Test Anxiety: A Major Educational Problem and What Can Be Done About It

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The Elementary School Journal
Volume 85, Number 1

0013-5984/85/8501-0008$01.00

This paper is concerned with the educational problem of evaluation anxiety and what can be done to eliminate its interfering effects in the school setting. Our discussion is organized around a series of questions about anxiety, such as, What is anxiety? Whom does it affect? and What can be done about it? The discussion concentrates primarily on Hill and his colleagues' long-term program of research on evaluation anxiety in children. This work began with basic research investigating the causes and consequences of anxiety and has evolved into collaborative intervention studies with school staff that are attempting to improve anxious children's positive motivation and performance in different evaluative school settings. Of course, other relevant work will be presented as well. Section I begins with an overview of the problem of anxiety in school; in section II solutions to the problem are discussed.

I. The problem of anxiety

Anxiety: its nature and importance

There is growing evidence that motivation has a significant impact on school achievement (for a review of studies documenting this relationship, see Walberg & Uguroglu [1980]). Various lines of research, such as S. Sarason, Davidson, Lighthall, Waite, and Ruebush's (1960) work on anxiety in children, Atkinson and his colleagues' work on achievement motivation (Atkinson 1964, 1980; Atkinson & Feather 1966; Atkinson & Raynor 1974), Zigler's studies of motivation and testing (Zigler, Abelson, & Seitz 1973), Weiner's and Covington's research on achievement attributions (Weiner 1972, 1979; Coving-

ton & Omelich 1979), and Dweck's work on learned helplessness (Dweck & Goetz 1978) identify motivational dynamics that negatively influence achievement. As many children become older, motivational factors may exert as much influence on their school performance as do cognitive skills and abilities.

Test anxiety is one of the most important aspects of negative motivation and has direct debilitating effects on school performance. Dusek (1980, p. 88) defines test anxiety as "an unpleasant feeling or emotional state that has physiological and behavioral concomitants, and that is experienced in formal testing or other evaluative situations." Although most students experience some occasional anxiety when evaluated in different situations and areas, we are primarily concerned here with test anxiety as a relatively stable predisposition in evaluative situations (see Hill 1980). Different theorists believe that such test anxiety emerges for some children during the preschool or elementary school years, when parents begin to make unrealistic demands or hold overly high expectations for their children's performance. The parents then react negatively to their children's failure to meet their expectations, and the children in turn become fearful of evaluation in achievement situations and overly concerned about adult reaction to their academic successes and failures (see Hermans, ter Laak, & Maes 1972; Hill 1972, 1980; S. Sarason et al. 1960).

As children progress through the elementary school years, other factors create or enhance evaluation anxiety. In school, children experience increasingly formal, complex, and frequent evaluation, which they often cannot cope with effectively (Hill 1980). At about the second grade, children begin to compare their performance with other children, which can lead to competition and pressure to do better than most others. Obviously, only a few children can excel when such comparative standards are used to judge classroom performance. During the middle and later elementary school years, students receive more feedback about and become better able to judge their ability, both absolutely and compared with others (Nicholls 1976). These factors increase the anxiety of many children, especially those not doing well or as well as they would like. Most students in many schools may wish to rank in the top part of their class (e.g., at the elementary school level, to attain "high grades" or "mostly A's") because of parental, peer, or self-induced aspirations and expectations. This will place many students under strong pressure to achieve at a higher level than they can, resulting in strong anxiety dynamics (Hill 1980). In our highly competitive educational system and society, this pressure increases with age, which may account in good part for the increasingly strong debilitating effects of evaluation anxiety across the elementary and secondary school years (Hill 1980, 1984).

Hill (1972, 1980) discusses some of the motivational consequences of anxiety. Building on the theoretical work of Atkinson (1964), Atkinson & Feather (1966), and S. Sarason et al. (1960), he argues that anxious children are more sensitive to failure and react more to evaluation from adults than low-anxious children. More specifically, high-anxious children have strong motives to avoid criticism and failure because they fear negative evaluation. In contrast, low-anxious children are relatively more motivated to approach success and obtain praise since they do not have as much fear of failure. These different motivational patterns have important behavioral consequences. Low-anxious children are more likely to choose, persist in, and enjoy the challenge of evaluative situations, be less concerned with adult reaction to their performance, and strive to do well on relatively difficult tasks. In contrast, high-anxious children try if possible to avoid highly evaluative situations, are overly concerned with parents' and teach-

ers' evaluations of their performance, and choose, persist, and do better on easy tasks in which success is more certain (see Hill 1972, 1977). Thus, anxious children will not show optimal performance in test and other evaluative school situations as a result of the interfering effects of anxiety.

Other theorists (e.g., Dusek 1980; Liebert & Morris 1967; I. Sarason 1972, 1975; Spielberger 1972; Wine 1971, 1980) discuss cognitive aspects of anxiety. Wine (1971, 1980) reviews research on the effects of anxiety and argues that many performance differences between high- and low-anxious persons are because of attentional differences; high-anxious persons are overly self-preoccupied and hence do not focus adequately on the task at hand, whereas low-anxious persons are more task focused. Wine cites numerous studies that show that high-anxious adults have more task-irrelevant thoughts than low-anxious adults (e.g., Mandler & Watson 1966; I. Sarason & Stoops 1978). These task-irrelevant thoughts often involve excessive preoccupation with negative personal characteristics (Doris & Sarason 1955; I. Sarason & Glanzer 1962, 1963; I. Sarason & Koenig 1965). Such task-irrelevant, self-deprecatory thinking is especially likely when tasks are introduced as tests of ability (see I. Sarason 1973, 1975).

Several studies show that anxious children also have difficulty attending to relevant task information. Nottelmann and Hill (1977) observed fourth and fifth graders as they performed an anagrams task. High-anxious children were off task more and asked fewer task-related questions than low-anxious children. High-anxious children also performed less well, and their difficulty staying on task was probably an important reason why.

Dusek, Kermis, and Mergler (1975) and Dusek, Mergler, and Kermis (1976) found that high-anxious children attended less well to the central stimuli in a position-learning task and thus performed more poorly than low-anxious children. Instead of focusing on the central stimuli, high-anxious children were more distracted by the nonessential (or incidental) stimuli in the task. The performance differences between the high- and low-anxious children in the study increased across the age range studied (second through sixth grade). However, when high-anxious children were given an encoding strategy that helped them focus on the central stimuli, they showed optimal performance, doing as well as low-anxious children.

Anxiety, then, interferes with performance in situations in which evaluative pressure leads some individuals to become overly preoccupied with the possibility of failure and concerned about possible negative reactions of adult evaluators. Such situations are common in most elementary and secondary classrooms; examples are classroom tests, standardized achievement tests, reciting to the teacher or before the class, and new or difficult learning situations.

Furthermore, several recent educational trends are likely to increase anxiety among school-aged children. One is the push for minimal competency testing now required in some form in two-thirds of the states. As the consequences of test performance assume a more important role in school, such as determining whether a child is promoted to the next grade (or eventually receives a high school diploma), children will experience strong apprehension about evaluation, and as a result many of these students will do even less well (Hill 1984). Similarly, the increased use of test scores to evaluate educational programs and greater public pressure for high levels of skill learning and achievement in schools create a more pressure-laden atmosphere. This pressure also should result in more children experiencing strong debilitating anxiety. If these trends continue, the problem of anxiety may become even more serious over the next few years. Before we describe in more detail the debilitating effects of anxiety on performance in evalu-

ative situations, we will first briefly discuss how anxiety can be measured.

Measuring anxiety

Anxiety traditionally has been measured by student self-report questionnaires. The most widely used measure for children is the Test Anxiety Scale for Children (TASC) developed by S. Sarason et al. (1960). This 30-item scale measures anxiety about test performance (e.g., "Do you feel nervous while you are taking a test?") and classroom performance ("Do you think you worry more about school than other children?"). S. Sarason et al. (1960) also developed a defensiveness measure, the 11-item Lie Scale for Children (LSC), to control for the possibility that some children are unwilling or unable to report anxiety. An example of an item on this scale is, "Do you ever worry?" Hill and Sarason (1966) showed that highly defensive children report less anxiety but perform much like high-anxious children. Boys are more likely to be defensive, while girls are more likely to admit anxiety. When both measures are used, anxiety effects are equally strong for boys and girls (Hill & Sarason 1966).

Feld and Lewis (1969) revised the TASC into a positively worded format so that questions ask children how relaxed they are about tests (e.g., "Do you feel relaxed while you are taking a test?"). They also factor analyzed children's responses to the TASC-Rx, finding that four major factors best described the responses. These factors concerned specific worry about tests, physiological reactions to evaluative pressure, negative self-evaluation, and worry about school while at home. These findings show that different children will report (and experience) anxiety in various ways. Both the TASC and TASC-Rx have been found to be reliable and valid measures of anxiety (Feld & Lewis 1969; Hill 1972, 1980). However, school personnel often prefer the positive wording of the TASC-Rx.

Harnisch, Hill, and Fyans (1980) developed a seven-item version of the TASC-Rx, called the Test Comfort Index (TCI), that has been shown to be a reliable and valid measure of anxiety. These researchers analyzed a statewide random sample of 7,000 students in Grades 4, 8, and 11. They correlated responses to each item on the TASC-Rx with the total score and selected the items with the highest correlations for the TCI. Most of the items come from the test-worry factor defined by Feld and Lewis (1969). The TCI is quick and easy to administer and is worded positively. School personnel find it to be a particularly satisfactory measure (see Hill 1984).

Other measures are useful in assessing negative motivation. Research on the attributions or reasons individuals give for success and failure indicates that attributing success to ability and failure to lack of effort relates to positive achievement motivation. In contrast, attributing failure to lack of ability and success to luck or the task being easy relates to negative achievement motivation as well as to poor achievement in school (see Weiner 1972, 1979). Dweck (1975) and Fyans (1979) found that high-anxious children tend to follow the negative attribution pattern just discussed; hence, assessing attributions for success and failure is a good way to supplement the identification of children experiencing test anxiety.

In our current research efforts, teacher ratings as well as student responses to anxiety questionnaires are used as a way of assessing anxiety. Teachers rate the positive motivation of each child in their classrooms, whether the child is test anxious, and whether the child has good test-taking skills. Such ratings can be used as a check on students' self-reports of anxiety, to conjointly identify anxious children, or simply to determine which children teachers are concerned about regarding evaluation anxiety. Given recent concern over the use of personality scales to distinguish groups (Nicholls, Licht, & Pearl 1982), it is desir-

able to use several measures to identify children experiencing negative motivation. All the measures just discussed can be used quite easily in the classroom.

Children affected by anxiety

Considerable research has assessed the relationship between children's test anxiety and their test and school performance. In a 5-year longitudinal study of about 700 elementary school children from middle- and working-class backgrounds, Hill and Sarason (1966) found that the negative relationship between test anxiety (TASC) scores and achievement test scores increased steadily across the elementary school years. In first grade, the relationship between the two measures was negligible. At third grade, the correlations were statistically significant but modest, averaging −.25. By fifth and sixth grades, the correlations were moderate and highly significant, reaching −.45. TASC scores also related negatively to IQ test scores, school report card grades, and failing to be promoted to the next grade. The negative relationships were obtained for both boys and girls, though the TASC detected most findings for girls, while the TASC and LSC together did so for boys. These results clearly show that test anxiety and performance in evaluative situations are related in a strong and negative fashion.

More recently, analysis of a statewide data set shows that this relationship is even stronger among junior high and high school students, with the correlation between TCI scores and achievement test scores reaching .60 by eleventh grade (Fyans 1979; Hill 1979; the use of the positively worded TCI transposes the sign of the correlation coefficient). Willig, Harnisch, Hill, and Maehr (1983) further assessed the relationship between test anxiety and test performance in a study of black, white, and Hispanic late-elementary and junior high school students. Results indicated a strong negative correlation between test anxiety and performance in all three groups (see Hill 1980). Negative success-failure attributions also correlated negatively with achievement test performance, most strongly for the black students.

In sum, various studies show that test anxiety and other forms of negative motivation are a problem for children from a variety of ethnic backgrounds, for both boys and girls, and for middle- and working-class children—in short, for children from all major sociocultural groups in our society.

The issue of causality

The issue of causality in the relationship of anxiety and performance is a complex and important one (see Hill 1972). Does a high level of anxiety cause students to be unable to demonstrate what they know, or is it that students who perform poorly become anxious in evaluative situations? One way to assess this issue is to give tests in different ways to see if anxious children's performance can be improved. If anxious children immediately do better under optimal testing conditions, then it can be argued that they do know the material, and their anxiety is what is causing them to do poorly in standard testing situations. If their performance does not improve, then it is more likely that their poor mastery of the material is what is leading them to be anxious.

In section II we will present evidence that indicates that anxiety is the major causal factor in the anxiety-performance relationship (see also Hill 1984). In the studies presented in section II, testing conditions were changed, and high-anxious students performed much better in optimizing conditions than they did under standard conditions, often doing as well as low-anxious students. These findings indicate that anxious children often know the material, and their performance mostly is constrained by negative motivational dynamics resulting from evaluative pressure. As children become older, however, high

anxiety and low performance increasingly occur together (Hill & Sarason 1966) and may influence each other in a cyclical fashion (Hill 1972). We will argue that for valid assessment of anxious children's learning and achievement, testing conditions should be changed so that anxious children can demonstrate what they do indeed know. We will return to these points in section II.

Strength of anxiety's effects

One way to answer this question is to refer to the correlational evidence just presented; correlations ranging to (−).60 indicate that anxiety has a strong negative relationship to performance in evaluative situations. Using a group research design, Hill and Sarason (1966) compared the performance of the 10% most anxious fifth and sixth graders in their sample with that of the 10% least anxious. The high-anxious children were over a year behind national norms and the low-anxious children a year ahead in reading and mathematics basic skills performance. The achievement test performance levels of these two groups showed almost no overlap. High-anxious children also were twice as likely not to be promoted and received much lower report card grades. This evidence indicates that high-anxious children perform quite poorly in school relative to their low-anxious peers (see also Hill 1984).

Another way to determine how strong the effects of anxiety are is to consider the number of students seriously affected by the problem. Using Hill and Sarason's 10% extremes for extrapolation suggests that two or three children in a typical classroom are highly anxious and perform quite poorly in evaluative situations. Nationwide, this means approximately 4–5 million children in elementary and secondary schools experience strong debilitating evaluation anxiety. Hill and Sarason's results also suggest that an additional 10%–15% of the children in a classroom likely experience significant anxiety, meaning that they too would experience difficulty in evaluative situations. This adds at least another 5 million students nationwide for a total of about 10 million elementary and secondary school students. Clearly, anxiety is a widespread educational problem that requires attention.

Generality of anxiety effects

Most of the evidence we have reviewed so far pertains to the relationship between anxiety and performance in evaluative school situations, such as on standardized achievement tests, classroom tests, and report card grades. We believe this relationship would be obtained, perhaps even more strongly, on other kinds of tests in school such as minimal competency tests (see Hill 1984).

Other evidence indicates that anxiety relates to performance in many different evaluative situations. Hill (1972) reviewed studies showing how anxiety influences performance on a wide variety of experimental tasks. Generally, these studies indicate that, when anxious children perform tasks under evaluative pressure, they do less well than low-anxious children. For instance, Stevenson and Odom (1965) showed that high-anxious children did less well than low-anxious children on a concept-formation task, because their anxiety interfered with their ability to remember the concepts. Anxious children also do poorly compared with low-anxious children when they are asked to perform quickly (S. Sarason et al. 1960) or when the task is introduced as a test of ability (Barnard, Zimbardo, & Sarason 1961; Lekarczyk & Hill 1969; McCoy 1965). Other work shows that anxious children tend to work very cautiously in many evaluative situations (Ruebush 1963) and perform less well when an adult observer is present (Cox 1966, 1968). Low-anxious children are less affected by these manipulations; if anything, they perform better with some evaluative pressure. However, high-anxious children sometimes perform better than

low-anxious children if the task is introduced in a nonevaluative way (Barnard et al. 1961; McCoy 1965; see also Brockner [1979] and I. Sarason [1972, 1975] for similar findings with adult high- and low-anxious individuals). This experimental work indicates that evaluative pressure contributes greatly to performance differences between high- and low-anxious children. We will return to this point when we discuss our work on optimizing testing.

To summarize this first section, we have reviewed evidence suggesting that evaluation anxiety is an important educational problem, one that affects millions of children nationwide. Anxiety increases in strength across the school years, affects children from all major socioeconomic and ethnic groups, and relates to performance on the most significant measures of school achievement and progress. The crux of the problem is that, in evaluative school situations, anxious children do not perform up to their capabilities; thus, measures such as standardized achievement tests and report card grades underestimate these children's achievement, skills, and learning. In the second section, we will discuss some educational solutions to the problem of debilitating test anxiety that we have been developing in a series of collaborative school-university research projects carried out in recent years.

II. Educational solutions to anxiety

The broad goal of our research program is to develop new school evaluation procedures and teaching programs that help all students develop positive motivation and self-confidence and show optimal learning and performance in evaluative situations. Most of the studies to be discussed in this section are school intervention studies. The research involves a close collaboration with teachers, principals, school district administrators, and state education agency officials. This collaboration has been essential to the development of the new testing and teaching practices. Before we describe the studies, we will discuss the collaborative school-university research model in more detail.

The collaborative school-university research model

There are a number of ways in which our research projects are collaborative efforts. Teachers and other practitioners have been involved in the planning and implementation of all of the educational intervention projects. For instance, staff at both elementary and junior high schools were interested in changing their report card grading systems, projects that are described in more detail below. The staffs at the participating schools were involved with our research staff in all phases of the reporting system change projects, from initiating and designing the changes to participating in the evaluation of the change. Parents at the schools were also involved in the evaluation of the changes.

Similarly, in our testing and teaching intervention studies described below, teachers helped design changes in testing procedures and played a major role in developing, refining, and implementing classroom teaching programs dealing with test-taking skills and test motivation. The staff at one elementary school have been particularly involved in this latter project, joining our research staff in meetings throughout the school year. Over the summer, the teachers developed hundreds of items to use as part of classroom teaching programs to help children learn to cope with the pressures of testing. Teachers also spent many hours developing the original lesson plan and refining the full 10-session teaching program.

We also are working closely with school district and state education agency officials. We plan to implement the classroom test-taking skills program districtwide in the coming years, and the strong support of the district administrators and building principals, as well as teachers, is essential to do so. At the state level, we are working

with state education officials to develop motivational indexes to identify students with test-taking problems. Also, state officials are interested in implementing short forms of the classroom test-taking skills program in a statewide testing programs.

What we are doing, then, is advancing our knowledge about the problem of evaluation anxiety as we implement and validate changes in school evaluative practices that school personnel believe will help their students. Teachers' and other practitioners' knowledge of students and the classroom situation is an essential part of designing workable solutions to the problem of evaluation anxiety. Full collaboration with school personnel has been essential in all of our intervention research and will continue to be so. We will begin our discussion of the collaborative intervention studies with the projects dealing with report card grades.

Changing report card grades

Report card grades are, of course, one of the most important ways of documenting students' progress in school. Though most of the work on evaluation anxiety has focused on anxiety and test performance, Hill and Sarason (1966) found that anxiety correlated significantly and negatively with report card grades as well. Traditional letter grades can have a negative impact on many children's motivation in school (see Hill 1977; Hymel 1981). For instance, letter grades may promote excessive competition among students, especially when a normative grading system is used. As noted earlier, social comparison may become a problem by the middle elementary grades, since students are very likely to compare their grades among themselves by then (see Ruble 1980).

Parents may view children's report card grades in a comparative manner, too, wishing for high grades because it means their children are doing better than others. If three-quarters of the parents in a school define success as their children being in the top quarter of their class, then most children will not feel they are successful. Worse, parents or the students themselves may push for a higher level of accomplishment (as indicated by report card grades) than is realistic or possible. Since report card grades have such an important impact on children's future plans and possibilities, many children will become overly concerned when their grades do not meet their (or their parents') expectations. This concern could be translated into anxiety about doing poorly in school, in spite of a fairly high actual level of performance.

Single A-B-C-D-E grades for each subject also provide little diagnostic information and likely reflect teachers' evaluations of students across several dimensions, such as their learning, effort, persistence, and conduct. As Hill (1977, p. 19) states, "Single letter grades may be misleading. For example, an 'A' grade may reflect less than optimal learning for a very bright child while a 'C' grade might fail to give credit to a child who is working very hard but not doing well in learning activities." These concerns that grades may be misleading, that children may not be receiving credit for their effort, and that there may be too much competition and pressure for high grades were the main reasons staff at the collaborating schools wished to change their grade reporting system. These concerns are similar to those of many motivation theorists who argue that judging children only on their ability will lead those children who are trying hard but still not doing well to give up (e.g., Covington & Beery 1976; Covington & Omelich 1979; Dweck & Goetz 1978; Fyans 1979; Nicholls 1979).

The first report card change project was conducted at an elementary school. Parents, school personnel, and our research staff first met to discuss grading practices, the current report card system, and options for changing the report card format. Next, teachers and parents completed a questionnaire about grading practices and

the kinds of information they believed would be most useful to have on the report card. The meetings and survey results revealed that parents and staff valued information about achievement and effort most, student strengths and weaknesses in each subject area a close second, and comparative information about students' relative standing in the classroom a distant third. A new grade card was developed that reported (in the form of individualized comments based on each student's progress) the child's achievement, effort, and particular strengths and weaknesses in each subject area, as well as information on the child's social development. The report card itself simply lists subject areas with room for the teacher's comments.

Follow-up surveys were given to assess teachers' and parents' reactions to the new report card that eliminated letter grades. The response was very favorable in both groups. Additionally, students completed various motivational measures (anxiety and achievement motivation scales) prior to and after initiation of the new reporting system. Ongoing analyses are assessing relationships between the motivational variables and report card grades and whether anxiety about grades has decreased following the introduction of the new report card. This project, then, is one in which school evaluative practices were improved, as well as a great deal of information on student motivational characteristics was obtained. Following this project, other elementary schools in the district adopted similar report cards.

The second major report card change project was conducted at a junior high school in the district. At this age level, surveys revealed that both parents and teachers strongly preferred use of letter grades on report cards. School staff also were concerned that a single letter grade does not provide enough useful information about students' progress or give them credit for their effort. Students, parents, and teachers completed questionnaires so that school staff and our project staff could ascertain preferred ways of grading junior high students. The survey results indicated that parents and teachers both wished to have separate grades for ability and effort. The school staff and our project staff together developed a new card that included letter grades for both achievement and effort in each subject area and a checklist for strengths and weaknesses in each area.

As in the elementary school project, follow-up surveys showed that both parents and teachers greatly preferred the new grading system (about 80% of each group liked it better). Student reaction was somewhat less positive. Though they believed the new card provided more information, they expressed some concern that this information sometimes caused trouble for them, especially when their effort grades were not high. As one student said, "Now I have to get twice as many A's to do well."

In the second and third years of the project, students completed several additional measures, such as anxiety and achievement motivation scales, attributions for grades received and expectations for future grades, and attitudes toward the new report card. These measures were obtained to assess changes in the relationships between students' motivation and their report card grades. Initial analyses show that anxiety is related negatively to report card grades, and children making external attributions for success (e.g., good grades result from luck, easy courses, the teacher) tend to have lower grades than those crediting success to the positive internal factors of ability and effort (see Hymel 1981). Ongoing analyses are assessing other relationships among these variables and whether student motivation is becoming more positive as a result of the changes in the report card grades.

These projects are both good examples of how the school-university research model operates; school personnel and our research staff worked closely together through all phases of developing and eval-

uating the changes in report cards to provide more information for both students and parents whiile seeking to reduce students' negative motivation and undue concern about evaluation. Along with the surveys assessing changes in evaluative practices, information also was collected on student motivation and school performance to help evaluate the new reporting system.

Based on these projects and other research, we can make several suggestions for improving report cards in elementary and junior high school (see also Hill 1977, 1980). First, report cards should have separate comments or letter grades for achievement and effort, as well as information on personal social development so that grades are not a composite of all these things. Separate evaluation in these different areas provides much more diagnostic information about students' progress. Second, competition and social comparison should be minimized in grading practices, especially during the elementary school years. We believe children can be prepared for the pressures inherent in competitive grading at later ages if elementary schools use written progress reports like that developed in the elementary school project. Letter grades could be introduced at the junior high level, or letter grades might be phased in during the last year or two of elementary school, with separate grades for achievement and effort. This could help ease students' transition to middle school/junior high school, since they would have learned to deal with letter grades in their later elementary school classrooms. Third, the purposes of grading should be explained clearly, and teachers should make suggestions for how students can improve in each area evaluated. This may allow more students to be positively motivated in school.

Changing classroom and standardized tests

School tests, especially standardized achievement tests, make many unique demands on children. These include test time limits and time pressure, which create stress, especially among anxious children who prefer to perform slowly and cautiously (see Hill 1972). Similarly, test instructions emphasizing that the test measures ability can and do lead anxious students to become overly concerned with the adequacy of their performance (see Hill 1972, 1980; I. Sarason 1972, 1975; Wine 1971, 1980). Also, tests often contain problems that are quite difficult, since tests generally are given to students at several different grade levels. Other unique demands of testing include often complicated and unfamiliar question and answer formats and computer answer sheets. These test mechanics compound the difficulties of children who are already not dealing well with test pressure. Many children can cope with these various demands of testing; however, high-anxious children in particular do poorly under such highly evaluative and demanding testing conditions. The studies to be discussed in this section have modified various testing parameters to see if anxious children's performance would "optimize" when testing demands and pressure are reduced. By "optimize" we mean performing up to present capability and not being constrained by test pressure.

Research on optimal testing conditions dates back to Hutt's (1947) classic work on changing testing procedures. Hutt showed that alternating easy and hard test items on an IQ test improved the performance of "poorly adjusted" students, compared with their performance when items were sequenced from easy to hard. More recently, Zigler and his colleagues (Zigler et al. 1973; Zigler & Butterfield 1968; Zigler & Harter 1969) have shown that preschool, low-income children do better on ability tests when they are given time to become familiar with the examiner and the testing situation and when difficulty level is modified so that repeated failure is avoided. This work shows that parameters

of the testing situation relating to motivation strongly influence some children's test performance and that by changing those parameters the children's performance can be improved.

Our program of research on changing testing procedures focuses on three important testing parameters: (1) time limits and time pressure, (2) success-failure experiences and instructional information about test difficulty, and (3) testing instructions and mechanics. Our studies on validating optimizing test procedures have progressed from laboratory studies to studies in which achievement testing procedures were changed in actual school testing programs.

In an initial experiment, Hill and Eaton (1977) assessed how reducing time pressure influenced children's performance on basic arithmetic computation problems given in individual testing sessions. Fifth and sixth graders were either allowed to finish all the problems they attempted (success condition) or performed under individual problem time limits in which only two-thirds of the problems given could be finished (mixed success-failure condition). Results, shown in figure 1, indicate that, under time limits, high-anxious children showed two- to threefold performance deficits in both speed and accuracy. When time limits were removed, high-anxious children performed about as well and as quickly as low-anxious children. Middle-anxious children performed in between the low- and high-anxious groups, with one exception. The problems given in this study were ones that the children should have learned in earlier grades. This study shows how motivation and testing factors, and not lack of math skills, underlie high-anxious children's poor performance; with time pressure, the anxious children did poorly on problems that are easy for students of this age, but when time limits were removed, anxious children did quite well on the same problems.

Furthermore, the problems of anxious children in evaluative situations have been shown to worsen if their anxiety increases over time. Eaton (1979) reanalyzed the data from the Hill and Eaton (1977) study, assessing how the consistency of children's anxiety over an 18-month period prior to the study influenced the results. Children who became increasingly anxious over time were more likely to show poorer performance in the mixed success-failure condition and improved performance in the success condition than were children whose anxiety decreased. Also, children who were consistently anxious showed stronger interfering effects and greater optimizing effects than did children whose anxiety varied over time.

Plass and Hill (1979) extended the Hill and Eaton (1977) study to a more testlike situation. Third and fourth graders did age-appropriate math problems in small groups. Children performed under group-imposed time limits in one condition while in the other condition they were given all the time they needed to finish. As before, high-anxious children performed less well than low-anxious children under time limits. With no time limits, high-anxious boys performed as well as low-anxious boys, but high-anxious girls' performance did not improve. This gender difference was unexpected, since sex differences usually have not been obtained in this kind of work. Perhaps it was more difficult to optimize high-anxious girls' performance on age-appropriate math problems because math is sex typed as a male domain (see Plass & Hill [1979] for further discussion). More research is needed to assess the reliability of this sex difference. The Plass and Hill results again illustrate how test anxiety can interfere with test performance and that reducing time pressure lessens the negative effects of such anxiety.

Plass and Hill also examined how low-, middle-, and high-anxious children differed in their test-taking rates. In the time pressure condition, most low-anxious chil-

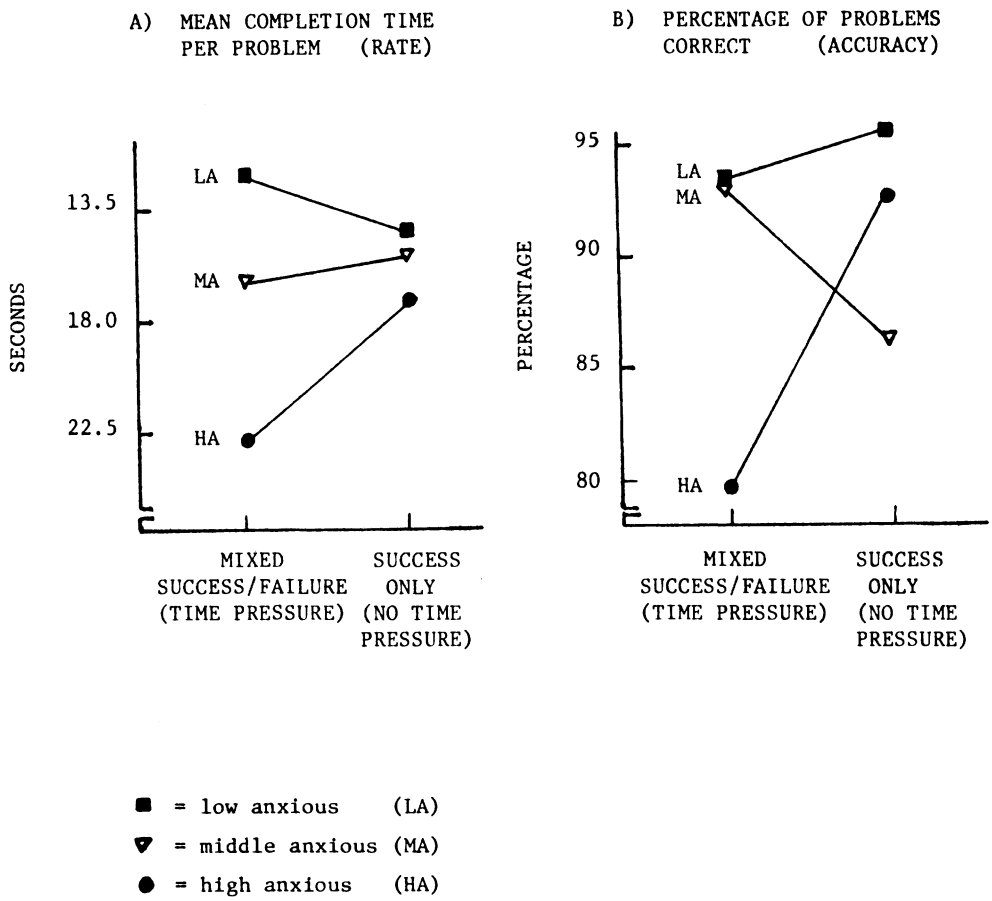

FIG. 1.—Performance as a function of test anxiety and time pressure induced success/failure experiences (based on figure 1 in Hill and Eaton [1977], with the Y-axis inverted so that superior performance is at the top of the axis).

dren worked at an intermediate rate and performed well. Some middle- and high-anxious children also performed at an intermediate rate but with less accuracy. Compared with low-anxious children, the middle- and high-anxious groups also showed more maladaptive strategies. Some children in the middle-anxious group appeared overly cautious, working quite slowly and with moderate accuracy. Some children in the high-anxious group, mostly boys, worked very quickly and quite inaccurately. When time limits were removed, fewer high-anxious boys showed the inappropriate fast-inaccurate strategy, which was a main reason this group did better in this optimizing condition. The implication of this finding is that middle- and high-anxious children need to learn to use an optimal, intermediate rate in doing test problems, proceeding neither too cautiously nor too hurriedly.

Williams (1976) examined how different kinds of test instructions influenced fifth and sixth graders performance on age-appropriate math problems given under time limits. Children worked on problems individually. When the problems were introduced as a test of ability, high-anxious children showed the typical pattern of performing less well than low-anxious children. In a condition where evaluative pres-

sure was reduced by telling children that some problems were difficult and not to worry about missing them, high-anxious children's performance markedly increased. High-anxious children actually performed better than middle- and low-anxious children when they were told that the experimenter was only interested in group performance, not individual performance. Thus, changes in instructions that reduce evaluative pressure or change children's expectations about successful performance benefit anxious children (see also Hill 1980).

The most recent in this series of optimizing studies (Hill, Wigfield, & Plass 1980) assessed how changes in both time limits and test instructions influence student performance in an actual school achievement testing situation. Seventh and eighth graders took the district's usual reading comprehension and math computation achievement subtests (in separate testing sessions) in one of four conditions: a standard testing condition, a relaxed time limits condition in which students were given about twice as much time as usual per subtest, a condition reducing evaluative pressure by providing information that some problems might be difficult and not to worry about missing some, or a combined optimizing condition in which both the relaxed time limits and difficulty information were given. Results showed that, under standard conditions, low-anxious students did much better than high-anxious students, as expected. With relaxed time limits, however, either alone or in the combined optimizing condition, middle- and high-anxious students (particularly eighth graders) performed better on the math subtest. In fact, the eighth-grade high test-anxious students actually performed slightly better than their low-anxious counterparts on the math subtest in the combined optimizing condition.

Results of this study are important because they were obtained in the school's actual achievement testing program. The results provide the strongest evidence to date that anxious children's achievement test performance can be optimized when testing procedures are changed. This series of studies indicates that anxiety, rather than lack of knowledge, is causing poor performance in many evaluative situations. When time limits are relaxed and instructions changed, anxious children perform much better than under standard conditions, often performing about as well as low-anxious children. Thus, when standard testing procedures are used to assess what high test-anxious students have learned, the tests typically provide an invalid underestimate of those students' learning and of how effective the school's educational program is.

One suggestion resulting from this series of studies is that schools and testing companies should consider giving tests in both standard and optimizing ways. Low-anxious children, with their history of doing well in highly evaluative testing situations, should do best under standard conditions, since some of the optimizing procedures seem actually to lower their performance slightly (see similar findings reviewed in Hill [1972, 1980, 1984]; and reported by I. Sarason [1972, 1973]). High-anxious children should do best when tested under optimizing procedures like the ones used by Hill et al. (1980), either the relaxed time limits or the combined optimizing condition. One way for schools to implement this kind of testing would be to adopt what we call a "dual testing program." All students could first take achievement tests under the standard procedures, as is now done. Then some (or all) students could retake the tests; if only some children were retested, likely candidates would be anxious students, ones identified as having other test-taking problems, or ones whom the teacher thought scored lower than expected. Most students being retested could take tests the second time under optimizing conditions, but some students should retake the test again under

standard conditions to serve as a control for test/retest gains. The truer estimate of a student's achievement would be the higher of the two sets of scores obtained. This kind of dual testing program would provide more valid estimates of all students' learning in school (see also Hill 1984).

The studies discussed in this section are concerned with standardized achievement tests. Classroom tests often are quite different from standardized tests in that they do not impose as many unique demands. For instance, classroom tests nearly always concern familiar material appropriate to the class grade level, usually involve straightforward question and answer formats, and typically provide ample time for students to try all of the problems. Classroom tests, however, still involve challenging material and pressure to perform well so that many of the points we have made in this section can be applied to giving classroom tests. Most important, teachers should be careful in how classroom tests are introduced to children and give children plenty of time to complete the tests. Classroom tests, moreover, can be used to help children become more accustomed to and able to cope with achievement tests and testing pressure. We turn to this topic in the next section.

Teaching students how to deal with evaluative pressure

The testing intervention studies just reviewed have been successful in helping high-anxious children perform better on school achievement tests; relaxing test time limits and giving instructions that provide information about attainable performance levels consistently have had facilitating effects. But more needs to be done in addition to modifying aspects of testing that exacerbate the debilitating effects of test anxiety. In our more recent intervention work, we have been working with school staff to develop more thorough and systematic ways of teaching students how to cope with the demands and pressures of testing. We will discuss two kinds of projects here, one an individualized tutoring program to help children identified as having special test-taking problems do better on tests, and the other a classroom teaching program to prepare students for testing (see also Hill 1984).

In the tutoring program, the test-taking skills and positive motivational dispositions taught are targeted to the needs of individual students who are having difficulty with and often do poorly on classroom tests, especially mathematics tests. At the collaborating school, third and fourth graders from four classrooms take twice-weekly timed math tests that assess their knowledge of math facts. These classroom tests are given under fairly stringent time limits, in part to be sure children have mastered the facts and are facile in their use, and in part to help students learn to perform quickly and accurately in test situations. Students in the tutoring program are those who are rated by their teachers as being anxious and having test-taking problems and who do poorly on the timed math tests.

The tutoring program, though varying across students, basically teaches the students how to cope with time pressure and difficult problems and to use effective test-taking strategies. The tutoring focuses on several specific problems: high test anxiety, considerable off-task behavior, lack of effort, negative attitudes, writing difficulties, and specific problems with knowledge of the math skills necessary to do well on the classroom tests. Undergraduate students and members of the research staff serve as tutors.

The success of the ongoing tutoring study is being assessed by having judges rate each tutored student's progress on the classroom tests. The judges use a three-point scale—little progress, good progress, or excellent progress—to rate each child. Initial results show that a majority of the children were rated as making good or ex-

cellent progress on the tests, which is encouraging. The students who were not making progress on the tests were often observed to be showing more positive motivation and to have more confidence in their test-taking skills.

These positive results indicate that the tutoring program is beneficial and can be used to help children perform better on classroom tests and likely in other testing situations. The major problem with implementing this program is its cost, since it requires individual attention to the targeted students from school staff or professionally trained volunteers. We would suggest that schools interested in improving children's test-taking skills adopt the classroom test-taking skills teaching program to be discussed next and use the tutoring program for those students with special problems who continue to have difficulty coping with test pressure even after they participate in the classroom teaching program.

The classroom teaching program builds on findings from the research on optimizing testing as well as on the tutoring program. The teaching program was developed with collaborating teachers from the cooperating elementary school. The purpose of the classroom teaching program is to familiarize students with the unique and often strong demands and pressures of standardized achievement testing. As we have discussed, these demands include time limits, unfamiliar or difficult material, lengthy testing sessions, and unfamiliar question and answer formats. To give some specific examples, unfamiliar question and answer test formats include things such as reading a paragraph and answering multiple-choice questions about it. Achievement test subtests may have as many as a half-dozen sets of instructions that the students must read and understand on their own. Computer answer sheets are introduced in the middle elementary school years and may compound these and other difficulties.

Teachers initially developed a one- to two-session practice testing experience for students in Grades 2–6 (see Hartman 1981). Teachers began the practice testing session by briefly discussing major demands of testing and giving suggestions for how to deal with them. Students then did several problems from each major area of achievement. Older students were taught how to use computer answer sheets.

Teachers thought the practice test was very useful, but that there was not enough time, even after two sessions, to cover adequately all topics. Teachers were interested in expanding the program to give more practice on problems and foster positive test motivation. Second-grade teachers developed an eight-session classroom teaching program dealing with test-taking skills and positive test motivation. Each session lasted about half an hour. The program was developed and validated initially at the second-grade level because this is the grade level at which children in the collaborating school take their first achievement test. Teachers felt many students are quite unprepared for standardized testing at this age.

The eight-session classroom program consisted of an introductory session in which children learned about the general purposes of testing and were given some tips on how to take tests and on maintaining positive motivation. Appendix 1 gives examples of the kinds of points covered in this session. In each of the next seven sessions, specific achievement areas evaluated in school testing or by many achievement tests (e.g., reading comprehension, language arts, math computation) were dealt with. Each session began with some reminders about test strategy and motivation (e.g., don't worry if some problems are too hard, do the ones you know first, work at a comfortable pace, etc.), and then the children practiced on problems teachers developed for the program. The purpose of the practice testing was to familiarize children with the general kinds of test in-

structions, question and answer formats, answer sheets, and other aspects of testing mechanics they would encounter on any achievement test. The problems used in the practice sessions were not taken from any test, since the interest was in teaching students how to take tests, not the content of any test.

Because the school staff and our research team were interested in documenting the effectiveness of the program, two teachers with 34 second graders in their classrooms implemented the program, and three teachers with 31 second graders served as a comparison control group. All 65 students were given a pretest (developed by the teachers and our research staff) that assessed language arts, reading, and math skills. The premeasure allowed us to assess gains from the teaching program while controlling for individual differences in children's achievement before the program began. The eight-session program was given over a 4-week period, beginning several weeks after the premeasure was administered and ending a week before the school district's achievement testing. The effectiveness of the program in improving children's scores on the full-scale achievement test (given under standard testing procedures) was assessed in an analysis of covariance, using the premeasure scores as the covariate.

The group receiving the teaching program performed significantly higher, $p < .01$, $p < .001$, than the control group on two of three language arts subtests, resulting in a significant difference on the total language arts test, $p < .001$. On the reading subtests, the teaching group performed significantly better on one subtest, $p < .01$, with trends that were nearly significant on the other two subtests, $p < .10$, $p < .15$. As a result, the teaching group did significantly better on the total reading test, $p < .01$. Children in the teaching group also scored better on both math subtests, but not significantly so. Most important, these combined differences resulted in the teaching group having significantly higher total achievement test scores than the control group, $p < .05$. Corrected for performance on the premeasure, the teaching group scored at the 71st percentile on average for the overall achievement test, while the control group scored at the 61st percentile.

These results documenting the effectiveness of the teaching program are quite encouraging. The most likely reason stronger differences were obtained in language arts and reading rather than mathematics is that on this and most other achievement tests the language and reading areas have more complicated question and answer formats, whereas the math tests are more similar to classroom exercises. Also, at the second-grade level, time limits and unfamiliar or excessively difficult material are not yet as serious a problem as they are at later grades. Teaching and control group differences may be even stronger at later grades, as test formats become more complicated, time limits and difficulty of test content become more of a problem, and anxiety interferes more with performance (see Hill 1980, 1984).

During the 1982–83 school year the teaching program was refined and is being given by six of the 10 teachers in Grades 3–6 of the collaborating school to assess its effectiveness across the elementary school years. The program has been expanded to 10 sessions, with two sessions now devoted to discussion of the purposes of testing and general strategies for taking tests and two sessions to reading paragraph tests because of the difficulty students have learning to master this testing format. The content of the various sessions is summarized in Appendix 2. The program has been tailored to the specific needs of students at different grade levels taking varied levels of achievement tests; for instance, older children receive practice with computer answer sheets while younger children answer directly on their practice sheets. As in the initial year of the project,

the teaching program is being implemented in some classrooms but not others in order to have a comparison control group to assess the effectiveness of the program. Collaborating teachers again developed a premeasure to assess language arts, reading, and math skills. The premeasure was given to all children in Grades 3–6, and analysis of covariance again will be used to assess whether the children in the teaching program attain higher test scores. Our collaborating staff anticipates that the program will be effective at all age levels, considering results of the second-grade project, the earlier tutoring studies, and teachers' impressions while giving the program.

We plan to offer the 10-session program in a districtwide project next year, because staff of the other schools in the district have expressed interest in the project. This will give the opportunity to validate the effectiveness of the program with many more teachers and many students from a wide variety of backgrounds. As in the earlier and ongoing projects, some classrooms at each school will be in the teaching group, and others will serve as comparison controls. Since we are interested in improving the test performance of all children, teachers of control group classrooms will be able to give the program in their classrooms the following year. If resources permit the project to continue for a second year, we will examine the effectiveness of the program over time by having children who participate in the program in the first year either participate again, receive a shorter "booster" program, or receive no program in the second year of the school district study. This phase will provide important information concerning how gains resulting from the program can be maintained in the most time and cost-efficient way.

The goal of such a major project, then, is to validate the motivation and test-taking skills classroom teaching program district-wide. Each phase of our validation of the program involves a broader base of application, and, if the project is validated throughout Grades 2–6, it will be a major step toward the goal of developing a classroom teaching program that can be used in any school district in the country where there is concern about student test anxiety and its interfering effects on test performance. The teaching program is a general one relevant to most achievement tests. It has the potential to facilitate positive motivation and performance of millions of elementary and secondary students in this country and in other countries using similar tests and testing procedures.

III. Eliminating the debilitating effects of anxiety in the school setting

In this last section, we would like to draw together the implications of the work we have reviewed and to make some suggestions concerning how schools can deal with the problem of evaluation anxiety in a cost-efficient way. By now we hope we have shown that anxiety is an important educational problem and that there are specific things that can be done about it in the school environment. We suggest that schools (1) make an effort to assess student motivation systematically in order to identify students with test-taking problems and determine the seriousness of the problem; (2) develop new ways to evaluate students in order to minimize debilitating effects of anxiety; and (3) implement classroom programs to teach students how to deal with the test situation. Each of these suggestions will be discussed in more detail.

For schools interested in the problem of evaluation anxiety, a first task is to identify children who are anxious about testing and do poorly under evaluative pressure. As we have discussed, there are several questionnaire measures of anxiety that are easy to administer. The one that is the most cost-efficient is the seven-item Test Comfort Index (Harnisch et al. 1980). This scale can be given to children at all grades and takes only 5 minutes to administer. It has

been shown to have good reliability and predictive validity. Because the scale can be administered so quickly, we also suggest that students' attributions for success and failure on tests be obtained (see Hill 1984). The attribution measure also can be administered quickly, and it gives important information about children's beliefs about their test performance. These two measures provide an effective and cost-efficient way to identify students with test-taking problems.

Once these students are identified, schools then can do a variety of things to help them do better in evaluative situations. Changing evaluative practices is one of the most important. Grade reports should be modified so that children are evaluated on both effort and ability, and we believe letter grades need not be used until the end of elementary school or the early junior high/middle school years. Rather, progress reports describing students' effort, achievement, and strengths and weaknesses in each subject area are most useful at the elementary school level. Letter grades then can be phased in during the fifth or sixth grade or in middle/junior high school. These changes will result in less evaluative pressure, social comparison, and competition in grading, all of which are harmful for many children and particularly unnecessary at the elementary school level. Furthermore, evaluating both effort and ability will help students cope better with their concerns about grades and should allow them to do better in school, as well as provide more useful information to parents.

Similarly, the evaluative pressure of testing can be reduced in the ways we have discussed—particularly by reducing test time pressure, changing highly evaluative instructions, and providing information about performance expectations. The dual testing program we described earlier may be the most cost-efficient way to obtain the most valid test scores for all students. All students could be tested first under standard conditions, and then either all students or those students identified as having test-taking problems could be tested again under optimizing conditions. Students performing much better under optimizing than standard conditions not only have given a better indication of their academic skills and knowledge but also have shown that they need to learn to cope effectively with the demands of standardized testing. Test scores have a strong influence in determing children's school progress and what they will be able to do later in life. As we have noted, the importance of testing is increasing in many school districts, as minimal competency testing is used to determine promotion and high school graduation, and tests in general are used to evaluate the effectiveness of educational programs. Because of testing's importance, we believe it is essential that all students' test scores accurately reflect what they do know and not be negatively influenced by test anxiety and other test-taking factors.

Perhaps the most important thing schools can do is to prepare students more thoroughly for highly evaluative achievement, aptitude, competency, and other tests. Achievement and other tests impose unique demands on students, and regular classroom instruction and testing do not sufficiently prepare many students to meet these demands. The 5-hour, 10-session classroom teaching program described here is one model for how to prepare students for testing. By practicing on problems with testlike formats, learning to cope with time limits and difficult test material, and more generally learning good test-taking strategies, children will be better prepared to show what they know on tests and will be more likely to maintain effort and positive motivation during testing.

The motivational assessment, new testing procedures, and teaching programs discussed here should be beneficial to all students; however, the students who will benefit most will be those experiencing de-

bilitating test anxiety. There are 5–10 million such students at the elementary and secondary school levels coming from all socioeconomic backgrounds. Effective educational programs that eliminate the harmful effects of such negative test motivation could make an enormous contribution to the educational progress and lives of many of these students by greatly facilitating both optimal test performance and positive motivation. Test results would then also provide a more valid assessment of the effectiveness of our educational system.

Appendix A

Examples of test-taking skills and motivational dispositions

1. General test skills and knowledge:
   a. Be comfortable and sit where you can write easily.
   b. Pay attention to the teacher when she talks.
   c. The teacher can help you understand how to work on the test, but she can't tell you the answer to a problem on the test.
   d. Taking tests is something we learn to do in school.
2. Positive motivation—doing your best:
   a. All I ask is that you do your best. I will be really pleased if you try to do your best.
   b. If you finish a section before time is up, go back and check your answers. Don't disturb others; instead, work quietly at your desk.
   c. Before we begin, remember to carefully listen to me, be quiet, take a deep breath, and feel relaxed.
3. Positive motivation—expectancy reassurance:
   a. Some tests have some very hard problems. Don't worry if you can't do some problems.
   b. It's OK if you aren't sure what the right answer is. Choose the answer you think is best. It's OK to guess.
   c. If you work hard but don't finish a test, don't worry about it! The most important thing to me is that you try hard and do as well as you can. I know you'll do a good job if you try!
4. Test strategy and problem-solving skills:
   a. There is only *one* best answer.
   b. Do what you know first. If you can't answer a problem or it's taking a lot of time move on to the next one. You can come back later if you have time.
   c. Don't rush. If you work *too fast*, you can make careless errors. You have to work carefully.
   d. Don't work too slowly. Do the problems at a moderate rate.
   e. Pay close attention to your work.
   f. Keep track of where you are working on the page by keeping one hand on this spot.
5. Test logistics and instructions:
   a. Various skills are taught, many relating to specific areas of tests.
   b. The specific skills taught are included in the script for each session of the classroom teaching program.

Appendix B

Outline of the 10-session classroom test-taking skills program

1. General discussion of testing. Introduce children to purposes of testing, kinds of tests they will take in and out of school, general test-taking strategies.

2. General discussion of testing. Describe how achievement tests are different from classroom tests, review additional test-taking strategies, examine sample test problems.

3. Math computation. Review some general test-taking strategies, give tips for doing math computation problems, practice problems in testlike format.

4. Vocabulary. Review strategies, give tips for how to find word meanings, practice sample vocabulary problems.

5. Spelling. Teach students how to decide if words are spelled correctly or not, practice spelling problems in testlike formats.

6. Reading (part A). Give tips for showing reading skills, practice finding information in a story by locating key lines, phrases.

7. Reading (part B). Practice at reading paragraphs and answering multiple-choice questions involving factual or inferential material.

8. Math problem solving. Give tips for using math skills when doing math word problems in testlike formats, practice at different kinds of problems.

9. Punctuation and capitalization. Show how to find punctuation and capitalization errors, practice each kind of problem in testlike formats.

10. Language arts. Tips for doing grammar, word meanings and sentence ordering in a story; practice on the three kinds of problems; particular attention given to dealing with complicated and changing instructions.

In each session, teachers also go over some of the motivation points and test-taking skills listed in Appendix 1.

Note

The research reported herein was supported in part by research grants NIE G–76–0086 and NIE G–80–0015 from the National Institute of Education to the first author and by U.S. Public Health Service Training Grant HD–00244 from the National Institute of Child Health and Human Development to the Developmental Psychology Program, Department of Psychology, University of Illinois at Urbana-Champaign. The preparation of this paper was also supported in part by research grant NIE G–80–0015 and was a fully collaborative effort by the two authors. Requests for reprints may be addressed to Kennedy T. Hill, 147 Children's Research Center, 51 East Gerty Drive, University of Illinois, Champaign, Illinois 61820.

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