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THE EFFECTS OF TEACHERS' EXPECTANCIES AND ATTRIBUTIONS ON STUDENTS' EXPECTANCIES FOR SUCCESS IN MATHEMATICS

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Growing concern has been expressed over the differential participation of boys and girls in high school mathematics courses. Compared to boys, girls elect reduced participation as soon as this option is available to them. It is indisputable that this under-participation has both serious short- and long-term ramifications. Fennema (1976) has argued that the non-election of mathematics courses is the most important cause of sex-related differences in the learning of mathematics. Further, in terms of the future educational and career potentials of women, Sells (1976) has proposed that the avoidance of high school mathematics courses acts as a "critical filter." Because mathematics is a prerequisite for many college majors, limited mathematics background effectively precludes women from entering numerous career areas which include, but are not limited to, those in science and mathematics.

The purpose of the research project discussed in this paper is the investigation of factors that might influence students' decisions to take mathematics when it becomes an option. While we are interested in the processes affecting the participation of both boys and girls in advanced high school math, our *focus* in this paper is on sex differences.

One factor that has been shown to influence course selection is one's expectancy for success (see Parsons, Kaczala, Futterman, Goff, Karabenick, Heller, and Meece, 1979). Research into achievement behaviors and choice has confirmed a link between expectancies for success and both academic behavioral choice and task

persistence (Parsons, et. al., 1979). In addition, sex differences in expectancies for success are frequently found on a variety of tasks--mathematics being one--with girls in most cases having lower expectancies than boys (Parsons, et. al., 1979). The question addressed in this paper is the following: "How are teachers influencing students' expectancies for success in mathematics?"

Effect of Teachers' Expectancies. The effects of teachers' expectancies on their students' performance have been studied extensively since the publication of Rosenthal and Jacobson's *Pygmalion in the Classroom* (1968). While their results have been difficult to replicate, research by Brophy and Good (1974) has shown that teachers' naturally occurring expectancies for the students in their classrooms affect the kinds of interactions teachers have with their students. For example, students for whom the teacher has high expectancies are more likely to have their correct responses praised, are more likely to be questioned repeatedly until they give a correct answer, and are less likely to be criticized than students for whom the teacher has low expectancies. While girls are rated by teachers as being more effective learners and more hardworking than boys, it is the boys who have the *most* interactions of all kinds with their teachers. In fact the boys for whom the teacher has high expectancies also have the most favorable interactions with their teachers; the low expectancy boys are criticized the most, while girls of all achievement levels are treated similarly. Thus, teachers treat girls for whom they have high expectancies in ways that are less facilitative of achievement than the way they treat comparable groups of boys.

Another mechanism that might explain girls' lower expectancies for success has been proposed by Dweck and her colleagues (Dweck, Davidson, Nelson, and Enna, 1978). Their model emphasizes the importance of the types of praise and criticism used by the teacher and its relation to students' academic behaviors. Boys who receive frequent criticism for academic as well as nonacademic behaviors (such as conduct or neatness) can discount these negative evaluations as indicants of their own abilities. Rather, the teachers' criticism of the boys can be interpreted as a characteristic of enduring attitude of the teacher. In contrast, girls receive less criticism than boys, and it is usually not directed to their conduct or other nonintellectual aspects of their work. Criticism is most likely to be directed to the quality of their work. Because it is used quite specifically, this criticism provides more information about girls' levels of ability. The same line of reasoning applies to the use of praise.

As can be seen, it is the proportion of specific to generalized feedback that is important in this model. The teacher need not have differential expectancies for boys and girls to behave in ways that adversely affect girls' expectancies for success. Strong support was found for this model in an observational study of three

fourth and fifth grade classrooms. Less than one third of the criticism directed to boys was contingent on academic performance while more than two-thirds of the criticism directed to girls was aimed at the quality of their work. Boys also received more praise contingent on the quality of their work than did girls. In addition, the teacher was more likely to attribute failure to a lack of effort for boys than for girls.

Based on this research, two questions come to mind: first, are there sex differences in teachers' expectancies for their students in math classrooms? And second, what is the relation between teachers' expectancies, teacher-student interactions, and students' expectancies in math?

With regard to these questions the folowing hypotheses were generated: (a) teachers would give more positive feedback to students in the high expectancy group than to those in the low expectancy group; (b) boys, who have higher expectancies than girls, would receive more indiscriminate criticism (criticism directed toward work, the form of the work and conduct) than girls; (c) girls would receive a higher proportion of criticism on the quality of their work and more indiscriminate praise overall than boys; (d) teachers' behaviors would influence students' expectancies for success; (e) students who received positive feedback would have higher expectancies for success than those who received negative feedback; and (f) teachers' attributions to effort would influence students' expectancies positively.

Subjects of Survey. The subjects in this study included students and their math teachers in eight seventh grade classrooms, and seven ninth grade classrooms. These grades were chosen because previous research had identified the junior high school years as those in which sex differences in attitudes toward math and achievement in math begin to emerge (see Parsons, et. al., 1979 for review).

Students' expectancies and teachers' expectancies were measured by questionnaires. On the student questionnaire, items were divided into those assessing expectancies for familiar tasks and those assessing expectancies for unfamiliar tasks. Previous research has shown that sex differences are more likely to occur in expectancies for unfamiliar tasks. Our results supported this pattern; girls had lower expectancies for future performance (an unfamiliar task). We found no sex differences in the teachers' expectancies for their students, i.e., teachers in general had equally high expectancies for both boys and girls. One sex difference, however, did emerge on the teacher questionnaire; teachers rated girls as having tried harder than they rated the boys.

The observational system used was a modified version of both Brophy and Good's (1969) and Dweck's systems (Dweck, et. al., 1978). Observers coded interactions between teachers and individual students during 10 classroom sessions. The percentages of types of

praise and criticism given to boys and girls did not differ. In addition, there were no sex differences in teachers' attributions to effort.

To answer the question concerning predictors of students' expectancies, stepwise regressions were done to select the variables that best predicted students' expectancies for success. Predictor items included sex of student, most recent report card grade, teachers' expectancies for their students and the most important of the teacher-student interaction variables.

With regard to expectancies for familiar tasks, only teachers' expectancies accounted for a significant amount of the variance (31 percent). For expectancies for unfamiliar tasks, teachers' expectancies and sex of student were significant predictors (21 percent). None of the classroom interaction variables yielded a significant effect.

Contrary to our predictions, teachers did not give more positive feedback to students in the high expectancy group, and boys and girls did not differ in the discriminate and indiscriminate praise and criticism of the quality of their work, the form of their work or their conduct. The only significant main effect of sex on evaluative feedback was the amount of criticism from the teacher directed toward work and toward the quality and form of work combined; girls received less work-related criticism than did boys, and less criticism to the quality plus form of their work. Surprisingly, boys and girls did not differ in the amount of criticism directed to conduct. Classroom interactional measures were not predictive of student expectancies in these analyses.

Teachers' and Students' Expectancies. It is puzzling that teachers' expectancies as expressed on a questionnaire were related to students' expectancies but that their expectancies were not expressed in their behaviors. One reason that teachers' expectancies are related to students' expectancies may be that they are both strongly associated with students' actual achievement. Teachers' expectancies, therefore, do not necessarily reflect a bias by the teachers, but a natural response to the behaviors of their students. This, however, is not the only explanation for the relation between teachers' and students' expectancies. In our study, although the correlation between report card grades and teachers' expectancies was high (r=.66), teachers' expectancies accounted for a significant amount of variance in students' expectancies, even after the effect of report card grades was partialled out.

Interesting evidence concerning the relation between students' achievement and teachers' expectancies comes from other research as well. Teachers have been found to form expectancies early in the school year before they have had the opportunity to become fully acquainted with their students and their capabilities. For

teachers whose expectancies do not change over the school year, their attitudes toward their students are probably based on such things as school records, other teachers' reports, and knowledge of siblings. One longitudinal study, Crano and Mellon (1978), directly investigated the direction of causality between teachers' expectancies and students' achievement through cross-lagged panel analyses. They found that teachers' expectancies were more likely to affect students' achievement than students' achievement were to affect teachers' expectancies. It seems likely therefore, that teachers' expectancies are related to students' expectancies in ways that cannot be totally accounted for by their common association with students' achievement.

In sum, while the proposed relation between teachers' expectancies and students' expectancies was supported, the mediating effects of classroom behavior on expectancies were not demonstrated. The analyses reported thus far, however, were performed on the entire sample. It is possible that the effects of classroom behaviors are dependent on an interaction between teacher style and student characteristics. For example, some teachers may treat boys and girls differently while others may not. By collapsing across all of our teachers, these effects may have been masked, The analyses to be discussed now address this possibility.

Effects of High and Low Sex-differentiation in Classrooms. In order to provide an additional test of possible mediators of sex-differentiated expectancies, we selected from the sample the five classrooms with the largest sex differences in the students' self-reported expectancies and the five classrooms with non-significant sex differences in expectancies. The five low-difference classrooms consisted of two seventh grade classes (one male teacher and one female teacher) and three ninth grade classrooms (two female teachers and one male teacher). The five high-difference classrooms had four seventh grade classes (three male teachers and one female teacher) and one ninth grade class (male teacher). The observational data were reanalyzed using classroom type (high sex-differentiation in expectancies versus low sex-differentiation in expectancies). Since we wanted to compare classrooms, raw frequency rather than standardized scores was used.

As was true for the entire sample data analyses reported previously, most variables did not yield a significant difference. None of the variables predicted by the Dweck model yielded class-type effects. Those effects that were significant were divided into three types: behaviors characteristic of teacher style (teacher behaviors under primary control of the teacher, e.g., use of praise following a correct answer), behaviors characteristic of student style (behaviors under primary control of the student, e.g., student initiated dyadic interactions), and behaviors dependent on both teacher and student style (behaviors requiring interactive responses of both the teacher and students, e.g., total

dyadics).

Clearly, high and low sex-differentiated classrooms differed in the dynamics we observed. Teachers in high sex-differentiated classrooms, in comparison to teachers in low sex-differentiated classrooms, were more critical of work, form and conduct, were more likley to use a public teaching style and less likely to use dyadic interactions, and were more likely to rely on student volunteers for answers rather than directing the class participation by calling on specific children.

Stepwise regressions were performed to determine which behavioral measures best discriminated between the two classroom types. To add generalizability, three stepwise regressions were performed, each using a random 60 percent of the sample. Six variables emerged as significant predictors in all three samples. They are listed in order of importance here: total number of dyadics, total number of open questions (questions that are answered by a student who has raised his hand to be called on), total number of criticism, total number of conduct criticisms, total number of criticisms in teacher initiated response opportunities and total number of work praises.

The effect of the child's sex on student-teacher interaction patterns depended on classroom type. In particular, girls interacted more and received more praise in low sex-differentiated classrooms. Boys, on the other hand, interacted more and received more priase in the high sex-differentiated classrooms. To the extent that teacher praise can be viewed as a reinforcer, these results suggest that participation rates are being increased by teacher praise. These data also suggest that girls' expectancies will be higher when they are praised and when they participate more. Interestingly, the boys' expectancies do not suffer from the attention given to the girls in the low-sex-differentiated classrooms, while the girls' expectancies do appear to suffer from inattention in the high sex-differentiated classrooms.

Teacher Expectancies in Sex-differentiated Classrooms. We next divided the sample into two additional groups: those students for whom the teacher had high expectancies and those students for whom the teacher had low expectancies. In general, we found that both "bright" males and "bright" females (males and females for whom the teachers had the highest expectancies) were treated differently in each of the two classroom types. "Bright" girls interacted the most, answered more questions, received more work and form praise and less criticism in the low sex-differentiated classrooms. In contrast, "bright" boys were accorded the most praise nad interacted the most in the high sex-difference classrooms. "Bright" girls were accorded the least amount of praise of any of the eight groups in the high sex-differentiated classrooms.

One is tempted to conclude that these teachers were avoiding giving their brightest female students the praise they deserved. It isn't that these teachers did not use praise; in fact, their "bright" boys received more praise than any other group.

While our data do not allow for the text of alternative explanations as to what is accounting for this pattern of results, we did consult with several teachers. Two explanations emerged with some regularity. Female teachers explained the pattern by invoking their concern over boys' school motivations coupled with their confidence in girls' motivation. They felt that boys need the most encouragement, especially bright boys who might otherwise go adrift. Bright girls, on the other hand, were felt to be adequately motivated and not in particular need of reinforcements. In contrast to this explanation, some male teachers felt they had to constrain their positive interactions with girls in order to discourage any crushes that the girls might develop. It should be noted, however, that to the extent that this dynamic is indeed influencing the interaction patterns of the male math teachers and girl students, it is more pronounced when the girl student is considered bright by the teacher. Less bright girls are not denied positive reinforcement for their work in these same classrooms.

This sex-differentiated interaction pattern is apparent only in high sex-differentiated classrooms. In low sex-differentiated classrooms, it is the bright boys who are not being praised; this difference, however, can be explained by the low participation rates in general of these boys and by the low frequency of praise used by these teachers.

In concluding, two additional points are important to stress: first, the frequency rates of all these interactive variables are quite low; there is not much interaction between any specific child and the teacher in math classrooms. Second, interactional variables are not as predictive of students' expectancies as are other variables we have measured, e.g., students' sex and teachers' verbally reported expectancies. Consequently, while classroom interactions may be having an effect on children's expectancies, the effects are not large and certainly should not be irreversible.

What happens to bright girls. In summary, girls, especially "bright" girls, are being treated differently than boys in most classrooms. The direction of this difference, however, varies markedly between these two classroom types. In particular, girls are praised less and have lower participation rates than boys in precisely those classrooms in which the girls have lower expectancies for their math performance than do the boys. In contrast, the girls, especially the "bright" girls, are praised more and interact more in the classrooms in which they have equally high expectations for their math performance as the boys.

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CONGRUENCE BETWEEN PROFESSIONAL GOALS, JOB RESPONSIBILITIES AND UNIVERSITY PRIORITIES FOR WOMEN FACULTY IN BIG TEN SCHOOLS OF EDUCATION

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Purpose of the Study. The faculty women members of the University of Michigan School of Education Commission for Women set out to discover whether or not women faculty members of schools of education in our sister Big Ten universities perceived congruence between their own professional goals, their job responsibilities, and the priorities of the universities for which they work. In the process we hoped to help women faculty in these schools and in other schools of education to further their careers in academia.

Source of Data. A 70-item questionnaire was designed by colleagues both within the School of Education and at the Institute for Social Research at the University of Michigan. The questionnaire collected information on demographic variables, professional goals, job responsibilities, and university priorities as perceived by the respondents. Items also covered such topics as the following: previous employment, field of specialization, source of financial support for graduate training, perception of locus of control in decision-making regarding time and task commitments, collegial networks, publications, and membership and participation in professional organizations. Of the 224 questionnaires distributed to all women Assistant and Associate Professors in the Big Ten schools of education, 132 or 58.9 percent were returned.

Description of the Sample. Of the respondents 52.7 percent held the rank of Assistant Professor and 47.3 percent were at the Associate Professor rank. They have been at their present ranks for the following numbers of years: 44.7 percent for less than 3 years, 35.6 percent between four and six years, 13.6 percent for seven to ten years and 6.1 percent for 11 years or more. Of the respondents 52.3 percent are tenured, 37.9 percent are on the tenured track and