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*Child Development*, Vol. 53, No. 2 (Apr., 1982), 322-339.

Stable URL:
http://links.jstor.org/sici?sici=0009-3920%28198204%2953%3A2%3C322%3ASOAAAB%3E2.0.CO%3B2-6

*Child Development* is currently published by Society for Research in Child Development.

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# Socialization of Achievement Attitudes and Beliefs: Classroom Influences

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PARSONS, JACQUELYNNE ECCLES; KACZALA, CAROLINE M.; and MEECE, JUDITH L. *Socialization of Achievement Attitudes and Beliefs: Classroom Influences.* CHILD DEVELOPMENT, 1982, **53,** 322–339. The relation between classroom experiences and individual differences in expectations for future success in mathematics courses, self-concept of math abilities and perceptions of the difficulty of math were investigated in an observational study of 17 math classrooms for grades 5–9. 2 questions were addressed: (1) Does the sex of the student or the teacher's expectation for the student influence the nature of student-teacher interactions? (2) Do variations in teacher-student interaction patterns affect student attitudes? Although few sex differences emerged, girls received less criticism than boys, especially low-teacher-expectancy boys, and high-teacher-expectancy females received less praise than other groups. No support was found for sex differences in teacher discriminant use of praise and criticism. Some support was found for more general sex differences and teacher expectation differences in teacher behavior. Multiple-regression analyses, with the students' past grades used as a control variable, showed that teacher behaviors influence children's attitudes but the effects differ for males and females; for example, self-concept of ability for boys, but not for girls, was predicted by relatively high levels of both teacher criticism and praise. In general, past grades and student-teacher interaction variables accounted for a larger percentage of the variation in boys' attitudes than in girls'. In the second set of analyses 2 types of classrooms were compared: classrooms in which boys and girls had equally high future expectations and classrooms in which boys have higher future expectations. Boys and girls were treated differently in these 2 classroom types. The data suggest that boys and girls have equivalent expectations when the relative distribution of praise and criticism within a class across high- and low-teacher-expectancy groups is similar for both sexes.

## Introduction

The link between achievement expectancies and performance has been amply documented in the achievement literature (see Crandall 1969; Dweck & Bush 1976; Parsons, Ruble, Hodges, & Small 1976). Within this literature females often are found to have lower expectancies than males. This sex difference in expectancies has been suggested as an important mediator of the sex differences we observe in the achievement patterns of adolescents and adults. The developmental origin of this sex difference in expectation has come under recent investigation. For example, Parsons et al. (1976) suggested several ways in which teachers and parents might be perpetuating, if not creating, this sex difference. The research reported in this paper is concerned with the socialization of expectancies in classrooms. While it focuses primarily on student gender differences, it also explores more generally the relation between classroom experiences and individual differences in expectancies.

In assessing socialization processes within classrooms, two separable questions need to be addressed: (1) Are there characteristics of either the teachers or the students that influence the nature of the student-teacher interaction (e.g., does the sex of the student or the expectancy of the teacher influence teacher-student interaction patterns?); and (2) Do variations in teacher-student interaction patterns affect

This research was partially supported by grants from the National Institute of Education, U.S. Department of Education (NIE-G-78-0022), and the National Institute of Mental Health (1 R01 MH 31724-0) awarded to the first author. Grateful acknowledgments are extended to Kirby Heller, who was involved in the development of the observation system and initial data collection, and to the project staff who have been involved with this research throughout. Thanks are also extended to the classroom observers who collected these data and to all the students and teachers who allowed us to observe in their classrooms. Address reprint requests to Jacquelynne Eccles Parsons, Department of Psychology, 3441 Mason Hall, University of Michigan, Ann Arbor, Michigan 48109.

[*Child Development*, 1982, 53, 322–339.  0009-3920/82/5302-0024$01.00]

students' self-concepts of ability and expectations for their own future performance? It is quite possible that a given variable might yield sex differences but be unrelated to students' expectancies. Similarly, it is possible that a variable might yield no significant sex differences but have a strong relation to the expectancies of either boys or girls or both. Both of these questions are addressed in this study. Two additional concerns guided this investigation. First, we assessed the possibility that some teachers might have a potentially depressing effect on girls' expectancies while others might not. Second, in interpreting the meaning of various interaction patterns, we distinguished between those interactional variables that are under the control of the student and those which are under the control of the teacher.

## General Teacher-Student Interaction Patterns and Their Relation to Expectation

Teachers' expectations for their students' performance have been shown to affect not only teacher-student interactions but also student performance (see Brophy & Good 1974; Cooper 1979). Moreover, while teachers do not typically have lower expectations for girls, teacher-student interaction patterns have been found to vary as a function of the sex of the student (see Brophy & Good 1974). While girls are rated by teachers as being more effective learners and more hardworking than boys, boys have the most interactions of all kinds with their teachers. In fact, it is the boys for whom the teacher has high expectations who have the most favorable interactions with their teachers; low-expectancy boys are criticized the most, while girls of all achievement levels are treated similarly to one another. As a consequence, the way teachers treat girls for whom they have high expectations may facilitate achievement less than the way they treat comparable groups of boys.

These findings suggest that teacher-student interaction patterns may be important mediators of the sex differences in expectancies. But the link between teacher-student interaction patterns and students' achievement attitudes (e.g., expectancies, self-concepts of academic ability, and perceptions of task difficulty) has received very little direct attention. The only study which attempted to assess the effects of teacher-student interaction patterns on student expectations (Dweck, Davidson, Nelson, & Enna 1978) failed to test for the relationship directly in the classroom setting. Given the strong relation between expectancies and achievement, those teacher behaviors which vary across types of children and which have been found to be critical mediators of the teacher-expectancy effects ought to be related to student expectations as well. Based on past literature and on our general belief that cognition mediates behavior, two separate sets of hypotheses were generated for the first set of analysis.

### *Hypotheses Relating Teacher and/or Student Characteristics to Student-Teacher Interaction Patterns*

Dweck et al. (1978) predicted and found that the boys in the fourth and fifth grade (a total of three classrooms) received more indiscriminate criticism (criticism focused on conduct and the form of the students' work rather than the academic quality) than girls, while the girls received more indiscriminate praise. This differential pattern of feedback, they argued, should result in girls having lower expectancies than boys. While data from a laboratory study of the feedback patterns supported their suggestion, no attempt was made to test the relation between the feedback patterns and students' expectancies in the classroom. Based on this work, it is predicted that boys will receive more indiscriminate criticism and more ability-relevant discriminate praise, while girls will receive more indiscriminate praise and more ability-relevant discriminate criticism.

Cooper (1979) argued that teachers use praise and criticism to shape student questioning behavior. In particular, he proposed that teachers use criticism to reduce the number of student-initiated questions asked by low-ability children so that the teacher maintains control of his or her interactions with these children. Consequently, it is predicted that teachers' expectations for the students will be negatively related to the amount of criticism given for student-initiated questions.

Based on the work on teacher-expectancy effects (see, e.g., Brophy & Good 1974; Cooper 1979), the following relations are expected to hold: teachers will praise, interact with, and encourage continued responses from high-expectancy (high) students more than low-expectancy (low) students and will criticize "lows" more than "highs"; these differences will be more marked for boys than girls. Consequently, "high" boys will receive more praise and will interact more than "high" girls.

Students who have done well previously should be more confident of their abilities, and consequently should initiate more student-

teacher interactions than students who have done less well in the past.

*Hypotheses Relating Student-Teacher Interaction Patterns to Students' Expectations and Self-Concepts of Ability*

There has been little research directly related to this issue. Most existing teacher-expectancy work has focused on establishing relations between student-teacher interaction patterns and students' academic performance. Consequently, some hypotheses in this section represent what we consider to be logical extensions of the research findings reported in the performance literature. Two hypotheses are taken directly from the work of Dweck et al. (1978). Other hypotheses grew out of our analysis of the possible self-concept-relevant inferences or attributions a student might make from various classroom interaction patterns.

Since causality cannot be inferred from our data set, the hypotheses are stated as relationships rather than causal predictions. But, to the extent that a predicted relationship is not found, the causal relation implied is also called into question. Significant predicted relations indicate a possible causal relation that warrants further laboratory investigation. Nonsignificance suggests that the implied causal relation is not operative in the natural classroom setting even though such relations may have been demonstrated in the laboratory. Our specific hypotheses are listed below.

1. Based on the analysis by Dweck et al. (1978) reviewed earlier, it is predicted that the percentage of total criticism directed at the academic content of one's work will be negatively related to both self-concept of ability and expectations for future performance, while the percentage of total praise directed at the academic content of one's work will be positively related to both one's self-concept of ability and one's expectations.

2. Extending the findings relating teacher-expectancy effects to student performance (see Brophy & Good 1974; Cooper 1979), it is predicted that the following student-teacher interaction variables will be positively related to both students' self-concept of ability and expectations: frequency of interaction, encouragement to continue responding, high praise, and low criticism.

3. Based on general principles of reinforcement, it is predicted that rewarding experiences will have a positive effect on measures of self-concept of ability and expectancies, while punishing experiences such as criticism will have a negative effect. Consequently the frequency of praise one receives, and of being called on, and of being correct should be positively related to self-concepts of ability and expectations, while the frequency of criticism and being incorrect in public responses should be negatively related to self-concepts of ability and expectations. Alternatively, it may be the subjective meaning of the feedback that is more critical. If students are engaging in attributional analyses, then they should interpret teacher feedback in terms of the possible hidden messages regarding the teacher's expectations for them. Consequently, frequency of being called upon, criticism for incorrect answers, sustaining feedback following an incorrect response, and lack of praise for correct response may all convey the message that the teacher expects one to both participate and do well. Conversely, both praise following correct response and low frequency of being called upon may convey the opposite message. Both sets of hypotheses will be tested.

In addition, since students' past performance is related to their current self-concept, to the teacher's expectations regarding their performance, and potentially to the student-teacher interaction patterns, any relations emerging between teacher-student interaction patterns and students' self-concepts could very well reflect the concomitant effect of past performance on both. Thus, analyses will be performed with the effects of past performance partialed out.

### Classroom Type and Its Mediating Role

The possibility that not all teachers have a detrimental effect on girls' expectancies is the focus of our second set of analyses. As Brophy and Good (1974) have pointed out, not all teachers produce expectancy effects in their classrooms. Consequently, we were concerned with identifying a parameter that would allow us to discriminate between those classrooms in which teachers were most likely to have a detrimental effect on girls' expectations and those in which teachers were least likely to have such an effect. The presence or absence of a sex difference in the students' expectations within the classroom is the parameter we chose. In Analysis II, interaction variables that discriminate between these two classroom types, particularly in terms of the treatment of boys and girls, are identified and related to students' expectations. In keeping wtih the results reported by Brophy

and Good (1974), independent comparisons within classroom type are made for children who have been nominated by their teacher as "highs" and "lows." It is predicted that the interactional patterns which vary across these classroom types will differ most markedly for "high" girls and boys.

## Method

*Sample*

The student sample consisted of 428 children from 17 math classrooms in grades 5, 6, 7, and 9. All of these children are included in the descriptive analyses of classroom interactive patterns. Only the 275 children who volunteered (57% of the available population) to complete the student questionnaire are represented in the analyses involving the attitudinal scales taken from the questionnaire. Eight seventh-grade and six ninth-grade classes were chosen since past research has indicated that the early adolescent years might be critical in the formation of sex-differentiated expectancies in math. Three upper elementary school classrooms were included to provide a comparison sample for the Dweck et al. (1978) study. Participation varied across classes primarily due to variations in the individual teacher's commitment to the study.

Given the tremendous variability in teaching styles (Hearn & Moos 1978) across subject areas, observations were made in only one subject area. Math was chosen because it has recently come under intensive investigation due to a fairly clear developmental pattern associated with emerging sex difference in self-expectations, confidence in one's ability, and actual course enrollments (see Parsons, Adler, Futterman, Goff, Kaczala, Meece, & Midgley, in press).

*Instruments*

*Student questionnaire and school record data.*—Students' expectancies, self-concepts of ability, and concepts of task difficulty were measured by questionnaires. The questionnaire consisted of a long series of items each containing a seven-point Likert-type scale anchored at the extremes. Summary scales composed of two or more items were formed using Cronbach's coefficient $\alpha$ as a measure of internal consistency. These scales were then factored using the exploratory factor analysis program designed by Joreskog and Sorbom (1978). Two factors emerged: one related to self-concept of math ability and the other related to perception of the difficulty of math. Since expectancies loaded on the self-concept factor, it is most comparable to the expectancy measures used in past research. However, given both our interest in the determinants of sex differences in expectancies and previous findings suggesting that the sex difference in performance expectations is most marked for future math course or less familiar tasks (Heller & Parsons 1981), the scale composed of the three items asking for expectancies in future math courses and in a math-related career was included as a dependent variable. (Details on these analyses and the specific items used can be obtained from the first author.)[1]

Past grades and performance scores on the Michigan Educational Assessment Program (MEAP) and California Achievement Test (CAT) were obtained from the students' school records. A measure of past performance in math was created using the data obtained from the students' school records. Most recent math grade and any available scores on the MEAP or CAT were standardized within the population as a whole. The mean of the available standardized scores for each student was used as an estimate of past performance. A constant of 3 was added to make all scores positive. In addition to these scales, students were asked to rate how well they thought their teacher expected them to do in math.

*Teacher questionnaire.*—Each teacher filled out a six-item questionnaire regarding each of his or her participating students. Each item was a seven-point Likert-type scale anchored at the extremes. Teacher expectancies for each child were calculated using the mean of two items: "How well will ———— do in advanced math course?" and "How good is ———— at math?" Since the teachers varied in their use of these scales, a second teacher-expectancy score was created by standardizing the initial teacher-expectancy scores within each classroom. This standardized score was used to assign children

[1] The full questionnaire is discussed in more detail in Parsons, Adler, Futterman, Goff, Kaczala, Meece, & Midgley (Note 1), available from the first author. The full questionnaire contained the PAQ and the following six additional constructed scales: a shortened version of the IAR, a measure of sex-role identity, sex typing of the ability of math, utility of math for one's goals, incentive value of math, cost of effort needed to do well, perceptions of parents' use of and liking of math, perceptions of parents' beliefs regarding one's math abilities, and the importance of math.

to the high-expectancy ("high") and low-expectancy ("low") categories: children above the mean in each classroom were categorized as "highs," children below the mean were categorized as "lows."

*Observational system.*—The observational system used was a modified version of those used by Brophy and Good (Note 2) and Dweck (Dweck et al. 1978). Sequences of teacher-student interactions were coded in a variety of settings, such as public question-and-answer periods, student-initiated interactions, and private teacher-student interactions. The observation system focused on dyadic interactions or occasions in which the teacher interacted with a single student. Interactions in which the teacher addressed comments to a group of students or to the class were not recorded. Recordings of interactions included: (1) who initiated the interaction; (2) the type of interaction initiated; (3) the type of response the student gave the teacher; (4) the type of feedback the student received from the teacher; and (5) whether the interaction was public and monitored by the class or was a private interaction between the student and the teacher. In addition, all instances of praise, criticism, and statements of causal attributions for performance were coded. Attributions were coded into the following categories: ability or lack of ability, effort or lack of effort, and task ease or difficulty (84% agreement).

*Procedure*

Trained observers (four females and one male) coded interactions between teachers and individual students during 10 class sessions per class. Coding began after the observers had been in each classroom for three to five sessions familiarizing themselves with the teacher's general style and with the students' names. Observer reliability was assessed for 3 or 4 hours per observer, 1–2 hours taken prior to data collection and 1–2 hours taken approximately halfway through the observational period. The mean percentages of agreement at each day of collection for each observer ranged from 75% to 86% on both an estimate of total agreement and an estimate of the reliability for particular behaviors. Observation was completed in a 2-month period in the spring of 1978.

Questionnaires were administered to both teachers and students in a 2-week period following the observation of each classroom. Student questionnaires were group administered in two 30–40-min sessions. Teachers filled out their questionnaires at home, returning them on a specified date.

## Analysis I

### Results

*Overview of Measures in Analysis I*

Thirty-seven classroom interactional variables were created; 28 represent raw frequency counts. These raw frequency scores were converted to the average number of times each type of interaction occurred each class period that the student was present. (A summary of the raw frequency data and tests of differences in these frequencies between groups of males and females and high-expectancy and low-expectancy students can be obtained from the first author.)

Nine of the variables represent proportions of various types of interaction frequencies. Since proportions can be formed only if the student has a score for the denominator frequency, only students who, in fact, interacted with the teacher have scores for these variables. Since the modal frequency for many of the 28 mean frequency scores was zero, the $N$ for some of these analyses is slightly less than half the total sample.

The 37 observation variables were grouped into three categories: behaviors characteristic of teacher style (teacher behaviors under primary control of the teacher); behaviors characteristic of student style (behaviors under primary control of the student); and behaviors dependent on both teacher and student style (behaviors requiring interactive responses of both the teacher and the student). A list of the variables is presented in table 1.

*Individual Difference Analyses*

To test for sex and teacher-expectancy group differences in interaction patterns at the individual level, analyses of variance with planned paired comparisons were run on each of the 37 interactional variables, on the three student attitudinal variables, and the measure of student's past performance in math. Interactional scores for these analyses are the average number of interactions each student received per class period present. Means for all significant effects are displayed in table 2.

Nine variables yielded main effects for sex. Compared to males, females had lower future expectancies, $F = 5.55$, $p = .019$; believed math was more difficult, $F = 4.10$, $p = .044$; received less total criticism, $F = 8.16$, $p = .005$; work criticism, $F = 6.56$, $p = .011$; and conduct criticism, $F = 6.21$, $p = .013$; had fewer of their response opportunities criticized, $F = 7.00$, $p = .009$; had a smaller proportion of

TABLE 1—Observational Variables with Total Frequencies of Occurrence or Grand Means of Proportions

I. Frequency Variables

| Teacher Style Behaviors | | | Student Style Variables | | | Joint Style Variables | | |
|---|---|---|---|---|---|---|---|---|
| Items | Frequency | N[a] | Items | Frequency | N | Items | Frequency | N |
| Teacher-initiated dyadics[b] | 291 | 155 | Student-initiated procedure questions | 221 | 106 | Total response opportunities[c] | 2,003 | 309 |
| Direct questions[d] | 671 | 224 | Student-initiated dyadics | 1,491 | 321 | Open questions[e] | 950 | 180 |
| Teacher-initiated interactions | 1,078 | 306 | Student-initiated questions | 969 | 199 | Total dyadics | 1,780 | 349 |
| Response opportunities yielding criticism | 672 | 207 | | | | Total interactions | 5,034 | 413 |
| Response opportunities yielding work criticism | 18 | 16 | | | | Affirms[f] | 1,340 | 275 |
| Conduct criticism | 619 | 189 | | | | Negates[g] | 277 | 132 |
| Total work criticism | 41 | 34 | | | | Student-initiated questions yielding praise | 14 | 12 |
| Total criticism | 727 | 219 | | | | Student-initiated questions yielding criticism | 7 | 6 |
| Response opportunities yielding praise | 174 | 92 | | | | | | |
| Response opportunities yielding work praise | 154 | 86 | | | | | | |
| Total work praise | 295 | 137 | | | | | | |
| Total praise | 319 | 141 | | | | | | |
| Attribution statements | 88 | 64 | | | | | | |
| Negates with feedback | 97 | 59 | | | | | | |
| Ask other[h] | 129 | 86 | | | | | | |
| Sustaining feedback[i] | 263 | 154 | | | | | | |
| Negates with sustaining feedback | 36 | 29 | | | | | | |

II. Proportional Variables

| Teacher Style Behaviors | | | Joint Style Variables | | |
|---|---|---|---|---|---|
| Items | Mean Proportion | N | Items | Mean Proportion | N |
| % criticism on work | 6.3% | 219 | % student-initiated questions yielding praise | 1.8% | 199 |
| % interactions yielding criticism | 13.2% | 413 | % student-initiated questions yielding criticism | .8% | 199 |
| % praise on work | 93.0% | 141 | % response opportunities yielding negates | .13% | 309 |
| % interactions yielding praise | 6.5% | 413 | % response opportunities yielding affirms | .64% | 309 |

[a] $N$ = number of students having nonzero frequencies.

[b] Dyadics are private one-on-one interactions.

[c] "Response opportunities" are teacher-initiated questions which can yield right or wrong answer.

[d] "Direct questions" are teacher questions directed at a student who has not volunteered.

[e] "Open questions" are teacher questions directed at a student who has raised his or her hand to volunteer.

[f] "Affirm" is a teacher feedback acknowledging the correctness of an answer.

[g] "Negate" is a teacher feedback acknowledging the incorrectness of an answer.

[h] "Ask other" is a teacher feedback in which the teacher turns to another student for the answer following an incorrect response.

[i] "Sustaining feedback" is a teacher feedback in which the teacher re-asks a question after the student has given a response.

their total interactions criticized, $F = 6.13$, $p = .014$; and asked more questions, $F = 10.84$, $p = .001$, especially procedural questions, $F = 8.74$, $p = .003$. In comparison to males, then, females, on the average, have lower future expectancies, see math as more difficult, receive less criticism, and ask more questions.

Twelve main effects for teacher-expectancy groups emerged. Relative to low-teacher-expectancy children, high-teacher-expectancy children had done better in math in the past, $F = 69.96$, $p = .0000$; had higher self-concepts of their math ability, $F = 95.29$, $p = .0000$; had higher future expectations for success, $F = 47.81$, $p = .0000$; saw math as easier, $F = 46.25$, $p = .0000$; received slightly less work praise, $F = 3.66$, $p = .056$, and total praise, $F = 4.37$, $p = .037$; had a higher proportion of their questions praised, $F = 4.00$, $p = .047$; received less conduct criticism, $F = 4.87$, $p = .028$, and less total criticism, $F = 6.22$, $p = .013$; had fewer of their response opportunities criticized, $F = 5.00$, $p = .026$; received fewer teacher-initiated dyadic interactions, $F = 15.61$, $p = .0001$; and fewer total teacher-initiated interactions, $F = 6.91$, $p = .009$. Of these, four

TABLE 2

MEAN PROPORTIONS FOR SIGNIFICANT PROPORTIONAL INTERACTION VARIABLES, MEAN FREQUENCIES PER STUDENT PER CLASS PERIOD FOR SIGNIFICANT INTERACTION VARIABLES, AND MEAN SCORES FOR STUDENT PERFORMANCE AND QUESTIONNAIRE RESPONSES

| VARIABLES | OVERALL MEAN | FEMALE | | MALE | |
|---|---|---|---|---|---|
| | | Low Expectancy | High Expectancy | Low Expectancy | High Expectancy |
| Mean proportions:[a] | | | | | |
| Teacher style variables: | | | | | |
| % interactions yielding criticism[c] | 13.2% (413)[b] | 11.6% (85) | 9.9% (112) | 16.6% (101) | 14.6% (115) |
| % interactions yielding praise[d] | 6.5% (413) | 8.6% (85) | 4.3% (112) | 6.0% (101) | 7.4% (115) |
| Joint style variables: | | | | | |
| % student-initiated questions yielding praise[e] | 1.8% (199) | 0% (38) | 1.0% (59) | .2% (48) | 5.4% (54) |
| Mean frequencies per child per session present:[a] | | | | | |
| Teacher style variables: | | | | | |
| Teacher-initiated dyadics[d,e] | .08 (426) | .08 (89) | .05 (114) | .13 (103) | .05 (120) |
| Teacher-initiated interactions[e] | .28 (426) | .31 (89) | .26 (114) | .33 (103) | .23 (120) |
| Conduct criticism[c,d,e] | .16 (426) | .12 (89) | .12 (114) | .27 (103) | .13 (120) |
| Total work criticism[c] | .01 (426) | .005 (89) | .006 (114) | .02 (103) | .01 (120) |
| Total criticism[c,d,e] | .19 (426) | .15 (89) | .14 (114) | .31 (103) | .16 (120) |
| Response opportunities yielding criticism[c,d,e] | .17 (426) | .13 (89) | .13 (114) | .29 (103) | .15 (120) |
| Total work praise[e] | .08 (426) | .11 (89) | .06 (114) | .08 (103) | .07 (120) |
| Total praise[e] | .08 (426) | .11 (89) | .06 (114) | .09 (103) | .07 (120) |
| Student style variables: | | | | | |
| Student-initiated procedure questions[e] | .06 (426) | .08 (89) | .07 (114) | .04 (103) | .04 (120) |
| Student-initiated questions[e] | .25 (426) | .29 (89) | .41 (114) | .16 (103) | .16 (120) |
| Student and teacher questionnaire responses and student past performance: mean response: | | | | | |
| Past performance[e,f] | 3.99 (291) | 3.58 (69) | 4.31 (88) | 3.47 (53) | 4.32 (81) |
| Teacher expectancy[e,g] | 4.21 (483) | 3.22 (106) | 5.20 (128) | 3.03 (117) | 5.10 (132) |
| Math ability concept[e,h,d] | 4.91 (286) | 4.33 (60) | 5.12 (92) | 4.32 (52) | 5.47 (82) |
| Task difficulty concept[c,e,h] | 4.47 (285) | 5.00 (60) | 4.31 (91) | 4.84 (52) | 4.02 (82) |
| Future expectancies[c,e,h] | 5.09 (323) | 4.60 (76) | 5.21 (99) | 4.70 (60) | 5.63 (88) |

[a] Based on observations.

[b] $N$ = number of students represented in the proportion or frequency of scale mean.

[c] Significant sex effect, $p < .05$.

[d] Significant teacher-expectancy × sex interaction effect, $p < .05$.

[e] Significant teacher-expectancy effect, $p < .05$.

[f] Based on standardized summary score of past grades and performance on standardized tests.

[g] Based on teacher's rating of each student.

[h] Based on student's self-rating on student questionnaire.

variables (conduct criticism, total criticism, response opportunities criticized, and teacher-initiated dyadic interactions) yielded a significant expectancy group × sex interaction, indicating that the expectancy group effect was significant only for males. In comparison to low-expectancy children, then, high-expectancy children have done better in the past, have higher self-concepts of their ability, see math as easier, receive less total praise but have a higher proportion of their questions praised, and have fewer teacher-initiated interactions.

Six teacher-expectancy group × sex interactions were significant. Both high-teacher-expectancy and low-teacher-expectancy males and low-teacher-expectancy females had a higher proportion of their interactions praised than did high-teacher-expectancy females, $F = 4.86$, $p = .028$. Females in the high-teacher-expectancy group had a lower self-concept of their math ability than did males in the same expectancy group, $F = 3.19$, $p = .075$. Low-expectancy males received more conduct criticism, $F = 4.69$, $p = .031$; more total criticism, $F = 4.48$, $p = .035$; more teacher-initiated dyadics, $F = 5.36$, $p = .02$; and had more of their response opportunities criticized, $F = 4.4$, $p = .037$, than all other groups. Thus, high-expectancy females have lower self-concepts of their ability than high-expectancy males; high-expectancy females have the smallest proportion of their interactions praised; and low-expectancy males receive the most criticism and the most teacher-initiated dyadics.

Since the present sample was predominantly seventh and ninth graders and the sample in Dweck et al. (1978) consisted of fourth and fifth graders, we ran additional ANOVAs for the fifth and sixth graders on the variables derived from the Dweck et al. (1978) hypotheses. None of these were significant. As was true in the total sample, fifth- and sixth-grade boys received more total criticism than girls, $F = 4.93$, $p = .01$, but the discriminant quality (i.e., the proportion associated with the academic content of a student's work rather than conduct or form) of both criticism and praise was equivalent across the sexes.

*Relations between Interactional Variables and Student Attitudes*

Correlations were used to assess relations between (1) observation variables and the students' self-concept, (2) observation variables and the students' perceptions of their teacher's expectancy for them, and (3) observation variables and the teacher's actual expectancy for the students.

Correlations across the sexes and within each sex were used as the initial step in assessing relations between each of the 36 interaction variables and the student self-concept measures. Very few significant correlations emerged. The significant relations are summarized in table 3. The general pattern of relations is similar for boys and girls: high self-concepts of math ability, low ratings of task difficulty, and high future expectancies were related most strongly to the teachers' written expectations even when the effects of past performance were partialed out (partialed $r$ of teacher expectancy to students' self-concept of ability = .43, $p < .01$; to students' rating of task difficulty = −.26, $p < .01$; and to students' future expectations = .26, $p < .01$).

Among the observation variables, work criticism had the strongest and most consistent effect on student attitudes. For both girls and boys high levels of work criticism in public response opportunities and high proportions of criticism associated with academic work were related to high self-concepts of ability, low estimates of difficulty, and high future expectancies. The total amount of criticism received was related to low estimates of difficulty only for girls.

The relation between praise and student attitudes was less clear. A relation between praise and a low estimate of math difficulty was found for all students, but a high amount of praise was related to a high ability concept only for boys. In addition, the proportion of praise focused on work was positively related to ability concept and future expectancies only for boys.

The use and interpretation of student-initiated questions also distinguished girls and boys. Among boys the number of questions they asked related positively to how hard they thought math was, while the number of questions girls asked was unrelated to their estimates of difficulty. A high number of student-initiated questions criticized related to low-ability concept and low expectancies for all students.

To provide additional light on these relationships, we asked the students to give us their estimate of their teachers' expectations for them. If teachers' influences on students' self-concepts are mediated by inferential processes, then there ought to be a relation between the interactional variables and the students' perceptions of their teachers' expectations for them. Significant correlations testing these relations

TABLE 3

ZERO-ORDER CORRELATION MATRIX: OBSERVATIONAL VARIABLES AND TEACHER EXPECTANCY × STUDENT ATTITUDINAL MEASURES

| | TOTAL | | | FEMALE | | | MALE | | |
|---|---|---|---|---|---|---|---|---|---|
| | Math Ability Concept | Child's Future Expectancy | Task Difficulty Concept | Math Ability Concept | Child's Future Expectancy | Task Difficulty Concept | Math Ability Concept | Child's Future Expectancy | Task Difficulty Concept |
| Teacher expectancy | .54** | .39** | −.36** | .46** | .33** | −.32** | .64** | .48** | −.40** |
| Response opportunities yielding work criticism | .16* | .17** | −.16** | .15 | .16 | −.17* | .17 | .17 | −.15 |
| Total criticism | .01 | .04 | −.12 | .06 | .02 | −.21* | −.06 | .01 | .00 |
| % criticism on work | .15 | .14 | −.19* | .17 | .13 | −.22 | .15 | .17 | −.16 |
| Response opportunities yielding praise | .06 | −.01 | −.16* | .00 | −.03 | −.13 | .14 | .03 | −.21* |
| Response opportunities yielding work praise | .09 | .01 | −.17** | .01 | −.02 | −.14 | .19* | .07 | −.22* |
| Total work praise | .11 | .02 | −.15* | .02 | −.05 | −.13 | .21* | .11 | −.16 |
| Negates with feedback | −.16* | −.11 | .13* | −.13 | −.09 | .14 | −.20* | −.16 | .13 |
| % praise on work | .19* | .11 | −.06 | .03 | −.03 | −.00 | .36* | .27* | −.12 |
| Student-initiated question | −.06 | −.04 | −.03 | −.02 | .00 | −.13 | −.14 | −.05 | .20* |
| Student-initiated questions yielding criticism | −.25** | −.19* | .05 | −.31** | −.24** | .04 | −.21* | −.15 | .06 |
| % Student-initiated questions yielding criticism | −.33** | −.28** | .05 | −.39** | −.32** | .04 | −.26* | −.19 | .06 |

* $p < .05$.

** $p < .01$.

are presented in table 4. For both boys and girls, frequency of direct questions and teacher-initiated interactions were positively related to perceptions of teachers' expectancies while the percentage of student questions yielding praise was positively related to perceptions of teachers' expectations for girls and negatively for boys. In addition, total work praise and total praise were both positively related to perceptions of teacher's expectancies for boys only. Interestingly, it is only these last two relations that coincide with the relations existing between the interactive variables and the students' self-concept of ability: praise was related to self-concept of ability for boys only.

The variables relating to students' perceptions of teacher expectancy were not the same variables that related to actual teacher expectancies. For all students, teachers' expectancies were related negatively to the number of teacher-initiated dyadics and to the amount of criticism given. There was no relation between teacher praise and teachers' expectancies.

Since we are most interested in the biasing effect of teacher-student interactions, the variables identified above were entered with past performance into stepwise regression analyses. Past performance, as the control variable, was entered into the analyses at the first step, allowing for the assessment of the magnitude of the effects of teacher-student interaction patterns on each of the three criteria measures over and above the effect of the child's past history of performance in math. Because the sample size and membership fluctuated so markedly as the various proportional variables were added to the analyses, only the mean frequency data items and the two proportional items on which there were data for 90% of the sample were used in these analyses. The independent effects of the other proportional items with significant zero-order effects were tested with partial correlations. In each set of analyses, regressions were run on samples composed of both sexes as well as on samples composed of each sex separately. However, since the frequencies and variance of some of the variables differed in the male and female sample and since the psychological meaning of any of these interaction variables is a function of one's total interactional pattern, no attempt was made to either compare the correlations for males and females directly or to interpret differences in the size of the various correlations. The results of the multiple-regression analyses are presented in table 5.

With regard to self-concept of ability, past performance accounts for the largest share of the variance for both boys and girls. For girls the number of student-initiated questions yielding criticism is negatively related to self-concept; while for boys the number of negates with feedback is negatively related and both the amount of total praise and number of response opportunities yielding work criticism are positively related to boys' self-concept. For the pop-

TABLE 4

ZERO-ORDER CORRELATION MATRIX: OBSERVATIONAL VARIABLES × CHILD'S PERCEPTION OF TEACHER EXPECTANCY AND TEACHER'S ACTUAL EXPECTANCY FOR THE CHILD

| | TOTAL | | FEMALE | | MALE | |
|---|---|---|---|---|---|---|
| | Child's Perception of Teacher Expectancy | Teacher Expectancy for Child | Child's Perception of Teacher Expectancy | Teacher Expectancy for Child | Child's Perception of Teacher Expectancy | Teacher Expectancy for Child |
| Teacher-initiated dyadics | .07 | −.24** | .16 | −.11 | −.01 | −.32** |
| Direct questions | .20** | .13** | .18* | .10 | .22* | .14 |
| Teacher-initiated interactions | .20** | −.01 | .20* | .07 | .20* | −.09 |
| Total criticism | .07 | −.25** | .11 | −.13* | .05 | −.32** |
| Total work praise | .14* | −.05 | .09 | −.04 | .19* | −.06 |
| Total praise | .14* | −.06 | .09 | −.03 | .19* | −.09 |
| % praise on work | .01 | .09 | .02 | −.19 | .00 | .23* |
| % interactions yielding criticism | −.12 | −.19** | −.18* | −.19** | −.07 | −.17* |
| % student-initiated questions yielding praise | −.19* | .09 | .19 | .03 | −.28* | .14 |
| % student-initiated questions yielding criticism | −.08 | −.10 | −.04 | −.12 | −.20 | −.17 |

* $p < .05$.
** $p < .01$.

TABLE 5

SUMMARY OF STEPWISE REGRESSION ANALYSES

| TOTAL SAMPLE ($N$ = 236) | | | FEMALES ($N$ = 127) | | | MALES ($N$ = 109) | | |
|---|---|---|---|---|---|---|---|---|
| Variable[a] | Beta[b] | $R^{2c}$ | Variable | Beta | $R^2$ | Variable | Beta | $R^2$ |
| **Math Ability Concept** | | | | | | | | |
| 1. Past performance | .35 | .16 | 1. Past performance | .23 | .09 | 1. Past performance | .48 | .27 |
| 2. Student-initiated questions yielding criticism | −.18 | .19 | 2. Student-initiated questions yielding criticism | −.24 | .14 | 2. Negates with feedback | −.26 | .30 |
| 3. Response opportunities yielding work criticism | .23 | .22 | | | | 3. Total praise | .21 | .34 |
| 4. Negates with feedback | −.17 | .25 | | | | 4. Response opportunities yielding work criticism | .18 | .37 |
| 5. % interactions yielding praise | .14 | .27 | | | | | | |
| **Future Expectancies** | | | | | | | | |
| 1. Past performance | .28 | .10 | 1. Past performance | .22 | .07 | 1. Past performance | .38 | .16 |
| 2. Response opportunities yielding work criticism | .23 | .13 | 2. Student-initiated questions yielding criticism | −.18 | .10 | 2. Response opportunities yielding work criticism | .21 | .19 |
| 3. Student-initiated questions yielding criticism | −.14 | .15 | | | | 3. Negates with feedback | −.17 | .22 |
| 4. Negates with feedback | −.13 | .17 | | | | | | |
| **Task Difficulty Concept** | | | | | | | | |
| 1. Past performance | −.29 | .08 | 1. Past performance | −.23 | .04 | 1. Past performance | −.38 | .14 |
| 2. Total praise | −.20 | .11 | 2. % interactions yielding praise | −.23 | .08 | | | |
| 3. % interactions yielding criticism | −.14 | .13 | 3. Total praise | −.19 | .12 | | | |
| 4. Negates with feedback | .20 | .16 | | | | | | |
| 5. Response opportunity yielding work criticism | −.20 | .19 | | | | | | |

[a] Listed in order of appearance by step.

[b] Significant at $p < .05$.

[c] Cumulative $R^2$.

ulation as a whole, high self-concept is predicted by high past performance, relatively high proportions of interactions yielding praise, relatively high incidence of work criticism, low incidence of public feedback following a public error, and low incidence of criticism following a student-initiated question. (We include the qualifier of "relatively" because actual incidence rates of both praise and criticism are quite low. Consequently, it would be misleading to suggest that absolutely defined high levels of praise or criticism would produce similar effects.) In combination, past performance and the interactional variables accounted for a higher proportion of the variance in self-concept for boys than for girls.

Mirroring the results obtained for self-concept of ability, high future expectancies are predicted by high past performance, high levels of work criticism in response opportunities, low levels of teacher criticism in response to student-initiated questions, and feedback following public errors. Again these variables accounted for more variance among the boys than among the girls.

With regard to beliefs about task difficulty, past performance again accounts for a large share of the predicted variance for both boys and girls. Both percent of interactions yielding criticism and total praise are negatively related to girls' rating of the difficulty of math. For the population as a whole, the belief that math is a difficult subject is predicted by low past performance, low proportion of interactions yielding criticism, low levels of work criticism and total praise, and relatively high levels of public feedback following an error.

It has been suggested in previous research that the sex difference in proportion of variance accounted is a consequence of a sex difference in the amount of variance on either the predictor or criterion variables. $F$ tests were used to ascertain whether this hypothesis might be a viable explanation for the sex differences we found in the proportion of variance accounted for on the three criterion measures. There were no significant differences in amount of variance on any of the relevant variables.

The partial correlation analyses revealed four additional significant effects when past performance was partialed out. Self-concept of ability was related positively to the proportion of a student's questions yielding praise for girls only, partialed $r = .26$, $p < .05$, and negatively to the proportion of student questions yielding criticism for the sample as a whole, partialed $r = -.22$, $p < .05$. Similarly, for the sample as a whole, future expectancy was related negatively to the proportion of a student's questions yielding criticism, partialed $r = -.194$, $p < .05$, and the belief that math is difficult was related negatively to the proportion of a student's criticism that was focused on work, partialed $r = -.196$, $p < .05$.

## Discussion

### *Relations of Teacher and Student Characteristics to Classroom Interaction*

Student sex was related to student-teacher interaction patterns but not in the manner predicted by Dweck et al. (1978). The nature of the sex differences that emerged largely replicated the findings reported by Brophy and Good (1974): girls as a whole received less criticism than low-teacher-expectancy boys; high-teacher-expectancy girls, in particular, received less praise than other groups. In addition, girls asked more questions than did boys. Low-teacher-expectancy boys got a disproportionate amount of criticism and teacher-initiated dyadic interactions. Other than these few differences, boys and girls were treated similarly. Unlike other studies (e.g., Brophy & Good 1974; Fennema, in press), on the average, the boys and girls in this sample participated equally; low-expectancy boys were slightly more likely to engage in private interactions and girls were slightly more likely to engage in public interactions. But these differences were small.

Teacher-expectancy group effects were also minimal. Teacher-expectancy grouping was related most strongly to both the children's past performance and the children's attitudes: high-teacher-expectancy children had done the best in their past math courses and were confident of their math abilities both in the present and for the future. These results probably reflect the congruence of teacher expectations with a student's past performance rather than the effects of teacher expectations on student attitudes.

While teachers appeared to be treating these two groups of students fairly similarly, when they discriminated they did so primarily between the high- and low-expectancy boys. In support of the prediction derived from the work of Cooper (1979) and Brophy and Good (1974), low-expectancy children, especially boys, received more criticism and had fewer of their student-initiated questions praised than high-expectancy children. Low-expectancy boys

received more teacher-initiated dyadics, as was predicted by Cooper (1979), while low-expectancy females received more praise especially in response to teacher-controlled questioning. Apparently teachers use different control strategies for low-expectancy boys and girls. Teachers act as though they are trying to draw low-expectancy females into public class participation and low-expectancy males into private interactions. But, as noted above, these differences were small.

*Relations between the Interaction Variables and the Student Attitudinal Variables*

Again there was no support for the hypotheses proposed by Dweck et al. (1978). In fact, contrary to what Dweck et al. (1978) had suggested, it was the absolute level of praise and criticism and not their discriminative use (i.e., proportion of criticism and praise directed toward work rather than conduct and form) that was important: higher absolute levels of both praise and criticism directed to the academic quality of one's work were positively related to the self-concept of ability of boys. In the only marginally significant relation between the Dweck et al. (1978) feedback variables and student attitudes, high discriminative use of criticism for work was predictive of the belief that math is easy. Thus, if anything, one would have to conclude that the discriminative use of criticism for academic work has a positive rather than a negative effect on students' beliefs. This conclusion is bolstered by the positive relation between work criticism and self-concept of ability. Together these results lend support to the prediction derived from the attributional perspective (e.g., criticism for work conveys a message of high teacher expectations). However, the low frequency of work criticism must be noted. Our results may be true only when work criticism is used sparingly. As Dweck et al. (1978) had suggested, criticism may have its effect only when it is made more salient by its infrequent and discriminant use. But rather than having the negative effect associated with punishment, as proposed by Dweck et al. (1978), it appears that it is the inferential value of the criticism that is made salient by this pattern of administration.

The positive relation between boys' self-concept of ability and teacher praise supports, in part, the predictions based on the work of Brophy and Good and on the role of reinforcements. Praise, however, was not predictive of girls' self-concepts of ability; instead it was predictive of their belief that math is easy. This variation in the effect of praise on boys' and girls' mathematics attitudes could result from several factors. Teachers may be using praise differently for boys and girls; for example, teacher praise for boys may be associated with teacher expectancies, while for girls it may be administered more randomly. If this were the case, then praise would be a reliable cue of teacher expectancies for boys but not for girls. Data to be discussed in the Analysis II section provide some support for this hypothesis.

Teachers may praise different work behaviors for boys and girls; for example, girls may be praised for easy answers while boys are praised for difficult answers. We have no data to test this hypothesis. Alternatively, teachers may use praise similarly but boys and girls may assimilate this information to different cognitive schema; for example, girls may use praise to infer task ease while boys use it to infer ability. Attributional differences between males and females make this a viable hypothesis. The fact that work praise is unrelated to girls' perceptions of teachers' expectancies but is related to boys' perceptions of teachers' expectancies provides additional support.

Contrary to the predictions based on Brophy and Good (1974), neither frequency of interactions nor encouragement to continue responding (as measured by sustaining feedback and feedback following incorrect response) were related to students' attitudes. In fact, the frequency of feedback following an incorrect response was negatively related to self-concept of ability for boys. Boys in this sample do not appear to respond favorably to feedback following an error.

The effect of teacher's use of praise and criticism on students' self-concept-related attitudes is of particular interest. Use of praise and criticism is under the teacher's control. Teachers use praise and criticism quite selectively, and these data suggest that it is the use of praise and criticism rather than other interactional variables which influence students' self-concepts: praise having a reinforcing effect and work criticism serving as a cue to teachers' expectations. Other variables that are under more mutual control of students and teachers, such as number of response opportunities and whether an answer is correct or incorrect, were not significant predictors of student attitudes.

## Analysis II

To explore the possibility that some classrooms might have especially debilitating effects on females' achievement-related expectancies

and self-concepts, we compared the expectancies of boys and girls within each of two types of classrooms. There was a significant sex difference in expectations in only five of the classrooms (one ninth-grade and four seventh-grade classrooms). The other classrooms varied in the magnitude of the nonsignificant sex differences. The five classrooms (three ninth-grade and two seventh-grade classrooms) with the least sex difference in student expectancies were selected for comparison. Sex of teacher was not included in the analysis since the number of classrooms was so small. Both male and female teachers, however, were represented in each of the two class types.

## Results

Two × 2 × 2 (sex of student × classroom type × teacher expectancy) ANOVAs with planned comparisons were run on each of the 36 interactional variables, on the student attitudinal variables, and on the measure of the student's past performance. Only those interactions which included classroom type were explored in these analyses. As was true for the previous analyses, most variables did not yield significant differences. Neither the past performance measures nor the variables predicted by Dweck's model yielded classroom-type effects. Those differences that were significant are summarized in tables 6 and 7.

Table 6 summarizes the effects for classroom type and the interaction of classroom type with student sex. The sex differences in expectancy in the high-difference classrooms were a function of the girls' expectancies: girls' expectancies were lower in the high-difference classrooms, while boys' expectancies were equivalent in the two classroom types. In addition, these classroom types differed in the dynamics observed. Teachers in high-sex-differentiated classrooms used more criticism and praise, were more likely to rely on public response opportunities, were less likely to rely on more private dyadic interactions, and made more use of student volunteers for answers (open questions) than teachers in low-sex-differentiated classrooms.

The relation between student sex and classroom interactions varied as a function of classroom type. In comparison to boys, girls interacted more and received more praise in the low-sex-differentiated classrooms ($p < .05$ using Tukey HSD test for pairwise comparisons). Boys, on the other hand, interacted more and received more praise than girls in the high-sex-differentiated classrooms.

We next divided the sample into two additional groups: those students for whom the teacher had high expectations and those students for whom the teacher had low expecta-

TABLE 6

Sex × Classroom Type: Mean Frequency per Child per Class Period

| Behavior | Class Type | | | |
|---|---|---|---|---|
| | Low Difference | | High Difference | |
| | Females | Males | Females | Males |
| Teacher style behaviors: | | | | |
| Response opportunities yielding praise[a,b] | .043 | .013[e] | .045 | .085[c,d] |
| Total work praise[b] | .099 | .032[e] | .066 | .121[c,d] |
| Conduct criticism[a] | .089 | .141 | .179[d] | .274[d] |
| Teacher-initiated dyadics[a] | .094 | .092 | .035 | .046 |
| Total criticism[a] | .110 | .164 | .196 | .334 |
| Student style behaviors: | | | | |
| Student-initiated interaction[b,e] | 1.51 | .61[e] | 1.01 | 1.23[d] |
| Student-initiated dyadics[a] | .590 | .375 | .277 | .329 |
| Expectancies[f] | 5.08 | 5.17 | 4.41[d] | 5.24[e] |
| Joint style behaviors: | | | | |
| Total response opportunities[a,b] | .536 | .188[e] | .471 | .842[c,d] |
| Total dyadics[a] | .684 | .467[e] | .312[d] | .375[d] |
| Open questions[a,b] | .314 | .017[e] | .271 | .499[c,d] |
| Total interaction[b] | 1.76 | .80 | 1.20[d] | 1.52[d] |

[a] Class-type main effect significant: $p < .05$.
[b] Sex × class-type interaction significant: $p < .05$.
[c] Sex differences within classroom type significant: $p < .05$.
[d] Classroom-type effect within sex grouping significant: $p < .05$.
[e] Sex main effect significant: $p < .05$.
[f] Scored on a seven point scale with 7 = highest expectancies.

tions. The effects of this division on the relations between student sex and classroom type are tested with the three-way interaction term from the 2 × 2 × 2 ANOVAs described above. Tukey's HSD test was used for pairwise comparisons of interactional variables for which the three-way interactive term was significant. Student *t* tests were used to test for differences between a select set of pairs of future expectancy scores since predictions regarding these differences were made a priori. The results of these analyses are summarized in table 7. In general both high-expectancy males and high-expectancy females were treated differently in each of the two classroom types. High-expectancy girls interacted the most, initiated more interactions, and received more work praise in the low sex-differentiated classrooms. High-expectancy girls received less praise and interacted less than either the high-expectancy boys or the low-expectancy girls in the high sex-differentiated classrooms. In contrast in low-differences classrooms, boys and girls were treated similarly but the high-expectancy boys initiated significantly fewer interactions than the high-expectancy girls.

### Discussion

The sex × teacher expectancy interactions are particularly interesting in the high-difference classrooms where the teacher-expectancy effects follow the predicted pattern for boys only. High-expectancy girls in these classrooms are not treated in the manner predicted by the teacher-expectancy literature. Furthermore, the praise given to the low-expectancy girls in these classrooms does not appear to have the facilitative effect on their future expectation one would expect, even though they are participating more than the other girls. These data suggest that being in a classroom in which praise is used differently for boys and girls has a detrimental effect on all of the girls but not the boys. It is only the girls' expectations that differ across these two classroom types. In the low-difference classrooms, while boys are getting less praise than the girls, the pattern of its distribution across high- and low-teacher-expectancy children is equivalent for the two sexes. In this social climate, there is no sex difference in expectancies despite the fact that the girls are both getting more praise and interacting more than the boys. One cannot infer from these data that praise itself is responsible for the expectancy differences in the two classrooms. Rather, it appears that it is the pattern of distribution of praise across the various subgroups that is critical. Boys and girls have equivalent expectancies when the relative distribution of praise and criticism across high- and low-expectancy groups is similar for both sexes.

## General Discussion

The data from both Analyses I and II taken together clearly indicate that, unlike the old adage, a praise is not a praise is not a praise, and a criticism is not a criticism is not a criticism. The meaning of each appears to be situationally specific and dependent on its communicative meaning. To suggest that teachers should avoid criticism or give praise more freely overlooks the power of the context in determining the meaning of any message. A well-chosen criticism can convey as much positive information as a praise; abundant or indiscriminate praise can be meaningless; insincere praise which does not covary with the teachers' expectations for the students can have a detrimental effect on many students. Praise was positively related to self-concept of ability only in the group (in this case, boys) in which it, in fact, conveys information about the teacher's expectations. Among girls, a group for which the teacher's use of praise did not covary with the teacher expectations, praise was related neither to students' self-concept of ability nor to perceptions of the teachers' expectations. Thus, contrary to what Dweck et al. (1978) suggested, it is not the discriminativeness of praise to one's work that is critical; almost all praise is directed to work. Instead it is the informative value of praise with regard to the teacher's expectations that is critical. If the amount of praise is considered by the students to be a good indicator of the teacher's expectations, then the amount of praise one gets is related to one's self-concept of ability. When it is not a good indicator of teacher expectations, it has no direct relation to one's self-concept.

What role, then, do teachers play in perpetuating sex differences in expectancies? These data suggest that differential treatment is a key factor. The girls had lower expectancies in those classrooms in which they were treated in a qualitatively different manner than the boys; in particular, in those classrooms in which high-teacher-expectancy girls were not praised while high-teacher-expectancy boys were. Further, cross class-type comparisons suggest that providing relatively high levels of praise to the high-expectancy females facilitates the expectations of both high-expectancy and low-expec-

TABLE 7

SEX × CLASSROOM TYPE × TEACHER EXPECTANCIES[a]

| | LOW-DIFFERENCE CLASSROOMS | | | | HIGH-DIFFERENCE CLASSROOMS | | | | GRAND MEAN |
|---|---|---|---|---|---|---|---|---|---|
| | Low Teacher Expectancy | | High Teacher Expectancy | | Low Teacher Expectancy | | High Teacher Expectancy | | |
| | Females | Males | Females | Males | Females | Males | Females | Males | |
| Teacher style behaviors: | | | | | | | | | |
| Praise during response opportunity | .03 | $.02^{x}$ | .05 | $.01^{x}$ | $.11^{Y}$ | $.02^{x}$ | $.01^{x,y}$ | $.12^{X}$ | .05 |
| Total praise for work | .08 | $.02^{x}$ | 12 | $.04^{x}$ | .14 | .05 | $.02^{x}$ | $.17^{X}$ | .08 |
| Student style behaviors: | | | | | | | | | |
| Student-initiated procedure questions | $.05^{x}$ | $.02^{x}$ | $.09^{x}$ | $.04^{x}$ | $.24^{X}$ | $.02^{x}$ | $.03^{x}$ | $.05^{x}$ | .07 |
| Student-initiated interactions | 1.0 | $.69^{x}$ | $1.9^{X}$ | $.56^{x,y}$ | $1.6^{Y}$ | $.88^{x}$ | $.61^{x,y}$ | 1.4 | 1.1 |
| Expectancy[b] | $4.95^{N}$ | 4.98 | $5.28^{M}$ | 5.53 | $3.4^{n}$ | $4.48^{N}$ | $4.70^{m}$ | $5.58^{M}$ | ... |
| Joint style behaviors: | | | | | | | | | |
| Open questions | .15 | $.03^{x}$ | .48 | $.01^{x}$ | .42 | .28 | .16 | $.63^{X}$ | .27 |
| Response opportunities | $.32^{x}$ | $.24^{x}$ | .75 | $.15^{x}$ | .75 | .50 | $.29^{x}$ | $1.1^{X}$ | .51 |
| Total interactions | 1.23 | $1.00^{x}$ | $2.15^{X}$ | $.67^{x,y}$ | $1.85^{Y}$ | 1.15 | $.76^{x,y}$ | $1.75^{Y}$ | 1.33 |

NOTE.—X,Y; x,y: within each row a capital letter signifies a mean which is significantly greater than all means superscripted with a corresponding lowercase letter; significant differences were determined using Tukey's HSD, $p < .01$.

[a] All three-way interaction terms significant at $p < .01$.

[b] Student questionnaire item; scale 1–7, 7 = highest; M,N and m,n: significant differences were determined using a priori $t$ tests at $p < .03$.

tancy girls. Whether this is a causal relation or not remains to be tested.

In concluding, it is important to stress six additional points. First, the frequency rates of all these interactive variables, especially the use of praise and criticism, are quite low. The meaning of any of these variables is undoubtedly tied to the frequency with which it occurs. Changing frequencies markedly may well change the nature of the relation uncovered in this study.

A second, and related, conclusion regarding the potential impact of teachers on children's expectancies needs to be made. Many variables that one would predict as important mediators of teacher effects did not emerge as significant primarily due to their low frequency. We did not see teachers making attributions, stressing the significance of math for one's future, or actually involving children in the more enjoyable aspects of math. Casserly (Note 3) has documented the importance of these last two variables in creating a more positive attitude toward math. Dweck (1975) demonstrated the potential impact of attributional retraining on children's expectancies. Thus, while our data suggest that teachers are not having a big effect on girls' achievement attitudes, they might well have a positive effect if they included these strategies in their teaching styles.

Third, the interactional variables are not as predictive of students' self- and task concepts as are other variables we measured (e.g., students' past performance and teachers' expectancies). As has been argued by Brophy and Good (1974) and others, the interactional patterns do not have big effects on student outcome measures. Much of what is going on is noise. But teachers' expectations do have an effect independent of the students' past grades. These effects must be mediated by processes more subtle than the interactional variables we observed.

Fourth, the variables we chose to study account for less variance in girls' self-concepts of ability than boys'. In part this may be a function of the lower information value of teacher behaviors for girls. But in part it is also a function of the lower predictive value of past performance. Why this might be true is not apparent in our data. But it is clear that we need additional studies to identify the factors that do determine girls' expectations and self-concepts. Our findings do not support the suggestion that girls' expectancies, while lower than boys', are more accurate than boys' (cf. Crandall 1969; Fennema, in press). They are, instead, more unpredictable.

Fifth, the effects of classroom type may be mediated by the general social climate in the classroom rather than by the direct effects of one-to-one teacher-student interactions. Social climate is a function of both the teacher and the set of students in each particular class. Consequently, while classroom interactions may be having an effect on children's expectancies, the effects are not large and are, in part at least, a function of the children as well as the teacher.

Sixth and finally, if these data tell us nothing else, they highlight the necessity of assessing hypotheses regarding teacher effects on students' expectancies in the classroom as well as in the laboratory. Causal relations which emerge with clarity in the laboratory (e.g., Dweck et al. 1978) do not necessarily hold in the hustle and bustle of real classroom life. And intervention procedures designed on sound laboratory-based reasoning may backfire in the schools.

## Reference Notes

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