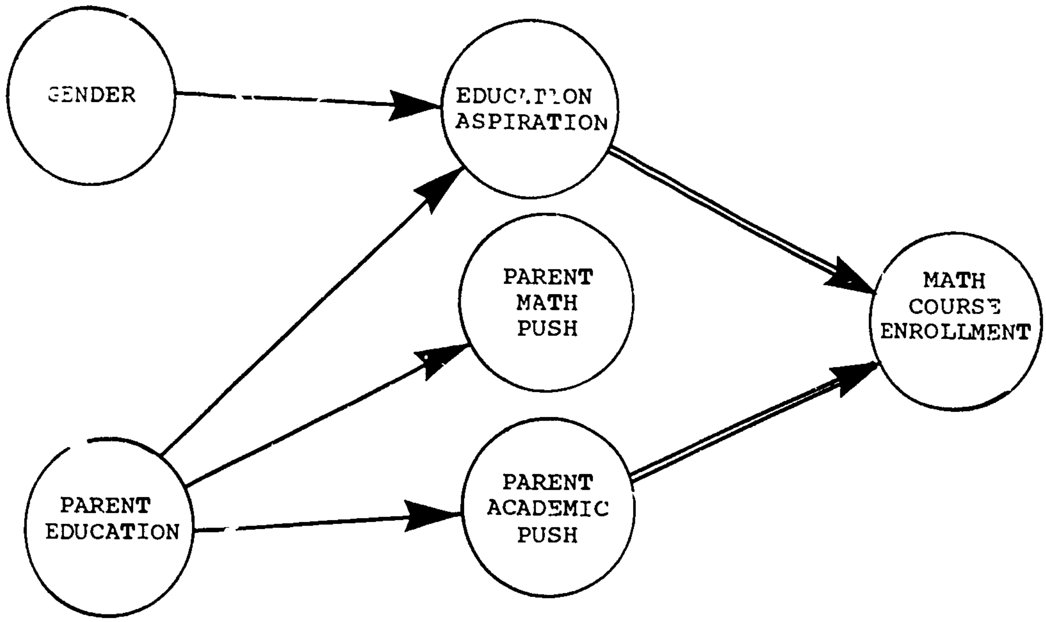

Figure 2: A Path Model to Predict Mathematics Course Enrollment among 10th-Grade Students.

Table 3: Some Logit Models to Estimate the Strength of Selected Paths.

Model	Terms	d.f.	LRX^2	CMPD	P
1.	Total mutual dependence in GP, M.	10	69.9	--	.000
2.	Mutual dependence accounted for by GM.	2	3.8	.054	.153
3.	Mutual dependence accounted for by PM.	4	60.8	.870	.000
4.	Total mutual dependence in GP, E.	10	287.7	--	.000
5.	Mutual dependence accounted for by GE.	2	15.3	.055	.000
6.	Mutual dependence accounted for by PE.	4	261.3	.938	.000
7.	Total mutual dependence in GP, A.	10	261.3	--	.000
8.	Mutual dependence accounted for by GA.	2	4.3	.032	.115
9.	Mutual dependence accounted for by PA.	4	121.2	.901	.000
10.	Total mutual dependence in GPEAM, Y.	322	772.6	--	.000
11.	Mutual dependence accounted for by GY.	2	3.6	.005	.162
12.	Mutual dependence accounted for by PY.	4	10.1	.013	.039
13.	Mutual dependence accounted for by EY.	4	128.3	.166	.000
14.	Mutual dependence accounted for by AY.	4	16.5	.021	.002
15.	Mutual dependence accounted for by MY.	4	4.3	.006	.368
16.	MD accounted for by all 5 main effects.	18	238.3	.309	.000

Legend:
- d.f. · degrees of freedom
- LRX^2 Likelihood-Ratio Chi-Square
- CMPD Coefficient of Multiple-Partial Determination

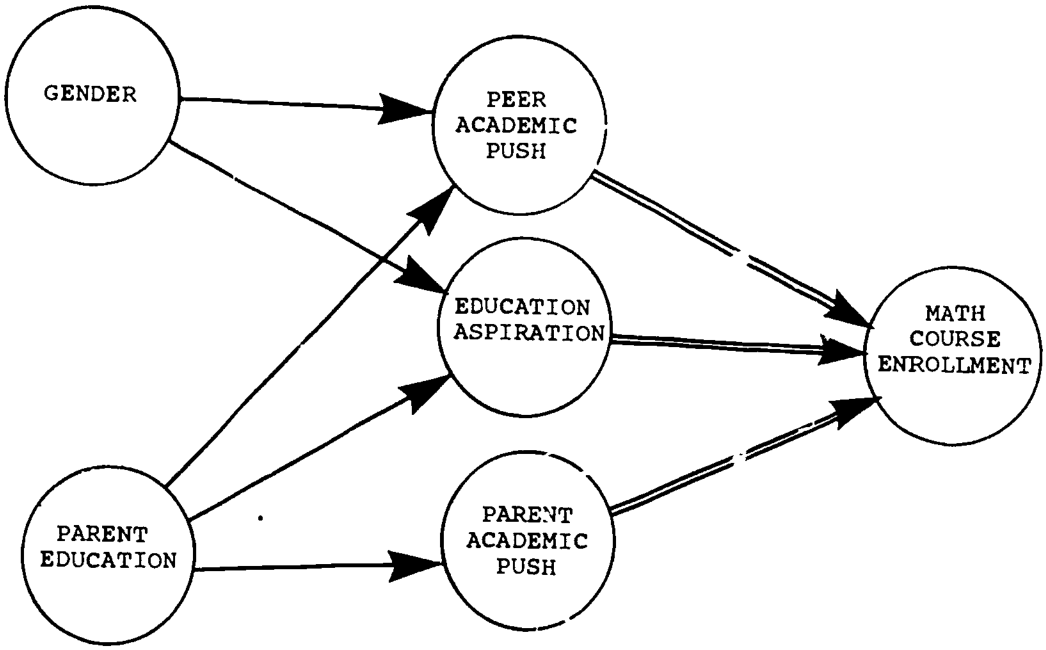

Figure 3: A Path Model to Predict Mathematics Course Enrollment among 10th-Grade Students.

Table 4: Some Logit Models to Estimate the Strength of Selected Paths.

Model	Terms	d.f.	LRX²	CMPD	P
1.	Total mutual dependence in GP, F.	10	82.3	--	.000
2.	Mutual dependence accounted for by GF.	2	52.7	.640	.000
3.	Mutual dependence accounted for by PF.	4	29.3	.356	.000
4.	Total mutual dependence in GP, E.	10	287.7	--	.000
5.	Mutual dependence accounted for by GE.	2	15.3	.055	.000
6.	Mutual dependence accounted for by PE.	4	261.3	.938	.000
7.	Total mutual dependence in GP, A.	10	261.3	--	.000
8.	Mutual dependence accounted for by GA.	2	4.3	.032	.115
9.	Mutual dependence accounted for by PA.	4	121.2	.901	.000
10.	Total mutual dependence in GPEAF, Y.	322	761.8	--	.000
11.	Mutual dependence accounted for by GY.	2	2.9	.004	.230
12.	Mutual dependence accounted for by PY.	4	10.0	.013	.041
13.	Mutual dependence accounted for by EY.	[illegible]	117.5	.154	.000
14.	Mutual dependence accounted for by AY.	4	14.7	.019	.005
15.	Mutual dependence accounted for by FY.	4	21.2	.028	.000
16.	MD accounted for by all 5 main effects.	18	255.1	.335	.198

Legend:
- d.f. — degrees of freedom
- LRX² — Likelihood-Ratio Chi-Square
- CMPD — Coefficient of Multiple-Partial Determination

At this point, it is useful to note that all of the parent and peer push variables have been entered into the preceding models as trichotomous variables. When models are expanded to include five independent variables and a trichotomous dependent variable, the number of cells and the number of degrees of freedom become large. Note in Table 4 that the final model examining the paths from all five independent variables produced 322 degrees of freedom. The expansion of the number of cells reduces the predictive power of the models and increases the requirements for significance. The declining proportion of the total mutual dependence accounted for by student's educational aspiration illustrates this point.

It would be unadvisable to increase the size of the model further. To explore the impact of peer mathematics push, we will substitute it into the preceding model, replacing peer academic push. This procedure will allow us to compare the influence of the two peer variables, holding constant parent academic push and the other variables in the preceding models. The resulting path analysis indicates that both gender and parental education are associated with peer mathematics push (see Figure 4), reflecting the same reasons noted earlier. As with peer academic push, there is a direct path from peer mathematics push to mathematics course enrollment. An examination of the relevant logit models indicates that student's educational aspiration continues to be the strongest predictor of mathematics course enrollment, with peer mathematics push and parent academic push ranking a weak second and third, respectively.

Since both peer academic push and peer mathematics push demonstrated stronger associations with mathematics course enrollment than parent academic push, the parent academic push variable was dropped from the model and both peer variables were entered (see Figure 5). The same procedures were repeated and the results remained essentially unchanged. Student's educational aspiration was the strongest predictor of course enrollment, with peer mathematics push and peer academic push ranking as weak second and third influences, respectively.

In all of the preceding models, gender has had a strong association with the two peer variables and a weak association with student's educational aspirations, but no direct association with mathematics course enrollment. While this is good news substantively, suggesting that the gender difference in participation in advanced mathematics courses is abating, it also suggests that the gender variable can be dropped from the model to allow the inclusion of other variables that do have a direct relationship with course selection. To better understand the relative influence of parent academic push and the two peer variables, gender was dropped from the model and the three push variables that had demonstrated a direct path to course selection were included in a new model.

The revised path model indicated the student's educational aspiration, parent academic push, peer academic push, and peer mathematics push were all directly related to mathematics course enrollment (see Figure 6). An examination of the relevant logit tables indicated that student's educational aspiration remained the best predictor of advanced course enrollment, followed by the two peer variables, with parent academic push a weak fourth influence (see Table 7).

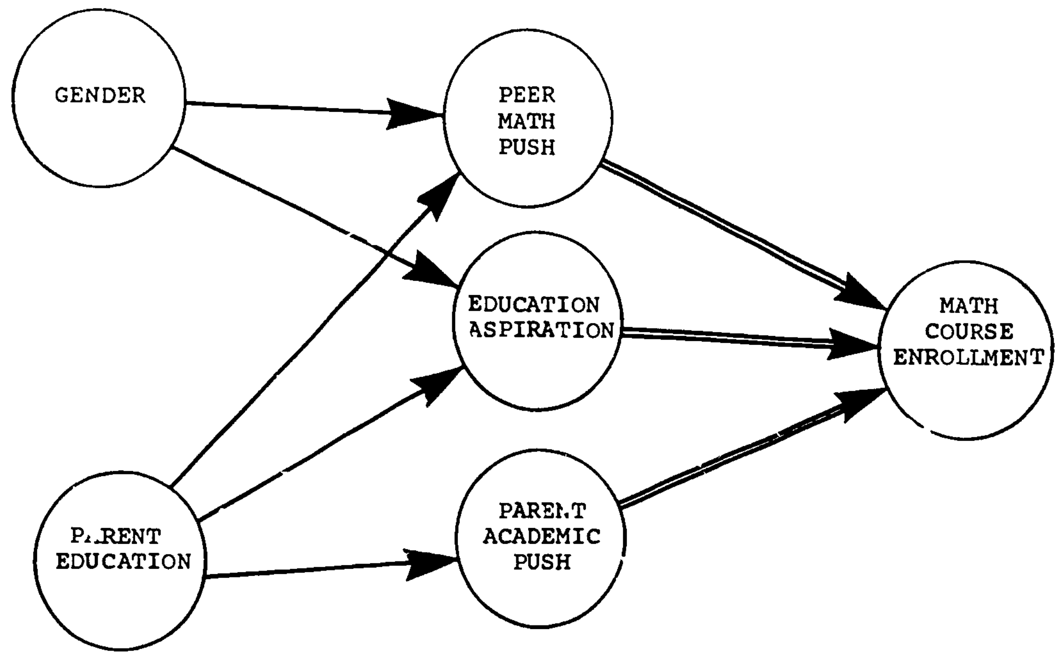

Figure 4: **A Path Model to Predict Mathematics Course Enrollment among 10th-Grade Students.**

Table 5: **Some Logit Models to Estimate the Strength of Selected Paths.**

Model	Terms	d.f.	LRX²	CMPD	P
1.	Total mutual dependence in GP, M.	10	53.2	--	.000
2.	Mutual dependence accounted for by GM.	2	13.7	.258	.001
3.	Mutual dependence accounted for by PM.	4	37.1	.697	.000
4.	Total mutual dependence in GP, E.	10	287.7	--	.000
5.	Mutual dependence accounted for by GE.	2	15.3	.055	.000
6.	Mutual dependence accounted for by PE.	4	261.3	.938	.000
7.	Total mutual dependence in GP, A.	10	261.3	--	.000
8.	Mutual dependence accounted for by GA.	2	4.3	.032	.115
9.	Mutual dependence accounted for by PA.	4	121.2	.901	.000
10.	Total mutual dependence in GPEAM, Y.	322	788.0	--	.000
11.	Mutual dependence accounted for by GY.	2	3.0	.004	.276
12.	Mutual dependence accounted for by PY.	4	11.4	.015	.022
13.	Mutual dependence accounted for by EY.	4	130.5	.166	.000
14.	Mutual dependence accounted for by AY.	4	19.9	.025	.001
15.	Mutual dependence accounted for by MY.	4	28.7	.036	.000
16.	MD accounted for by all 5 main effects.	18	262.7	.333	.000

Legend:
- d.f. — degrees of freedom
- LRX² — Likelihood-Ratio Chi-Square
- CMPD — Coefficient of Multiple-Partial Determination

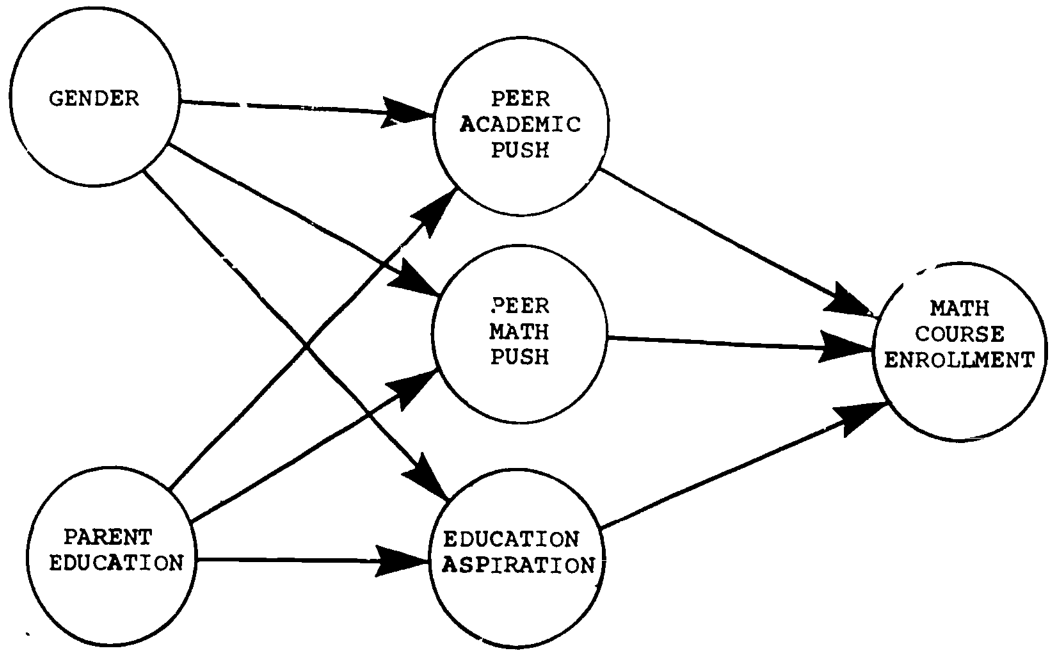

Figure 5: A Path Model to Predict Mathematics Course Enrollment among 10th-Grade Students.

Table 6: Some Logit Models to Estimate the Strength of Selected Paths.

Model	Terms	d.f.	LRX²	CMPD	P
1.	Total mutual dependence in GP, F.	10	82.3	--	.000
2.	Mutual dependence accounted for by GF.	2	52.7	.640	.000
3.	Mutual dependence accounted for by PF.	4	29.3	.356	.000
4.	Total mutual dependence in GP, M.	10	53.3	--	.000
5.	Mutual dependence accounted for by GM.	2	13.7	.258	.001
6.	Mutual dependence accounted for by PM.	4	37.1	.697	.000
7.	Total mutual dependence in GP, E.	10	287.7	--	.000
8.	Mutual dependence accounted for by GE.	2	15.3	.055	.000
9.	Mutual dependence accounted for by PE.	4	261.3	.938	.000
10.	Total mutual dependence in GPFME, Y.	322	760.5	--	.000
11.	Mutual dependence accounted for by GY.	2	.6	.001	.746
12.	Mutual dependence accounted for by PY.	4	12.4	.016	.014
13.	Mutual dependence accounted for by FY.	4	20.4	.027	.000
14.	Mutual dependence accounted for by MY.	4	22.7	.030	.000
15.	Mutual dependence accounted for by EY.	4	126.3	.166	.000
16.	MD accounted for by all 5 main effects.	18	263.2	.346	.000

Legend:
- d.f. — degrees of freedom
- LRX² — Likelihood-Ratio Chi-Square
- CMPD — Coefficient of Multiple-Partial Determination

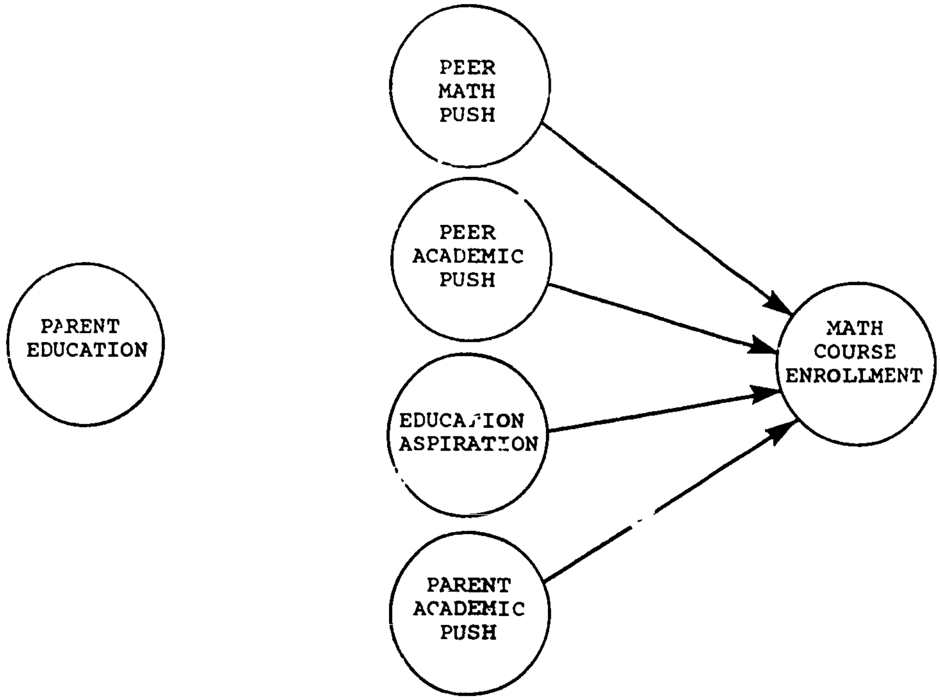

Figure 6: A Path Model to Predict Mathematics Course Enrollment among 10th-Grade Students.

Table 7: Some Logit Models to Estimate the Strength of Selected Paths.

Model	Terms	d.f.	LRX^2	CMPD	P
1.	Total mutual dependence in PMFEH, Y.	484	991.3	--	.000
2.	Mutual dependence accounted for by PY.	4	12.0	.012	.018
3.	Mutual dependence accounted for by MY.	4	26.8	.027	.000
4.	Mutual dependence accounted for by FY.	4	24.4	.025	.000
5.	Mutual dependence accounted for by EY.	4	121.5	.123	.000
6.	Mutual dependence accounted for by HY.	4	15.1	.015	.005
7.	MD accounted for by all 5 main effects.	20	288.2	.291	.000

Legend: d.f. degrees of freedom
LRX^2 Likelihood-Ratio Chi-Square
CMPD Coefficient of Multiple-Partial Determination

It should also be noted that the number of cells in the model has increased markedly, with 484 degrees of freedom in the analysis. The large number of cells in responsible for reducing the predictive power of the model. All of the "push" variables have been entered into the models as trichotomies, but since we are primarily interested in the influences that lead to enrollment in advanced mathematics courses, it would be reasonable to combine the bottom two categories of each of these trichotomies and to significantly reduce the number of cells in the model without damaging the substantive focus of the model.

This final model includes 142 degrees of freedom and provides substantially improved estimates of the relationships in the model. Student's educational aspiration is still the best predictor of mathematics course enrollment, accounting for 29 per cent of the total mutual dependence in the model (see Figure 7 and Table 8). Peer mathematics push has a direct path to course enrollment, but accounts for only four per cent of the mutual dependence. For the first time in any of the models, there is a direct path from parental education to course enrollment, but it is weak, explaining only three per cent of the total mutual dependence.

Conclusions

Substantively, this final model and the preceding analysis suggests that the primary factor (among those included in this analysis) associated with mathematics course selection is the level of education to which a student aspires. This is not news, since "college-bound" high school students have been expected to take advanced mathematics courses traditionally and a high proportion of college-bound students have enrolled in those courses. Peer and parent "push" activities make only minor contributions to actual course enrollment.

This analysis points to the central role of parental education and student's educational aspirations. From this limited model, it appears that the level of parental education is strongly associated with the level of education aspired to by a student, but more analysis needs to be done of the genesis of educational aspirations. The LSAY data identified a small gender association with student's level of educational aspiration and we need to investigate this dimension further.

This analysis is one of a series of base-year examinations that we hope will help us to better understand the dynamics of course and career selection during the middle school and high school years. The narrowing of the gender gap in algebra and geometry enrollments and the absence of any pattern of parental gender differentiation in pushing mathematics are encouraging findings. The smaller proportion of young women who plan to seek a graduate degree and the larger proportion who do not plan to obtain a college degree are less encouraging findings. We will continue to explore these issues and hope to report to you from time to time on our results.

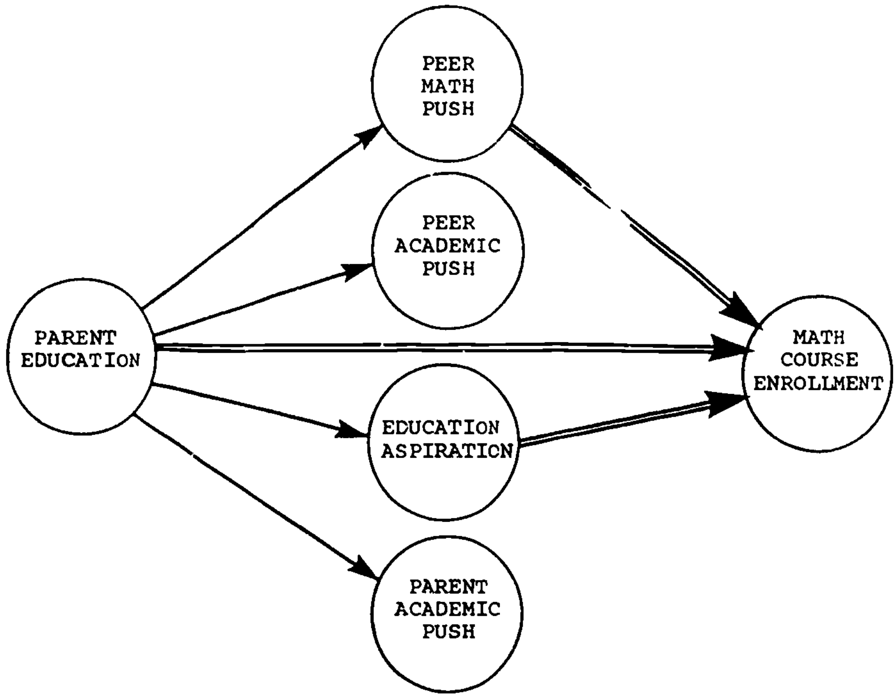

Figure 7: A Path Model to Predict Mathematics Course Enrollment among 10th-Grade Students.

Table 8: Some Logit Models to Estimate the Strength of Selected Paths.

Model	Terms	d.f.	LRX^2	CMPD	P
1.	Total mutual dependence in PMFEH, Y.	142	470.7	--	.000
2.	Mutual dependence accounted for by PY.	4	14.5	.031	.006
3.	Mutual dependence accounted for by MY.	2	19.0	.040	.000
4.	Mutual dependence accounted for by FY.	2	2.8	.006	.247
5.	Mutual dependence accounted for by EY.	4	135.5	.288	.000
6.	Mutual dependence accounted for by HY.	2	6.0	.013	.040
7.	MD accounted for by 3 direct paths.	10	240.4	.511	.000

Legend: d.f. degrees of freedom
LRX^2 Likelihood-Ratio Chi-Square
CMPD Coefficient of Multiple-Partial Determination