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Editorial

Articles

Ah, Spring!

William Purkey has referred to that period of time between the Christmas holidays and the arrival of spring as the "long death march of bleak and weary days." With the possible exception of skiers and snowboard enthusiasts, most of us look forward to the renewal and the warmer climes of spring. Ah, spring, indeed!

With the arrival of spring, we bring you new offerings in the JITP for your consideration. In the past, some have lamented the paucity of research articles in the journal. This issue brings nourishment for those who hunger for such offerings. Two thought-provoking articles dealing with research issues in invitational education provide additional understanding, and inevitably raise new questions.

Giovanni Valiante and Frank Pajares revisit a research topic when they take a further look at the Inviting/Disinviting Index. Their article, "The Inviting/Disinviting Index: Instrument Validation and Relation to Motivation and Achievement," complements and expands prior studies using the IDI. This article undertakes a rigorous examination of the validation of the IDI, while at the same time relating these concepts to Bandura's notions of self-efficacy. Their study examines responses of children in grades 6, 7, and 8 on the IDI and offers some interesting perspectives concerning the IDI specifically and, in a more general sense, the assessment of invitational concepts. This surely will be used as a base for subsequent research in this area, and reminds us, once again, we are dealing with complex notions, not easily distilled.

The second research article is by Frank Pajares and Amy Lapin Zeldin."Inviting Self-Efficacy Revisited: the Role of Invitations in the Lives of Women with Mathematics-Related Careers" touches two timely and important issues in invitational education: gender based invitations on career paths, and the issues of self-efficacy in this process. This is timely in terms of women and mathematics-related careers coming in conjunction with the recent Smith College announcement of the first all women's engineering program that will start in the fall of 1999. Pajares

and Zeldin's article is soundly presented, and includes open-ended semi-structured interviews with 15 women who were currently engaged in careers in mathematics, science, or technology. These interviews were analyzed in terms of the respondents' beliefs of self-efficacy and recollection of invitations they received that were related to their career choices.

Often, we are so close to what we are doing in education that we are unable to examine what we really are trying to accomplish. Sometimes, we need to find a way to step back and re-adjust our focus to get a clearer perspective. Margaret Maaka helps in her presentation, "Assessment of School Success: A Student-Centered Approach." Maaka, who has taught in New Zealand and Hawaii, draws upon her experiences in implementing state and/or national educational standards, and presents some of the contrasts with American education. Maaka takes a neutral stance in her presentation, but presents interesting and provocative differences in educational approaches between these different cultures. Perhaps this is most notable in her exposition of testing; both standardized testing and teacher-made tests, among the different cultures. Maaka provides a perspective, which many may find helpful in focusing on contemporary educational issues.

To top off our spring bouquet, it seems appropriate to include some comments to those of you wishing to submit articles to the *Journal of Invitational Theory and Practice*. While "Guidelines for Authors" are found in each issue of the journal, somehow a veil of mystery remains as to the process of reviewing and accepting articles. When a manuscript is submitted to the journal, all personally identifying information is stripped from the manuscript, and a number is assigned to the manuscript. This is done so members of the Editorial Board may do a "blind review." Typically, a manuscript is sent to four reviewers on the Editorial Board for their assessment and comments. To the extent possible, readers are selected for their expertise in the subject area of the manuscript, although this is not always possible. The reviewed articles are returned to the Editor four to six weeks after being sent out, and the comments are pooled into a summary evaluation, which is sent to the author. Each manuscript also receives a composite rating from the readers that falls

into one of three categories: “accept as is,” “accept with revisions,” and “ not acceptable.”

Very few of the articles receive an “accept-as-is” rating after the first reading. Most initial reviews fall into the second category, “accept with revisions,” which includes very specific comments from reviewers as to what might be needed to make the manuscript more acceptable for publication. Additionally, very few articles are rated as “not acceptable,” and in those instances where this is the judgment of the reviewers, alternate publications are often suggested that might be more appropriate for the manuscript under review.

The vast majority of manuscripts fall into the “accept-with-revisions” category. Many manuscripts may be returned to the authors two or more times for revisions. Persistence and the authors’ convictions of the importance of the manuscript become important in this stage of the review process. About 50 percent of the manuscripts returned to the authors for revisions are never returned to the journal. Additionally, not all manuscripts that are revised end up in print. This is all dependent upon the relationship of the topic to the purpose of the journal (i.e., invitational theory and practice), the clarity of presentation, the development of the ideas presented, and the scholarship of the manuscript. Since the journal is published every six months, chances are high that manuscripts submitted will be in a review and rewrite process somewhere in the neighborhood of six to eight months. Hopefully, this helps to clarify the process, and at the same time encourages more readers to submit manuscripts to the journal for consideration.

William B. Stafford
Editor

Assessment for School Success: A Student-Centered Approach

Margaret J. Maaka
University of Hawaii at Manoa

This article examines a national educational system that is founded on the premise that the individual student is the center of all learning and teaching. By drawing on her first-hand knowledge and experiences, the author presents an overview of the New Zealand student-centered curriculum. Central to this overview is: (a) a brief discussion of the beliefs New Zealand educators and the community have about children's learning, (b) an examination of the guiding principles that underlie the assessment of children's learning and how these translate into practice, and (c) a discussion of issues of accountability at the local and national levels of the educational system.

> We believe that teachers cannot create challenging classrooms unless they understand—deeply and coherently—the psychological principles of learning and development that they must assess and foster in their students. Otherwise, teachers rely on manuals, textbooks, workbooks, and tests prescribed by others to define and structure their teaching. This is how teachers become managers of materials, classroom disciplinarians, and didactic direction-givers instead of reflective mentors in their classrooms. We hope that teachers take control of their instructional and assessment practices, through knowledge and reflection, in order to create exciting environments that promote children's self-regulated learning. (Paris & Ayres, 1994, p. 32)

In their rejection of approaches to learning and teaching that are "shackled by tradition and habit," Paris and Ayres (1994) urged educators to loosen their imaginations and create classrooms that excite curiosity and inquiry, and invite self-assessment. For Paris and Ayres, school curricula must be child-centered, authentic, and empowering.

American educators often ask me about the New Zealand educational system and its student-centered philosophy of learning and teaching. This regard is nothing new. According to Trussell-Cullen (1996), Americans have been interested in New Zealand schools since

the 1970s, when comparative research studies began to identify New Zealand as one of the most literate countries in the world.

Although I am questioned about all aspects of New Zealand schooling, children's literacy development attracts most attention. Typically, I am asked about the essential learning areas (Ministry of Education, 1993c); teachers' beliefs about language learning and teaching (Ministry of Education, 1994b); integrated curriculum (Ministry of Education, 1994b); the Reading Recovery Program (Clay, 1993a); shared, guided, and independent reading and writing (Mooney, 1990); multicultural issues in education (Ashton-Warner, 1963; Ministry of Education, 1990); literacy skills and strategies (Ministry of Education, 1993c, 1994a); and curriculum evaluation (Ministry of Education, 1993a). Recently, I have been fielding more and more questions about the theory of student-centered assessment and its translation into practice. It is clear from ensuing conversations and from a mounting body of research that a new era of American educators are growing disenchanted with traditional methods of assessment, in particular, standardized achievement tests (Gardner, 1991; Paris, 1994; Sacks, 1997). The call for more effective methods for assessing and improving children's learning is gaining momentum in American schools (Paris & Ayres, 1994; Routman, 1996).

As a teacher educator for the past ten years, I have observed with much interest the standardized achievement tests versus authentic assessment (e.g., portfolios, student self-assessment) debate that has reverberated through the American educational system, particularly in my home state of Hawaii. Peculiar to this debate is the failure of both sides to reach agreement on the principles that should guide assessment policies and procedures for America's educational system. Unfortunately, much of the argument has centered on, "Which methods of assessment are *best*?" rather than, "Which methods of assessment *best improve children's learning and the quality of learning programs*?" This fundamental failing ensures continued debate with scant likelihood of resolution.

This article presents an overview of recently revised assessment policies and procedures for New Zealand schools. Interwoven in this discussion are my beliefs about assessment of children's learning drawn

from my teaching experiences in New Zealand elementary and secondary schools and from my experiences as a teacher educator in Hawaii. Where pertinent, I include commentary on assessment issues and trends in the American educational system. It is not my aim to promote a foreign curriculum as the panacea for the supposed assessment ills of America's educational system. Indeed, in conversations with educators, I caution against the practice of unquestioningly drawing from "successful" instructional and theoretical orientations. A hybrid or "mix and match" curriculum that does not consider or value the experiences and needs of individual students serves no good purpose (Gutierrez, Baquedano-Lopez, & Turner, 1997). My primary purpose is to stimulate discussion among those who are interested in developing a student-centered educational system in America.

The New Zealand Curriculum: Invitations for all Students

The Mission Statement: Beyond Eloquent Rhetoric

> Whatever their other cognitive and non-cognitive facets, educational institutions—preeminently schools—ought to seek to inculcate in their students the highest degree of understanding. I call into question the desirability of performances that are merely rote, ritualized, or conventional, and in doing so, I take issue with many traditional educators who call for "basic skills," "cultural literacy," or the mandating of standardized tests. By the same token, I embrace the position that educational institutions need to reach the broadest number of students and that they must therefore be responsive to different forms of learning, performance, and understanding. (Gardner, 1991, p. 18)

The most pertinent question I ask when examining any national curriculum is; "How many of the guiding principles are 'pie in the sky' compared with what can be accomplished by schools?" Unfortunately, too many educational systems develop mission statements of eloquent rhetoric without following through with the necessary supports to enable each and every school to "live" that rhetoric. Or, worse still, they adopt practices that run counter to their recommended goals. Citizenship education in America's schools is a good example of practice contradicting theory. If one of the primary goals is to help students to

"develop the ability to make informed and reasoned decisions for the public good as citizens of a culturally diverse, democratic society in an interdependent world" (National Council of Social Studies, 1994, p. 3), teachers must question commodified practices, such as the use of standardized achievement tests, to monitor children's learning. Rather than promoting "informed and reasoned decision making" and "cultural diversity", there is strong evidence to suggest that these types of assessment instruments reward superficial learning (Brandt, 1994; Sacks, 1997), and are culturally biased towards white-middle class experiences (Routman, 1994; Sacks, 1997).

In recent years, the New Zealand educational system has undergone comprehensive and controversial restructuring. The primary goal of education in New Zealand is to provide a wide range of opportunities to meet the diverse needs of all students in a system without barriers to participation and life-long learning (Ministry of Education, 1993a). Gardner (1991), one of America's foremost researchers in the field of children's thinking, supports this stance. His assertion that schools should be responsive to different forms of learning, performance, and understanding supports the idea that all children should experience school success (see also Purkey & Novak, 1996). Although New Zealand's primary educational goal smacks of rhetoric, I recognize two essential developments that enable schools to support each student to achieve potential, continue learning throughout life, and play a full part in society. The first is the national curriculum's driving postulate that the individual student is the center of all teaching and learning, and the second is the expected involvement of all New Zealanders in local and national goal setting partnerships to raise educational standards. It is not surprising that these developments greatly impact assessment policies and procedures for schools.

At the Center is the Individual Student

> All young people in New Zealand have the right to gain, through the state schooling system, a broad, balanced education that prepares them for effective participation in society. (Ministry of Education, 1993c, p. 5)

I believe that the core of an effective educational system is knowledgeable teachers who have the expertise to encourage all children to reach their full potentials (Maaka & Lipka, 1996; Paris & Ayres, 1994; Routman, 1994, 1996). Teachers who believe in the ability, value, and responsibility of each student are more committed to developing ethical approaches that summon students to take ownership of their learning (Purkey & Novak, 1996). The effect of student ownership of learning on school success was the focus of a year-long study of an American classroom. Maaka and Lipka (1997) implemented and monitored a set of instructional practices designed to invite student/teacher co-ownership of a Hawaii sixth-grade classroom. In an environment that promoted the involvement of all students in all aspects of program planning; the collaboration of students, teachers, and parents; a variety of instructional and assessment methods, designed to cater to a range of learning needs; and the acquisition of knowledge pertaining to the lives of students, high levels of student self-esteem and motivation for learning, and the development of positive literacy habits and attitudes were observed.

Student ownership of learning is central to the New Zealand Curriculum. It is promoted across all learning areas and all levels of the educational system. A coherent progression of learning experiences, incorporating innovative teaching methods and quality resources, helps children see the connection between the acquisition of knowledge and its application to all facets of their lives. This emphasis can be seen in the English curriculum (Ministry of Education, 1994b);

> All students should have equal access to the English curriculum. An inclusive curriculum, which is responsive to the wide diversity of perspectives and linguistic backgrounds in New Zealand, can enrich English education for all students. Learners not experiencing success in terms of participation and achievement should be identified so that equitable access to learning activities is assured. (p. 13)

in the social studies curriculum (Ministry of Education, 1994c);

> Programmes should be consistent with human rights legislation. Social studies programmes must value, respect, acknowledge, and include the interests, perspectives, and contributions of all students regardless of gender, culture, and social and religious background. They should also create a positive learning environment, enabling students to achieve learning objectives to the best of their abilities. (p. 19)

and in the science curriculum (Hill & Edwards, 1992);

> . . . the teacher must be prepared to start with the ideas that the students already have, and to accept that these ideas have validity for them. . . In this way, teacher and students will together decide on the purpose of the lesson and the activities required to fulfil that purpose. Teachers can then better direct the activities towards what they want their students to learn; and the students will be more prepared to take responsibility for their own learning because they now have a stake in the task. They, as well as the teacher, own it. (p. 7)

This strong belief in individual worth and potential is the foundation on which a range of effective practices and programs are built. Developments that invite school success for New Zealand children include collaborative approaches to learning and teaching; culturally-responsive instruction; mainstreaming or inclusion of students with special needs; various assessment methods such as teacher observation, student self-assessment, peer assessment, conferencing, portfolios, and formal tests; theme-based programs of learning and teaching that are integrated across the essential learning areas; intervention programs, such as Reading Recovery, for children having difficulties learning to read and write; English language programs for speakers of other languages; and Pacific Islands language and culture courses. One development, which should be of interest to those advocating the rights of America's indigenous peoples, merits special mention. The past two decades have witnessed the emergence of Maori language immersion programs, such as Te Kohanga Reo and Kura Kaupapa Maori. These innovative and timely programs foster and maintain the language and culture of New Zealand's indigenous people--a system of education in Maori, about Maori, and for Maori (Ministry of Education, 1990).

A Community of Shared Values

> New Zealand's future lies in education. We will succeed in building the future we seek only if we succeed in education. All New Zealanders--parents, education professionals, enterprise, and government--must work as a team. Education for the 21st Century is about building that team. (Ministry of Education, 1993a, p. 3)

In his call for the reform of America's schools, Levine (1995, p. 52) observed the many disgruntled participants--"from the cries of battle-weary teachers, from parents whose children aren't learning, from business people worried about their future workforce, from legislators alarmed at the growth of an economic underclass." He also referred to other participants such as educational policy makers and managers whose decision making has lead to much of this dissatisfaction. The central problem, he argued was deeply ingrained approaches that treat schools as knowledge factories and teachers as technicians. Purkey and Novak (1996) extend this notion of school-as-factory by describing distinguishing characteristics such as mass production, uniform product, cost effectiveness, technological efficiency, centralized control, and workers as functionaries. This pervasive mentality precludes the likelihood of widespread, meaningful reform to the American educational system.

Despite this gloomy forecast, recent years have seen an increase in the number of educators rejecting curricular decision making that does not take into account the needs and input of the wider community (Gardner, 1991; Levine, Lowe, Peterson, & Tenorio, 1995; Purkey & Novak, 1996; Routman, 1996). In describing their inviting family school with its respect for individual uniqueness, cooperative spirit, community focus, and positive expectations, Purkey and Novak emphasized the importance of democratic interactions among members of the school and members of the larger community. Teachers, students, school administrators, staff, parents, local business people, and interested community members are seen as vital to the establishment of an effective school.

The New Zealand educational system has experienced similar trends. Traditionally, submissions from faculties of schools, colleges of education, and universities; specialists in the Ministry of Education; and other educational groups have tended to shape the New Zealand Curriculum. There is now greater acknowledgment that the formal, planned school curriculum is only one of many factors influencing learning. The diverse experiences, values, and cultural beliefs that students bring from their informal learning environments are also considered influential. With this in mind, curriculum developers placed greater emphasis on submissions from all community interest groups, including students, parents, school trustees, employers, unionists, educational administrators, teachers, researchers, and Maori and Pacific Island representatives. This collaborative direction making ensures consistency and maintenance of standards in classroom programs throughout the country, and allows for discretionary innovations stemming from the requirements and expectations of local communities.

Assessment in the New Zealand Curriculum

Principles of Assessment for Better Learning

> The primary purpose of school-based assessment is to improve students' learning and the quality of learning programmes. (Ministry of Education, 1994a, p. 5)

Assessment is one way through which New Zealand preserves its educational standards. By providing clear learning goals (see Table 1) against which individual progress can be measured, the national curriculum is able to accomplish its primary assessment purpose of improving each student's learning and the quality of learning programs. This monitoring process includes identifying and promoting areas of strength and identifying and remedying areas of concern. The secondary purposes of assessment, which are inextricably woven with the primary, include appraising and supporting the professional development of teachers, assessing the effectiveness of schools, and monitoring overall national educational standards.

Table 1
Examples of Learning Goals—Junior (5-7 years of age) Level Curriculum (see Department of Education, 1989*).

Language and Languages

Knowledge: Knows that language can be used in various ways to meet a range of needs

Skills: Uses strategies of sampling, predicting, confirming, and self-correcting confidently and independently. Records ideas and information in a variety of ways

Attitudes: Sees language as a tool to help satisfy a natural curiosity about the world

Science

Knowledge: Makes sense of own world through developing ideas about time and space. Accepts that understandings about science change

Skills: Makes appropriate measurements about time and space. Carries out simple investigations inside and outside of the classroom

Attitudes: Enjoys science activities. Is curious about and explores things in own environment

Mathematics

Knowledge: Develops an understanding of comparisons, relationships, graphs, number, operations, shape, space, measurement, logic, patterning, and order

Skills: Shows increasing facility in using mathematical language to express ideas. Applies mathematical concepts to help solve problems in every day life

Attitudes: Enjoys mathematical problem solving. Sees mathematics as an opportunity to discover, explore, and create

* This booklet outlines current policy on the keeping of school records in primary (elementary) schools. Although this booklet is still recognized as providing a sound foundation on which records can be developed, it is expected to be reviewed to ensure that the design and details are consistent with the requirements and achievement objectives outlined in each of the new curriculum statements (Ministry of Education, 1994a).

As part of a comprehensive restructuring of the national curriculum, a discussion document was distributed in 1989 calling for feedback from the New Zealand public on a set of principles of assessment for better learning (Ministry of Education, 1990). The principles were intended to guide assessment policies and procedures for monitoring and evaluating the New Zealand educational system as a whole, including schools, teachers, and individual students. Over 80 percent of the responses

agreed that the principles were an appropriate base on which to develop educational procedures. Not surprisingly, there were also those who expressed reservations, criticizing the principles on the grounds that they were naive, mediocre, unrealistic; would result in excessive demands on teacher time; neglected the importance of basic skills acquisition; and promoted a system bereft of competitive spirit.

In 1994, a handbook on assessment policy, which included a revised set of basic assessment principles, was developed and distributed to schools. It was intended to provide schools with assistance in developing school-based assessment procedures consistent with recent curriculum developments (Ministry of Education, 1994a). The following set of principles (Ministry of Education, 1990; 1994a), which has been modified for this discussion, reflects the New Zealand Curriculum's driving postulate that the individual student is the center of all teaching and learning:

- The best interests and progress of each student should be paramount. Assessment should be planned, implemented, and reported in ways which maximize the benefits for each student.
- The purpose of the assessment should be explicit to all participants. The information gained should be used to identify strengths and suggest actions to improve the educational development of each student and the quality of educational programs. The emphasis should not be on comparisons of individuals and schools.
- Where possible, assessment should be an integral part of the learning process and not separate from it. The day-to-day classroom program should provide a variety of opportunities, when appropriate, for teachers and students to collect assessment information.
- Assessment should be ongoing, accurate, and as objective as possible. When developing assessment procedures, teachers must be guided by national requirements and school assessment policies and procedures, which includes identifying specific achievement objectives against which each student's progress can be monitored.
- Assessment should involve a variety of contexts and methods according to the needs of each student and the nature of what is being assessed. Self-assessment is an appropriate starting point for assessment and each student should be encouraged to take ownership of learning by setting, evaluating, and achieving specific personal goals.

- The forms of assessment should be appropriate for the knowledge, skills, or attitudes to be assessed. Greatest emphasis should be placed on developing and assessing higher-level thinking skills such as investigating, analyzing, and discussing complex issues and problems; and applying knowledge and skills to new learning situations.
- Assessment procedures should be fair to all. Students must perceive each assessment activity as credible and be motivated to participate. Important considerations include each student's age and developmental level; ways of learning, remembering, and performing; and cultural expectations (especially if the first language is not English).
- Where possible, all parties involved should be provided with assessment feedback immediately after the event. This is essential to the credibility and impact of assessment processes.

The National Assessment Guidelines

> Assessment alone cannot lead to improved learning and higher standards: *You do not grow taller by being constantly measured*. It is the interweaving of curriculum, good teaching, and assessment that ensures quality of learning. We must guard against an increasing preoccupation with assessment, as though it alone will set right the perceived problems in the educational system. (Ministry of Education, 1990, p. 16)

The New Zealand Curriculum (Ministry of Education, 1993c) is a framework that defined the learning principles; identified seven essential learning areas (language and languages, mathematics, science, technology, social studies, the arts, and health and physical well-being); set out the essential skills to be developed by all students; and indicated the place of attitudes and values in the school curriculum. It also recommended effective assessment procedures, which were closely linked to the classroom.

Although New Zealand schools are required to follow the national curriculum, they are not told everything that children need to know, nor are they told how to assess children's learning (Trussell-Cullen, 1996). Prepackaged curricula, similar to those spawned by Hirsch's (1987) proposal for a national "core knowledge" curriculum, are accorded little respect by New Zealand educators. Practices that ignore the histories,

traditions, and literature of non dominant cultures (Peterson, 1995) have no place in New Zealand classrooms. Rather than dictating assessment policies and procedures, the New Zealand Curriculum provided a coherent framework on which teachers, schools, and local communities have the responsibility and freedom to build practices and programs which are appropriate to the needs of their students (Ministry of Education, 1993c). As discussed earlier, this approach is based on the belief that schools and communities that are directly involved in making decisions that impact children's learning are more likely to develop administrative qualities and pedagogy that promote school effectiveness and, in turn, success for all students.

In keeping with the principles of assessment for better learning, a wide range of tasks (Table 2) are used to monitor children's progress against locally and nationally-established learning goals (Table 1). Tables 1 and 2, for example, illustrate a joint emphasis on: (a) basic skills such as understanding fundamental principles; (b) sophisticated skills such as investigating, analyzing, and discussing complex problems; (c) application of knowledge in a variety of ways and from one area of the curriculum to another; and (d) motivational and attitudinal behaviors. This approach underscores the value of comparing student performance to absolute standards, rather than to other students.

By developing an assessment program that utilizes a variety of methods, that engages students on tasks in which they are personally invested, and that monitors student learning in familiar learning environments, teachers can cater more effectively to the learning and assessment needs of all children, particularly those who do not usually perform well on standardized achievement tests.

Table 2
An Example of an Assessment Task*—Junior (7 years of age) Level Curriculum (see Ministry of Education, 1990, pp. 75-76).

Activity One: Discussing, interviewing, collecting data, reporting

Language: Question asked: How do we keep warm in winter? Collect samples of different types of materials that our clothes are made from.

Mathematics: Make a survey of the clothes worn by children in the classroom. Record this information on a graph. Make a report.

Activity Two: Estimating, measuring temperature and time

Language: Question asked: Which materials keep us warmest? Wrap one layer of a different material around each of several similar sized bottles--e.g., cotton, fur, felt, polyester, nylon, wool, leather (etc).

Science & Fill the bottles with warm water.

Mathematics: Measure the temperature in each, using a thermometer, and record it. Estimate which bottle of water will cool first and say why. Measure the temperature every half hour and record. Which bottle of water grew cold first? Why? Which stayed warm? Why?

Activity Three: Estimating, measuring temperature and time, problem solving, recording, discussing, sequencing, writing, computer work

Science & Question asked: What would help keep the bottles of water warmer?

Language: Discussion.

Science: Repeat the experiment, wrapping four layers of one type of material or a combination of materials around each bottle. Are the results different? How? Why? Which material/combination kept the water warm the longest?

Mathematics: Put the bottles into sequence, coolest to warmest.

Health Ed: How is it best to dress in cold weather?

Language: Write or use a computer to publish the results of this experiment.

* This task is typical of those that are part of an integrated approach to learning--it involves activities across the curriculum. Teachers are provided an opportunity to observe children's collaborative and individual problem-solving approaches to the task, as well as children's attitudes and levels of motivation exhibited as the task is undertaken. The emphasis is not solely on finding the correct answer. The task requires children to display a variety of abilities such as estimating, observing, measuring, drawing conclusions, recording, interviewing, collecting data, problem solving, discussing, sequencing, and working on a computer.

> It is important that assessment information is systematically accumulated, so that sound judgments may be made about each student's attainment of the range of knowledge, ideas, and skills described by the relevant achievement objectives. Through initial assessment, students existing knowledge, ideas, and skills can be identified; this will facilitate appropriate planning. (Ministry of Education, 1994c, p. 22)

The New Zealand Curriculum identified three broad, although not exclusive, categories of assessment (Ministry of Education, 1994a):

- Diagnostic assessment takes place at specified times during the school year or as needed. It provides information on what each student knows and can do. It enables the teacher to identify the nature or scope of real or potential strengths and difficulties, and plan learning activities designed to meet specific needs. For example, the teacher systematically observes, analyzes, and summarizes the early literacy skills and book behaviors of a young child using diagnostic reading procedures (Clay, 1993b). This record provides insights into the strategies the child uses to make meaning from texts.
- Formative assessment is an integral part of the day-to-day classroom program. It provides immediate feedback to the student and teacher and enables them to build a profile of the student's progress, and make informed decisions about the next steps in learning and teaching. For example, the teacher of a child new to school spends the first few weeks observing the child at play in directed and undirected activities both inside and outside of the classroom. This cumulative record of behaviors provides insights into the child's abilities to work independently and cooperatively.
- Summative assessment is usually structured, formal, and administered at the end of a unit of study. It enables the student and teacher to make judgments about the student's achievements in relation to targeted achievement objectives, and plan for the next learning stage. For example, the teacher sets a formal essay test requiring the child to write about a personal experience using the style and tone of a newspaper columnist. This writing sample provides insights into the child's understanding of the genre of newspaper writing.

The national curriculum requires teachers to implement a range of assessment methods which are appropriate to each learning area, and appropriate to the developmental level(s) of each student. The following

list gives a brief description of recommended practices for gathering assessment information on individual children. Each of these can be used for diagnostic, formative, or summative purposes (Ministry of Education, 1994a, pp. 16-23):

- Informal observation: The teacher monitors each child's progress throughout the day during regular classroom activities (e.g., an examination of independent reading behaviors during a sustained silent reading session).
- Formal observation: The teacher monitors each child's progress during a specified period using a formal instrument (e.g., an examination of social skills using a standardized observation schedule).
- Self-assessment by each child: Having set personal learning goals, each child monitors his or her progress using informal methods (e.g., a self-examination of prior knowledge of a unit of study by responding to the question; "What do I know about_?") and formal methods (e.g., a self-examination of reading motivation using a survey of reading habits and attitudes).
- Peer assessment: Each child monitors his or her own contribution and others' contributions to a particular task (e.g., an examination of the ability to understand and accept the ideas of others during a science problem-solving activity).
- Conferencing: Each child monitors his or her progress through ongoing meetings with the teacher--both provide feedback to each other (e.g., an examination of writing accomplishments or difficulties during the preparation for publication phase of a writing project).
- Portfolios: Each child makes reflective observations about his or her progress throughout the year by selecting and critiquing a representative, ongoing, and changing collection of work samples (e.g., an examination of the ability to communicate ideas and emotions through an exhibit of still photography).
- Teacher-made written tests: The teacher monitors each child's progress by administering a variety of tests appropriate for particular purposes (e.g., an examination of the ability to interpret and discuss the literary qualities of a text using an essay test format).

The National Monitoring of Student Learning

Public Accountability of the Educational System

Just as the interweaving of curriculum, good teaching, and assessment ensures the quality of learning, so the interweaving of good management, curricula, good

> teaching, community involvement, and assessment produces quality schools. (Ministry of Education, 1990)

As is the case with most educational systems, New Zealand's is expected to provide assurance to the government and the general public that it is performing well. Current monitoring at the national level provides information on educational matters such as student numbers, classification of students by age and class level, class sizes, subjects taken, financial provisions, qualifications and experiences of teachers, and availability and use of special services and programs (Ministry of Education, 1990). However, although each school has its own well developed system for monitoring student progress, based on national curriculum guidelines (see Table 1), there has been, until recently, little emphasis placed on monitoring the educational attainments of students nationwide. Because of this dearth of information at the national level, a monitoring system is being developed to provide the government with detailed and trustworthy information for improving education. This initiative focuses on public accountability of the educational system as a whole, an appraisal of the extent to which national requirements are being achieved by schools, the identification of satisfactory and unsatisfactory trends in performance, and the targeting of appropriate resources and practices.

The recommended approach to the national monitoring of student outcomes will use standardized procedures, will involve a small representative sample of students from throughout New Zealand (probably 5 percent) at ages 8 (year 4) and 12 (year 8), and will take place once every four years (Ministry of Education, 1993c). After data gathering and collation, the findings will be clearly communicated to interested parties, and recommendations for the improvement of student learning and the improvement of learning programs will be made in a realistic and timely manner. By having a small number of students attempt a portion of a total collection of standardized tasks, which reflect a broad range of goals for education, the data cannot be used to rank or judge individual students, teachers, or schools.

Standardized Achievement Tests and Educational Accountability: A Lesson from America

> Most Americans have taken standardized tests from the day they entered kindergarten. Test scores have told the gatekeepers of America's meritocracy--educators, academic institutions, and employers--that one student is bright, the other is not bright, that one is worthy academically, the other less so. Some, with luck, are able to overcome the stigma of poor performance on mental tests. But others will not. (Sacks, 1997, p. 25)

The assertion that the "interweaving of curriculum, good teaching, and assessment ensures quality of learning" (Ministry of Education, 1990, p. 16) is pertinent for American educators interested in developing a student-centered curriculum. Over the past two decades, a wealth of research has advanced our understanding of how children learn and how this learning should be facilitated and monitored. Several significant studies of children's learning have emanated from America (Gardner, 1988, 1991; Sternberg, 1988). Yet, despite convincing evidence that these advances run counter to the standardized achievement testing paradigm, Sacks (1997) claims that America remains preoccupied with the quantification, standardization, and measuring of minds. He asserts that such assessment methods impede rather than promote educational reform and that they continue to produce inaccurate and biased assessments of the abilities of many American children (see also Paris, 1994). In his search for an explanation, Sacks concludes that, "Like a drug addict who knows he should quit, America is hooked. We are a nation of standardized-testing junkies." (p. 25)

In their recommendations for the national monitoring of student outcomes, New Zealand educators steadfastly reject the practice of relying primarily on a single, nationally administered standardized measure. In a system where the interests of students are paramount, there is strong resistance to curricula that serve the needs of assessment policies and procedures and not the needs of students. Trussell-Cullen (1996) is forthright in his criticism of the testing of students at several points throughout their schooling and of the use of the results to publicly compare and call to account students, teachers, schools, school districts, and states;

The result of any testing the teacher or school may do is regarded as something for professional interpretation and use by the teacher. The results would certainly not be made public or, as in parts of the United States, be published in the newspaper. New Zealand teachers would be horrified at the thought of such crude assessment instruments being accorded so much deference and credibility. (p. 97)

This rejection of standardized achievement tests rests on a sound pedagogical foundation. It is strongly believed that the information gathered is flawed and distorts perceptions of what should be the important goals of education (Dougherty, 1994; Paris, 1994). There is also concern that crusades to raise the levels of student achievement on standardized achievement tests lead to substantial portions of the teaching day being devoted to test-related practices that result in a significant narrowing of the curriculum. Kher-Durlabhji and Lacina-Gifford (1993) document a number of time consuming, test-related practices teachers use to prepare students for formal testing situations. These include the development of teaching objectives and strategies that promote familiarization with the structures and procedures of these types of tests, the use of commercially prepared exercises designed to improve test scores, and the enhancement of student motivation for taking tests.

Paris (1994) discusses other concerns. These include the manipulation of the reporting of scores by excusing selected students from testing, the retention of older students so that they will score higher in lower grades, and the "mysterious loss" of test booklets before they are shipped to district headquarters. Other bizarre activities include the commentaries of self-proclaimed educational experts, such as newspaper editors, that bemoan the failure of education and wax philosophically about "getting better test scores"; and the advertising approaches of real estate agents who use test scores to rate neighborhoods in terms of the "quality of schools" (Haladyna, Haas, & Nolen, 1989). This "high stakes" mentality which pressures students, teachers, and schools to give improved test performances priority must raise serious questions about the quality of education. Everyone involved in the process should be asking, "If assessment does not promote better learning and better programs, what value should be placed on it?"

In the New Zealand educational system, the answer is clear. Assessment programs are expected to ensure not only high standards, but also maximum benefits to students. These two goals are accomplished by measuring a wider range of outcomes of schooling than those indicated by performance on standardized achievement tests.

Concluding Comment

> Just as students possess relatively untapped potential for development, educators possess relatively untapped potential for encouraging this development. (Purkey & Novak, 1996, p. 119)

Like any educational system, New Zealand's is not without its concerns. There are areas that still need attention. In particular, policies and procedures for the "appropriate" assessment of minority groups, including women, Maori students, students with limited English language proficiency, and students with disabilities need to be developed. However, despite these areas, new directions are resulting in better decisions, actions, and educational consequences. With ongoing reexamination and refinement by all interested parties, the national curriculum will increasingly provide a wide range of opportunities to meet the diverse needs of all children in a system without barriers to participation and life-long learning.

What, then, can American educators learn from the New Zealand student-centered curriculum and its assessment policies and procedures? Trussell-Cullen (1996) suggests that because the New Zealand model has successfully evolved over time and continues to develop, it can provide important information on the wide variety of ways in which children learn, as well as the wide variety of ways in which teachers can effectively assess this learning. However, he cautions against the mechanical adoption of the New Zealand model at the expense of the needs and interests of American children.

It is appropriate at this point to revisit the introductory words of Paris and Ayres (1994). Like them, I believe that it is time for a more balanced view of assessment policies and procedures for America's schools. This, however, can be accomplished only when teachers, students, parents,

school boards, policy makers, and members of the wider community arrive at a consensus on their understandings about how children learn and how this learning should be assessed and fostered. This agreement must be in place before teachers can create exciting classroom environments that promote school success for all children.

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The Inviting/Disinviting Index: Instrument Validation and Relation to Motivation and Achievement

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Exploratory factor analysis results revealed that the inviting self and inviting others scales of the Inviting/Disinviting Index possess internal consistency and provide a reliable assessment of invitations. Findings also suggest that the disinviting scales require additional study and possible modification. Inviting self and inviting others were related to motivation constructs, but path analysis results showed that, although invitations did not have a direct effect on academic achievement, inviting self influenced achievement indirectly through academic self-efficacy and self-efficacy for self-regulation. Girls were more inviting of others and less disinviting of others than were boys. Sixth-grade students reported being more inviting of themselves and of others than did eighth-grade students.

Invitational theory can be traced to a perceptual tradition in psychology which maintains that the beliefs people develop about themselves help form the perceptual lens through which they view the world and interpret new experiences. As a consequence, individuals' self-beliefs have a profound influence on their actions (Purkey & Novak, 1996). Support for this view comes from social cognitive theorists who argue that what individuals do is more likely to reflect what they believe themselves capable of accomplishing than what they are actually capable of accomplishing (Bandura, 1986, 1997; Schunk, 1991).

The messages that people send and receive play an important role in creating the beliefs that they develop about themselves, for it is these messages that often constitute the bridge on which perception, interpretation, and meaning travel. In school settings, teachers send messages through their behavior, posture, tone of voice, and even the enthusiasm with which they approach their teaching. Invitational theorists contend that people can intentionally send uplifting and empowering messages to themselves and to others, and so they have defined

invitational education as "the process by which people are cordially summoned to realize their potential" (Purkey & Novak, 1996, p. 4). According to invitational theory, the messages that people send can be either inviting or disinviting and can be directed either at oneself or at others. *Inviting messages* tell others that they are able, valuable, and responsible. *Disinviting messages*, on the other hand, tell people that they are incapable and worthless and that they are not welcome to participate in their own development. Because individuals can exercise control over the messages that they send, invitational theorists urge students, teachers, and school administrators to intentionally invite themselves and others, and they provide examples of how this can be accomplished (Purkey & Novak, 1996).

Research findings suggest that *self-efficacy*, the confidence that individuals have in their ability to accomplish a task or succeed at an activity, is related to academic motivation and achievement (Bandura, 1997). Scholars have noted the conceptual relationships between invitations and motivation constructs such as self-efficacy (Purkey & Novak, 1996; Pajares & Zeldin, in press; Wiemer & Purkey, 1994). Pajares (1994) has suggested that the tenets of self-efficacy theory and those of invitational theory complement each other, and he provided a model showing the hypothesized relationship between efficacy beliefs and invitations. Pajares asked students to recall instances in their lives when invitations contributed to, or disinvitations undermined, beliefs about their writing ability. He concluded that invitations created and bolstered self-efficacy beliefs whereas disinvitations destroyed and diminished them.

As do invitational theorists, social cognitive theorists argue that students' self-beliefs are created and developed in part by the messages, that is, the invitations and disinvitations, that students receive from themselves and from others. Pajares and Zeldin (in press) investigated the relationship between these messages and the sources of the self-efficacy beliefs of women with careers in mathematics, science, or technology. They found that the invitations the women reported receiving were important in their initial choice to pursue nontraditional careers and also formed the self-beliefs that nurtured the effort, persistence, and resilience required to overcome personal, social, and academic obstacles. It is worth noting that the invitations from others that the women received

early in their development reemerged at later points in their lives as self-invitations. These findings support the contention of invitational theorists that others play a powerful role in the beliefs that students come to develop about themselves.

To date, insights regarding the relationship between invitations and motivation beliefs such as self-efficacy have either been conceptual or based on findings from qualitative studies. In part, this has been due to the lack of a quantitative instrument with which to measure invitations. The Inviting/Disinviting Index (IDI) (Wiemer & Purkey, 1994) was designed to assess people's self-perceptions about the extent to which they are inviting or disinviting to themselves and to others. Although preliminary results indicate that the IDI possesses sound content validity, Schmidt, Shields, and Ciechalski (1998) urged researchers to engage in additional validation studies with school-age participants.

The purpose of this study was twofold. Our first aim was to follow the recommendations of Schmidt et al.(1998) and continue to investigate the internal reliability and construct validity of the IDI. Our second aim was to explore the relationship between inviting oneself and inviting others on the one hand and various motivation and achievement indexes on the other. To this end, we sought to discover whether being inviting to self or inviting to others differently predicts key constructs prominent in theories of academic motivation as well as academic achievement. Finally, we explored whether there are differences in invitations to self and to others across gender and grade level.

Method

Participants and Procedures

Participants consisted of 245 students (114 girls, 131 boys; 79 in grade 6, 85 in grade 7, 81 in grade 8) from a public middle school in the Northeast. Instruments were group administered in individual classes during one class period and took approximately 30 minutes to complete. Directions and individual items were read aloud by the first author, who administered all instruments.

Instruments and Variables in the Study

Invitations of Self and of Others. The Inviting/Disinviting Index (Wiemer & Purkey, 1994) consists of four subscales representing the degree to which individuals are inviting to self (sample: "I am impressed with my own abilities."), inviting to others (sample: "I congratulate others on their successes."), disinviting to self (sample: "I neglect my own needs."), and disinviting to others (sample: "I blame others when I think they did something wrong."). Schmidt et al. (1998) altered the wording of four items to better reflect age-appropriate vocabulary of middle school students. For example, "I forgive others for their transgressions" was changed to "I forgive others for their misbehaviors and mistakes." We also altered the wording of several items with age-appropriate vocabulary and greater clarity in mind. For example, "I plan time for enjoyable activities with myself" was changed to "I plan time for enjoyable activities that I can do on my own." We increased the 5-point Likert response scale to 7 points that ranged from 1 (never) to 7 (always) (see Albaum, 1997, for rationale on increasing points on a Likert scale). Inter-rater reliability coefficients ranging from .88 to .96 have been reported for the IDI. Test-retest reliability has ranged from .68 to .83 for the scales of the original IDI (Wiemer & Purkey, 1994) and .41 to .59 for those of the adapted version (Schmidt et al., 1998).

Academic Self-Efficacy. The Academic Self-Efficacy Scale is a subscale from Bandura's Children's Multidimensional Self-efficacy Scale (see Zimmerman, Bandura, & Martinez-Pons, 1992). This scale assesses students' judgments of their capability to learn academic subjects as well as certain subject-specific academic skills such as reading and writing. Using a Likert scale that ranged from 1 (not well at all) to 6 (extremely well), students were asked to respond to six questions that asked how well they felt they could learn mathematics, science, social studies, and English grammar, as well as reading and writing skills. Zimmerman et al. (1992) reported a Cronbach's alpha coefficient of .70. We obtained .76 in the present study.

Self-Efficacy for Self-Regulated Learning. The Self-Efficacy for Self-regulated Learning Scale is also a subscale from Bandura's

Children's Multidimensional Self-efficacy Scale that assesses student's judgments of their capability to use various self-regulated learning strategies. As with the Academic Self-Efficacy scale, students were asked to respond on a 6-point Likert scale to items such as "How well can you motivate yourself to do schoolwork?" or "How well can you finish your homework on time." A validation study by Zimmerman and Martinez-Pons (1988) revealed that a single factor underlay the items. Cronbach's alpha values ranging from .80 to.87 have been reported by researchers (Pajares & Graham, in press; Pajares & Valiante, 1997,1998; Zimmerman & Martinez-Pons, 1988; Zimmerman et al., 1992). We obtained a coefficient of .81.

Academic Self-Concept. Consistent with Bandura's (1997) definition of self-concept, we conceptualized academic self-concept as a student's composite view of his or herself formed through experience and feedback from others. Self-concept differs from self-efficacy in that self-efficacy is a context-specific assessment of competence to perform a task. Self-efficacy is, in essence, a cognitive appraisal of confidence. Self-concept is measured at a broader level of specificity than is self-efficacy. Self-concept also includes the feelings of self-worth associated with engaging in a task or activity (see Pajares, 1997, or Skaalvik, 1997, for a discussion of this issue). We adapted 6 items from Marsh's (1990) Academic Self-Description Questionnaire (ADSQ), transforming them from subject-specific content into general academic content. For instance, an item such as, " I get good grades in mathematics" was changed to " I get good grades in school." Students responded on a 6-point Likert scale ranging from definitely false to definitely true. Reliability estimates for the self-concept instrument in areas such as mathematics or writing have ranged from .86 to .94 (Marsh, 1990; Pajares, 1992; Pajares & Valiante, 1998). We obtained a coefficient of .86.

Value of School. The degree to which students value school was measured using 8 items assessing 3 indexes that contribute to perceived value of a domain: importance, interest, and enjoyment. Students were asked to rate how true or false statements were on a 6-point Likert scale. (sample item for importance: "It is important to me to get good grades in school"; enjoyment: "I enjoy school"; and interest: "My schoolwork is interesting for me."). Researchers have reported alpha coefficients

ranging from .69 to .91 when value has been assessed relative to a specific subject area (Pajares & Graham, in press; Pajares & Valiante, 1998). We obtained .91.

Academic Anxiety. We conceptualized academic anxiety as the feelings of tension and apprehension that interfere with engaging in tasks and activities across a wide variety of academic situations. To measure general academic anxiety we adapted items from the Mathematics Anxiety Scale used by Pajares and Urdan (1996). We selected 4 of the 10 original items and altered the wording to make them reflect general academic anxiety. For example, "I am afraid of doing math assignments when I know they will be graded" was changed to "I am afraid of doing school work when I know it will be graded." Students were asked to respond on a Likert scale ranging from 1 (definitely false) to 6 (definitely true). Reliability estimates for this scale in the areas of mathematics and writing have ranged from .80 to .93 (Pajares & Graham, 1997; Pajares & Valiante, 1997).We obtained a Cronbach's alpha of .79.

Academic achievement. Teachers ratings of students' academic aptitude have been acknowledged as a reliable assessment of academic capability (Hoge & Butcher, 1984), and we selected this as our measure of academic achievement. Teachers were asked to rate their students' general academic achievement on a 5-point scale (F to A). The teachers were organized into teaching teams, each teacher saw every student daily, and the teachers met weekly as a team to discuss student progress. As a consequence, each teacher on the team was capable of providing an overall judgement of a student's academic aptitude. The assessment was made in late March, midway through the third quarter of the school year, after teachers had ample time to become familiar with the abilities of all the students on the team.

Analyses

To meet the first objective and test the reliability of the IDI, we conducted exploratory factor analysis of the IDI and also obtained Cronbach's alpha coefficients for the four subscales. We used the maximum likelihood method of extraction (Jöreskog & Lawley, 1968) because this is the method believed to produce the best parameter estimates (Pedhazur, 1982). Criteria to determine the number of common factors to retain and analyze included Cattell's (1966) scree test, eigenvalues greater than one, the percentage of common variance explained by each factor using the weighted, reduced correlation matrix, and the interpretability of the rotated factors. Because we expected any factors that emerged from the analyses to be intercorrelated, we chose the obliminal method of oblique rotation. All analyses were conducted using the SAS system's FACTOR procedure (SAS Institute, Inc., 1989). We explored construct validation by examining the relationship between the IDI and measures of academic motivation and achievement.

To discover the nature of the relationship between invitations, motivation constructs, and academic achievement, we conducted a path analysis using the variance-covariance matrix with inviting self and inviting others as exogenous variables and the motivation constructs and academic achievement as endogenous variables. By using path analysis, we hoped to discover the direct and indirect influence that invitations would have on the variables in the study. Finally, to discover whether inviting self and inviting others differed as a function of gender and grade level, we conducted a multivariate analysis of variance (MANOVA) with gender, grade level, and the interaction of gender and grade level as independent variables.

Results

Results of the factor analysis revealed that three factors underlay items on the IDI. The first factor included 9 of the 10 inviting items and accounted for 46% of the common variance; the second factor included all 5 items of the disinviting self subscale and accounted for 29% of the common variance; the third factor included all five items of the disinviting others subscale and accounted for 25% of the remaining common

variance. Item #6 ("I forgive others for their misbehavior and mistakes") failed to load. Table 1 shows the factor loadings from the rotated pattern matrix and percentage of variance explained for the three-factor solutions. The loadings from the pattern matrix are conceptually similar to standardized regression coefficients, demonstrating the re-lationship between a variable and a factor when holding all other variables constant. Factor loadings of .35 or higher were considered strong enough to demonstrate that the variable indicated the common factor.

It seems reasonable to view low scores on the invitation items as reflecting disinviting responses and low scores on disinvitations as reflecting inviting responses. Respondents who strongly disagree that they are disinviting on a particular matter are actually reporting that they are inviting on that matter. For instance, a response of "never" to the disinviting item "I don't pay attention to others needs" indicates that the respondent is inviting of others and pays attention to their needs. Consequently, we believed that inviting self and disinviting self should be highly, if negatively, correlated, as should inviting others and disinviting others. That was not the case, however. Interfactor correlations were low and reveal problematic relationships. For example, the correlation between the Factor 1 (inviting self and others) and Factor 2 (disinviting self) was a positive .14. The correlation between Factors 2 and 3 (each composted of disinviting behaviors) was a negative -.15. Only between Factor 1 and Factor 3 did the correlation reflect an appropriate negative relationship (-.20). That the inviting items loaded separately from the disinviting items can, in part, be explained by the positive and negative wording of the items (see Kim & Mueller, 1978). It is troubling, however, that factors that should mirror each other were weakly correlated.

Table 1.
Factor Analysis Results for IDI - Standardized Regression Coefficients from Rotated Factor Pattern

	FACTOR 1	FACTOR 2	FACTOR 3
Inviting Self items			
8. I am quick to recognize my own value.	49 *	6	0
11. I plan time for enjoyable activities that I can do on my own.	39 *	9	0
13. I congratulate myself on my successes.	72 *	-3	16
18. I forgive myself for my misbehavior and mistakes.	63 *	-7	14
20. I am impressed with my own abilities.	62 *	-19	19
Inviting Others			
1. I like to include other people in enjoyable activities.	38 *	4	-20
4. I congratulate others on their successes.	43 *	29	-23
6. I forgive others for their misbehavior and mistakes.	29	29	-31
9. I am impressed with the abilities of other people.	39 *	40 *	-12
15. I am quick to recognize the value of other people.	37 *	30	-23
Disinviting Self			
2. I am hard on myself when I think I've done something wrong.	3	62 *	3
5. I neglect my own needs.	-11	57 *	40 *
7. It affects me for a long time when I think I've done something stupid.	1	61 *	-1
10. I am overly critical of myself.	-16	58 *	24
14. I don't pay attention to my own needs.	-28	54 *	6
Disinviting Others			
3. I criticize others when I think it is needed.	5	13	39 *
12. I neglect the needs of other people.	-1	24	64 *
16. I tell other people when I think they have done something stupid.	27	1	52 *
17. I don't pay much attention to other people's needs.	1	-6	47 *
19. I blame others when I think they did something wrong.	13	3	57 *
Common Variance explained	46%	29%	25%

Note: Loadings on the pattern matrix > | .35 | are underlined.

Our initial exploratory factor analysis results suggest that inviting self and inviting others tapped into the same source of variance when they are included in an instrument that includes the disinvitations. Because the nature of the intercorrelations suggested some instability in the disinviting factors, we submitted only the inviting items to a second factor analysis. Note on Table 2 that, when the disinviting items were removed, two factors accounted both for the inviting self and for the disinviting self scales. This increases the likelihood that the disinviting items, either for conceptual or empirical reasons (or both), introduce a good deal of noise into the IDI. To shed more light on this issue, we ran correlations between the four subscales of the IDI and the variables in our study. Note on Table 3 that, in each case, the inviting items were strongly correlated with the motivation variables. The disinviting items, however, which logically should also have been highly, if negatively, correlated, were either uncorrelated or weakly correlated. In addition, note that disinviting self was positively related to value, further evidence that the disinviting items may possess less than optimum internal consistency. Cronbach's alpha coefficients also revealed that the inviting scales had modestly higher internal consistency (.72) than the disinviting scales (.69 for disinviting self; .63 for disinviting others). As a consequence of these findings we decided to use only the more stable inviting self and inviting others subscales to meet the second objective of the study.

Recall that the second objective was to discover the nature of the relationships between invitations, motivation variables, and academic achievement. Table 3 provides correlations between the invitation subscales and the motivation and achievement variables in the study. As the factor analysis results foreshadowed, the inviting subscales were correlated (.42), but the correlations involving the disinviting scales were difficult to interpret. For example, the disinviting scales were not significantly correlated with each other, and the correlation between inviting self and disinviting self, scales that should mirror each other negatively, was also nonsignificant (-.06). In addition, inviting others and disinviting self were positively correlated (.25), a finding that we find conceptually counterintuitive and thus difficult to interpret.

Table 2.
Factor Analysis Results for Inviting Items of the IDI - Standardized Regression Coefficients from Rotated Factor Pattern

	FACTOR 1	FACTOR 2
Inviting Self items		
8. I am quick to recognize my own value.	19	44 *
11. I plan time for enjoyable activities that I can do on my own.	12	33
13. I congratulate myself on my successes.	13	61 *
18. I forgive myself for my misbehavior and mistakes.	18	44 *
20. I am impressed with my own abilities.	-19	81 *
Inviting Others		
1. I like to include other people in enjoyable activities.	37 *	17
4. I congratulate others on their successes.	64 *	6
6. I forgive others for their misbehavior and mistakes.	59 *	-2
9. I am impressed with the abilities of other people.	45 *	20
15. I am quick to recognize the value of other people.	71 *	-3
Common Variance explained	74%	26%

Note: Loadings on the pattern matrix > | .35 | are underlined.

The next step was to conduct a path analysis to decompose the effects for the variables in the model and test direct effects of the two invitations subscales (see Figure 1). The influence of inviting others was observed on self-efficacy for self-regulatory practices ($\beta = .257$) and on value of school ($\beta = .363$). Inviting self had a significant direct effect on self-regulation ($\beta = .343$) and on academic self-efficacy ($\beta = .170$). As expected, the effects of academic self-efficacy and self-concept were the only significant predictors of academic achievement. Invitations did not influence academic achievement directly, but they had indirect influences through self-efficacy for self-regulation. In addition, inviting self had an indirect effect on achievement through self-efficacy. Estimation of the path model revealed a Goodness of Fit Index of .94 and a Normed Fit Index of .92. Both are strong indices of goodness of fit.

Table 3.
Correlations between Subscales of the IDI and Variables in the Study

	Self-Achievement	Self-	Self-efficacy	Anxiety concept	Value regulation	
Inviting Self	.40***	.45***	.45***	-.10	.31***	.24**
Disinviting Self	-.13	-.17	-.10	.32	.21**	-.11
Inviting others	.32***	.37***	.40***	-.02	.51***	.16*
Disinviting others	-.08	-.08	-.16*	.10	-.17*	-.15

	M	SD	IS	DS	IO	DO
Inviting Self (IS)	5.2	1.1	--	-.06	.42***	.12
Disinviting Self (DS)	3.9	1.3		--	.25***	.16
Inviting Others (IO)	5.3	1.0			--	-.23**
Disinviting Others (DO)	3.4	1.1				--

*** $p < .0001$, ** $p < .001$, * $p < .01$

Our final objective was to discover whether there were differences in invitations across gender and grade level. MANOVA results revealed a multivariate effect both for gender, Wilks' Lambda = .89, $F(4, 238) = 7.69$; $p < .0001$, and for grade level, Wilks' lambda = .91, $F(8, 476) = 2.84$, $p < .0043$. The interaction of gender and grade level was nonsignificant. As Table 4 shows, the univariate effect for gender on inviting others revealed that girls (M = 5.6) were more likely to report being inviting to others than were boys (M = 5.0); similarly, girls (M = 3.1) were also less likely to be disinviting to others than were boys (3.7). Sixth-grade students were also more inviting to themselves (M = 5.4) and to others (M = 5.5) than were eighth-grade students (4.9 and 5.1, respectively). Recall that the Likert scale was composed of 7 points.

Figure 1
About Here

Table 4.
Differences by Gender and Grade Level for Invitations and Disinvitations

	Girls		Boys		6		7		8	
	M	SD	M	SD	M	SD	M	SD	M	SD
Inviting Self	5.1	1.1	5.2	1.1	5.4a	1.0	5.1ab	1.1	4.9b	1.1
Inviting Others	5.6a	0.9	5.0b	1.1	5.5a	0.9	5.2ab	1.0	5.1b	1.1
Disinviting Self	4.0	1.2	3.7	1.4	4.1	1.2	3.8	1.2	3.7	1.4
Disinviting Others	3.1a	1.0	3.7b	1.1	3.3	1.2	3.8	1.1	3.6	1.1

Note: Group means for a dependent variable (row) that are subscripted by different letters are statistically different (experimentwise α .05) computed on an effect identified by MANOVA or follow-up.

Discussion

The first objective of our study was to test the reliability of the Inviting/Disinviting Index (Wiemer & Purkey, 1994). Factor analysis results revealed that three factors underlay the instrument. One factor was composed of all inviting items with the exception of #6. We believe that the problem with this item may lie in students' being asked to forgive others both for their "misbehaviors and mistakes." It seems reasonable to suppose that respondents may be more predisposed to forgive mistakes more than misbehaviors. That potential lack of clarity may account for its failure to load. Note that the original IDI used only the word "transgressions" (Wiemer & Purkey, 1994), which Schmidt et al. (1998) judged age-inappropriate. We concur with Schmidt et al. but suggest that "misbehaviors" be removed from that item to increase both its clarity and its intent. We believe that the inviting self and inviting others subscales of the IDI possess strong internal consistency and provide a reliable assessment of invitations. Although they initially loaded on the same factor, this was due to the influence of the less stable disinviting items. When the inviting self and inviting others items were factor analyzed on their own, the expected two factors emerged.

It seems clear that the disinviting subscales also have strong internal properties, as reflected by their loading on the second and third factor of the IDI, but the problematic intercorrelations with the inviting factor and with each other, as well as their general failure to correlate with the motivation constructs, lead us to conclude that continued investigation of their reliability properties is warranted. Although it is likely that the positive and negative wording of the items may account for the differing loadings, it is also possible that being inviting and being disinviting, either to oneself or to others, may be perceived quite differently by students. The intercorrelations and weak relationship with the motivation constructs of the disinviting scales lead us to believe that something other than wording is at play. Recall that the inviting items of the IDI strongly correlated with motivation indexes whereas the disinviting items did not. Researchers will want to continue to explore differences between reported invitations and disinvitations to see whether they are indeed differently viewed and represent different constructs. If, as we inferred, they should be measuring the same phenomena but from different direction, it seems clear that the disinviting items may be accomplishing that problematically.

We recommend two strategies. The first is to conduct a study in which the IDI items are presented with positive wording. Although we certainly agree with Wiemer and Purkey's (1994) contention that being inviting to others and inviting to self represent separable theoretical constructs, we also believe that the difference between invitations and disinvitations can also be explained by reverse scoring of each of the items. It seems reasonable for us to suppose that students who strongly disagree that they are disinviting on a particular item are actually reporting that they are strongly inviting. For instance, we believe that a response of "never" to the item "I don't pay much attention to other people's needs" (item #10) is actually indicating the same thing as a response of "always" to an item that could be positively phrased "I pay attention to other people's needs." We continue to believe that inviting and disinviting should be mirror images of each other, or perhaps a better metaphor would be two sides of the same coin. We believe also that students respond to negative items in ways quite different than they respond to positive items, and that this difference often has a great deal to do with affective concerns unrelated to the content of the item. We

believe that removing the negative wording would help reduce the noise and instability in the disinviting items. Let us also note that most motivation instruments present in the literature are composed primarily of positively-worded answers.

The second strategy would be to rethink the disinviting items with an eye to ensuring that respondents do indeed view the item as a clear disinvitation. We are not altogether sure that this is always the case with the present items. For example, "I am hard on myself when I think I've done something wrong" may very well be viewed as a form of an invitation if I believe that the "wrong" thing I have done deserves a reasonable amount of self-censure and self-reflection. "I criticize others when I think it is needed" may also be viewed as inviting if the respondent focuses on "when I think it is needed" rather than on "criticize." "I tell other people when I think they have done something stupid" could reasonably be viewed as a kind and somewhat inviting act if the interpretation made is that others need to know and we are willing to tell them when we believe that they are being foolish and potentially doing self-harm. The disinvitation may be, in this case, more a matter of *how* I tell other people than on whether I actually tell them.

Our second objective was to investigate the relationships between invitations and various motivation constructs and achievement, and in these analyses we chose to use only the two inviting subscales. Although neither inviting self nor inviting others had a direct effect on academic achievement, each set of invitations had a direct effect on students' reported self-regulatory practices. In addition, being inviting to oneself influenced academic self-efficacy, which itself influenced academic achievement. Two important issues merit noting. The first is that being inviting, especially self-inviting, has clear indirect effects on students' academic achievement through their effect on key motivation constructs. The second is that invitations are strongly related to self-regulatory practices and beliefs. It makes sense, for example, that students who engage in the sort of self-regulatory practices we tapped are, in essence, inviting themselves to succeed in the academic arena, hence the connection between self-regulation and self-invitations. It also makes sense that, when students are successful with self-regulatory habits such as participating in class discussions, completing their homework on time,

or concentrating on their schoolwork, they create the time and the self-confidence necessary to become more actively inviting and accepting of others in ways such as including people in enjoyable activities and congratulating others on their successes, two of our other-invitations.

Finally, we sought to discover gender and grade level differences in invitations and disinvitations. We discovered that girls and boys did not differ in the degree to which they report inviting themselves, but girls were more inviting of others and less disinviting of others than were boys. This is consistent with theoretical contentions regarding the relational and individual postures to which boys and girls are differently socialized, the view that girls perceive themselves as the center of an intricate relational web, and findings that girls function from an ethic that is built on care and on social responsibility (Gilligan, 1982; Noddings, 1988). Findings are not consistent with those of Wiemer and Purkey (1994), however, who found no gender differences in invitations or disinvitations. Their respondents were counselor education graduate students, however, so it is likely that the difference in our samples account for discrepant findings. We found also that sixth-grade students reported being more inviting of themselves and of others than were eighth-grade students. This finding does not surprise us, as it is consistent with results obtained by various researchers regarding the transition through middle school. In general, researchers report that middle-school students suffer a decrease in self-beliefs as they make their way through the middle grades (Bandura, 1997; Pajares, 1997; Wigfield, Eccles, MacIver, Reuman, & Midgley, 1991).

In general, we are excited by the joint research possibilities that the Inviting/Disinviting Index offers motivation and invitational researchers. We believe that its continued refinement and use will reveal the extent to which invitations and disinvitations are related to key psychological and motivational constructs. In addition, it is our hope that these connections will both validate the key contentions made by invitational theorists and afford insights that can be used to enhance the educational world of people, places, policies, programs, and processes.

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Inviting Self-Efficacy Revisited: The Role of Invitations in the Lives of Women with Mathematics-Related Careers

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The purpose of this study was to explore the personal stories of women who selected careers in mathematics, science, and technology to examine whether the verbal persuasions and invitations they received influenced their academic paths. Results revealed that self-beliefs were nurtured by familial, academic, and work-related influences. The self-beliefs, in turn, nurtured the effort, persistence, and resilience required to overcome obstacles. Three interrelated themes emerged: (a) invitations and verbal persuasions were instrumental sources for the development and maintenance of confidence: (b) self-efficacy beliefs, nourished by invitations, fostered resilience to academic and social obstacles: and (c) invitations from others reemerged at critical points as self-invitations that the women used to buttress themselves against challenges.

Women are attending university in ever increasing numbers. Nonetheless, their participation in mathematical, scientific, and technological fields, and their subsequent entry into such careers, continues to be disproportionate to that of men (Sadker & Sadker, 1994). During high school, girls are as likely as boys to take advanced mathematics and science courses, but this parity disappears at the university level, where women earn fewer degrees in these areas (National Center for Education Statistics, 1995). Reasons for this phenomenon vary, but both invitational and social cognitive researchers would suggest that the self-beliefs women hold about their capabilities may provide valuable insights (Bandura, 1997; Novak, 1992; Pajares, 1997; Purkey & Novak, 1996).

Most theories of academic motivation include self-beliefs as a key component. The central construct in Bandura's (1986) social cognitive theory is *self-efficacy*, which for our purposes we will define as

students' judgments of their capability to perform school-related tasks. According to social cognitive theory, students are more likely to be successful when performing tasks they believe they are capable of accomplishing than when performing tasks in which they feel less competent (Bandura, 1997). We believe that the tenets of self-efficacy theory (Bandura, 1997) and of the invitational approach (Purkey & Novak, 1996; Purkey & Schmidt, 1996) complement each other and share similar features. For example, Pajares (1994) provided a model in which the four invitational levels of functioning corresponded to the creation and development of self-efficacy beliefs. In the model, invitations created and increased self-efficacy beliefs; disinvitations destroyed or diminished them. Pajares concluded that common insights from each theoretical camp offered promising directions through which educators and researchers might better understand the ways by which they can help students develop their confidence and competence.

Students form their academic self-efficacy beliefs by interpreting information from various sources. One critical source of efficacy information is composed of the *verbal persuasions* that students receive throughout their academic careers. Verbal messages from significant others help students to exert the effort and maintain the persistence required to succeed, resulting in the continued development of confidence *and* competence. According to self-efficacy theory, positive messages are hypothesized to have the greatest effect on students who already feel efficacious. They tend to be less effective with students who lack confidence in their abilities. Of course, messages can also work to undermine efficacy beliefs when used to convince students that they are not capable. For example, when women receive social messages that they do not belong in a male-dominated field such as mathematics, they may be especially vulnerable to believing that they are not, and cannot be, competent in that area (Bandura, 1997).

It will seem clear from our description that verbal persuasions share critical defining features with Purkey and Novak's (1996) description of the process of invitations as "based on developing, transmitting, and evaluating caring, proactive messages" (p. 4). Invitations and verbal persuasions each involve patterns of communication, and each can be viewed in terms of the messages that one individual or group sends to

another individual or group. When these are sent to students, positive messages convey the view that students are capable, valuable, and responsible. Verbal dispersuasions, or disinvitations, convey the view that students are incompetent, incapable, and irresponsible. Invitational theorists believe that people can intentionally send uplifting and empowering messages both to themselves and to others, and they have thus defined invitational education as "the process by which people are cordially summoned to realize their potential" (Purkey & Novak, 1996, p. 4). In school contexts, the messages that students receive powerfully influence the beliefs that they develop about themselves, for it is these messages that often constitute the bridge on which perception, interpretation, and meaning travel. It is thus reasonable to suggest that verbal persuasions and invitations tap the same phenomenon although they are described from differing theoretical vantage points.

Invitations and self-efficacy beliefs also share similar effects. They influence the academic choices that students make, the amount of effort they expend, their resilience to encountered hardships, their persistence in the face of adversity, the level of anxiety they experience, and the success they ultimately achieve. Invited students with strong self-efficacy beliefs work harder and persist longer when they encounter difficulties than those who doubt their capabilities. Recent evidence suggests that students' self-beliefs are often stronger predictors of academic success than are their prior accomplishments, skill, or knowledge (Multon, Brown, & Lent, 1991; see also Pajares, 1997; Schunk, 1991).

The self-beliefs of college students pursuing mathematics-related majors and careers have received much study. Findings reveal that college women's perceptions of their capabilities to succeed in math-related areas are significantly lower than those of men (Pajares & Miller, 1994). Also, students' confidence in their mathematics capabilities influence their career choice and direction as potently as their performance (Hackett, 1995). In fact, researchers have observed that mathematically competent women often fail to pursue math-related careers because they have low self-efficacy about their competence (Lent, Lopez, & Bieschke, 1993). This is consistent with Bandura's (1997) observation that "girls have a lower opinion of their capabilities for mathematical activities than do boys, even though they perform equally

well in this subject" (p. 430). When college women come to believe that they are not as capable as they really are or that they will be unable to compete in a male-dominated career, they are likely to shy away from math courses, avoid math-related majors, and select academic paths for which they may be less prepared or interested but more confident (Hackett & Betz, 1989).

Nonetheless, there are women who overcome personal and social obstacles and pursue math- and science-related majors and careers. Despite educational and social systems that begin to undermine the mathematics confidence of girls as early as middle school (Midgley, Feldlaufer, & Eccles, 1989), some women maintain the high level of effort, persistence, and confidence in their mathematics skills required to succeed in this area. Self-efficacy theorists would argue that these women have selected math-related majors and pursue math-related careers in large part because their high attainments were accompanied by the corresponding confidence in their capabilities. Invitational theorists would argue that these women likely benefitted from therapeutic invitations that fostered persistence and resiliency. But how were they able to accomplish this in environments similar to those in which most other female students develop lower expectations about what they can achieve?

In this study, we explored the personal stories of women who selected and continue to excel in careers in the area of mathematics, science, and technology to examine whether the messages they received played a role in their decisions to select a math-related career. Our aim was to discover whether the invitational approach and self-efficacy theory can jointly provide insights about how the messages that students receive–the invitations and verbal persuasions–work to provide the confidence and competence required to succeed in academic domains hostile to their success. In essence, we sought to discover whether the verbal persuasions (and *dis*persuasions) that are considered an important source of students' academic self-efficacy beliefs, and which we consider synonymous with invitations (and disinvitations), play a role in the creation and development of positive academic self-beliefs and, subsequently, of academic success.

Methods and Procedures

We selected qualitative methodology to obtain the rich description and narrative that emerge when individuals explore their personal stories (Merriam, 1988). Our choice is in concert with Bruner's (1996) call for a greater use of narrative in studies of psychological constructs to better understand the meanings with which individuals imbue their experiences (see also Lieblich & Josselson, 1994).

Data for this study were gathered from 15 women who currently have a career in mathematics, science, or technology, and it had previously been analyzed to trace how women perceived the importance of the various sources of self-efficacy beliefs (Zeldin & Pajares, 1998). Several careers fulfilled the criteria for this study: mathematics professors, teachers, and researchers in math-related fields at the university level; chemists, physicists, computer software developers, program testers; and engineers. To provide insights relevant to America's educational system, we selected participants who were schooled in the United States. See Appendix A for a description and background of participants.

We designed an open-ended, semi-structured interview protocol (Appendix B) which was designed such that participants would not be led toward a discussion that would have them emphasize their self-efficacy beliefs or invitations in the context of their academic and career histories. If themes related to these constructs were to emerge from the study, we wanted them to emerge from the participants' own narratives rather than as prompted responses to leading questions. All interviews were conducted by the second author and recorded on audio cassette recorder. Recordings were transcribed verbatim. Interview length ranged from 40 minutes to 2 hours. So that participants could clarify or add to the transcript any meaning they thought was necessary, a complete copy of the interview transcription was sent to each participant and changes were made accordingly.

Transcriptions were coded by the guidelines set forth by Miles and Huberman (1994). Codes were generated from each question on the protocol. Start codes were initially descriptive in nature for the purpose of

chunking information into smaller units for analysis. We revised the start list during initial coding to add codes that were needed to describe more specific instances or subjects that were not included in the beginning list.

Results

Three interrelated themes emerged from the analysis of participants' responses. The first was that the messages, the invitations and verbal persuasions, that the women received were instrumental sources for the development and maintenance of confidence beliefs and played a key role in their decision to select a math-related career. Our participants recalled these messages to a greater extent than they did prior accomplishments. The second theme was that the self-efficacy beliefs of women in these male-oriented domains, nourished by the invitations they received, helped the women to be resilient to both academic and social obstacles. The women also demonstrated a great degree of persistence and effort while they continued along their academic and career paths. Finally, it was evident that the messages from others became internalized and reemerged at critical points in the women's lives as *self-invitations* that the women used to buttress themselves against obstacles and challenges.

Messages as Instrumental in Developing Confidence and Competence

Each of the women in our study spoke about a family member, teacher, friend, or supervisor she perceived to have had a positive influence on her academic self-beliefs. The invitations that the women recalled receiving were both intentional and unintentional. Suzanne, a chemist for 30 years, spoke of the unintentional invitation provided by her father's tenacity in pursuing an education in engineering:

> My dad was very, very good at [mathematics], but he never had much of a formal education. But he studied math at home by correspondence school and then he was actually given a degree in what would amount to electrical engineering. He always encouraged me in math and science, and I thought I could do anything the boys could do so it was never a problem.

Mary, a 34-year-old program manager, ascribed her perseverance with mathematics work to her father's encouragement, and she credited him as a primary influence in her career selection.

> [My] pursuit of mathematics is definitely due to my dad. He was very supportive, and I never got the impression that I couldn't do math from my dad. I never got that math anxiety, and in fact when I would not understand something, he would just get up with me in the morning and he would explain it to me and we would work through the problems together and he really emphasized that it just takes practice. You just practice and pretty soon you start to see a pattern.

For some women, the invitations they received from members of their family regarding the idea of women going into male-dominated areas and of women doing what they wanted to do were critical and integral to their later paths. These experiences did not have to be math-related in order to be confidence-enhancing. Martha, a 34-year-old chemist, discussed the powerful invitation she received from her mother during her early school years.

> My mother always engendered in me the attitude that I could do absolutely anything I ever want to do. So she really gave me a confidence that is a big part of success in academics and maybe in other things – sometimes you get to a point where you don't have that much either skill or knowledge and you have to just go on your guts or your confidence. You have to just kind of push your way through something until you have the time to accumulate the knowledge. And I think that that's something she engendered in me just by always being herself so confident of my abilities, rightly or wrongly. And my father certainly never detracted from that. He always portrayed her as being the smarter of the two. So, I was raised in an environment where women were not only capable but were even potentially very well and highly regarded.

A 30-year-old program manager named Laura who had majored in electrical engineering spoke about her grandmother's critical invitation.

> [My grandmother], as a small child she told me and my sister, this was my mother's mother, "You really have to study hard and have your career and your own life." Because my grandfather passed away when she was 32, so she

her whole life had to raise my mom by herself. And she gave us money to go to college and said, "Here's money — go to college – don't spend it on a guy. Don't get married and give it to your husband." It was like, you do it for yourself, you have your own career, be able to take care of yourself.

Tammy, a 44-year-old software developer, credited her grandfather in a similar way.

My mother's father would tell us stories when we were younger, and even as we got older. He died when I was 17. He came to America on the boat, all by himself, when he was 17 years old and he was very influential in saying things like "Take risks. Try something new. It just means another chapter in your life." He would say, "A lot of people will say, 'Don't do this.' But think about it for yourself. Make your own decisions."

Women were especially responsive to the invitations from their teachers. All women spoke about teachers they believed to be highly influential in the development of their competence and confidence. Jean, a 32-year-old chemical engineer, observed that she had been brainwashed by a high school mathematics teacher.

I found that if you were a female who was good at math and science, this particular teacher really believed in getting women into scientific degrees. So every year for two years that I was in his physics class, he said, "Marry a doctor, be an engineer!" When I came to college and I was pre-med, I hated physics though that is what I had planned to major in. Well, somewhere at this point this saying kept going through my head . . . just marry a doctor and be a chemical engineer, and I went into chemical engineering.

The teachers whom the women described arrived at various points throughout their academic and career paths. Cindy, a 27-year-old technical editor, described her experience with a middle school math teacher who paid her the sort of compliment one recalls for a lifetime.

One of our teachers, being most stereotypically weird, nerdy, coke-bottom-glasses, extremely shy math teacher was really quite nice. He walked up to me once some time early in class when I was studying and said one of the nicest things anyone has ever said to me, which was, "You slipped beautifully into the

> disjunctive!" Which was referring to a specific step in a math problem we were doing . . . which is right up there for emotional support.

Both male and female teachers were represented in the women's recollections. Although the instructor's gender did not seem to play a role as far as the perceived intensity of the influence, it was important that women believe that their instructors were *proactively* supportive of them. Patty, a 42-year-old professor of statistics, found this support in her high school algebra teacher.

> It was the first time I had algebra, and I loved it. And then all of a sudden I excelled in it. And the teacher said, "Oh no, you should be in the honors course," or something like that. So, there's somebody who definitely influenced me because I don't think I ever even noticed. I didn't care one way or the other about mathematics. It was just something you had to do. I remember she used to run up and down the aisle. She was real excited. She was just this little, tiny, skinny nun who was just full of energy. She said, "Oh, you gotta go in this other class. You gotta." And she kind of pushed a little bit and I was willing to be pushed, and so that was nice.

Nine women recalled receiving strong persuasive messages and encouragement from job supervisors. Anne, a 26-year-old engineer, credited her manager with affording her the confidence to pursue her current career.

> My manager was a really good influence. He was very encouraging in taking classes. You know, didn't make me feel that because I didn't have a computer science degree like I didn't have a chance. He would

> say things like, "Well, you know, a lot of other people don't too, and you can learn how." I definitely wouldn't have done it if I wouldn't have had him as a manager.

Messages as Instrumental in Developing Resilience

Confidence buttressed by invitations resulted in a pattern of resilience as women continued along their academic paths. The women described themselves as "persistent" and "resilient." Clearly, they had not let obstacles deter them from their paths. Instead, they had turned difficult situations into temporary setbacks rather than into insurmountable hurdles. Lynn, the 40-year-old geneticist in our group, spoke to this issue directly.

> I always knew I was smart. And I guess you get some confidence from just knowing. We always had some sort of struggle going on, and I had a lot of uncertainties in life, and when you deal with those as a young child, it helps you to deal with situations that aren't so comfortable when you're older. It wasn't just one thing that made me know that I could keep on going. I guess it was just watching the people around me. They just didn't believe in ever giving up. I mean not unrealistically, but they wouldn't give up just because adversity came and so I think I picked that up from them.

Note how Suzanne, a 53-year-old epidemiologist, described how a sense of resilience and persistence, of *willing* oneself to succeed, can result from the unintentional disinvitation that often results from a caring family member's efforts at being "realistic."

> About the time that I was graduating from high school, I told [my father] I was going to college. Well, [the family] didn't have any money. He said "Only rich men's children go to college. You can't go to college." I was really shocked that he would say that. I said, "I will." And that's it. I got a scholarship and went. Never a doubt in my mind that I was going to college. It wasn't that I wasn't capable of doing it, he thought. We had no money. Our family had never gone to college, so he didn't see how I would.

It is safe to say that the women in our sample found that their self-efficacy beliefs were resistant to the disinvitations they often received. Although all could speak of instances when they received negative sociocultural messages about women in their field, they either ignored them or did not let them deter them from their goals. Lily, a 31-year-old technical engineer, voiced this most eloquently.

> It was hard . . . because I'd never experienced that before. You got a lot of comments – Make sure you dress nice, and stand next to this equipment at the show and "Do you come with the machine?" You don't like to deal with that when it just brings out the ugly in me. You feel like saying, "Look, I have a master's degree and I can run circles around you mentally, so lay off." But that's an ugly feeling to have to feel that way. And in a business setting, that's not funny. When the manager of our division makes jokes like that, it's pretty unprofessional. It's beyond words. So you just deal with it and keep on going.

Although women sometimes considered peers with similar academic interests and careers to be positive influences, many described instances in which they received negative messages from peers. ("None of the boys wanted to be my lab partner."; "Some guys would make digs about you're really smart or something that was not a compliment at all."). Unable to alter their environment, women selected appropriate and often elaborate coping strategies, but they remained persistent in pursuit of their goals. The following passage illustrates the pain and pathos that disinvitations created for Jean, a chemical engineer and organizational consultant.

> The messages were pretty negative. But not so much about being technical as about being smart. Being too smart in many ways. I hated that. I went out of my way not to let anyone know. It's interesting. I felt a really strong drive to succeed and get good grades but I also tried to very hard to hide my grades from people. And from parents and relatives the good grades were really wanted. But whenever you get in a high school or peer type situation, where you're succeeding at a higher grade level, people look down on you. I think that's fairly common. That it's not considered to be feminine or you must not care about other things, or that must be all you do.

In general, it was evident that the perseverance and resiliency of the women in our sample had been primarily strengthened by the invitations they received from those who had played a critical role in their lives. Without a belief in their own capabilities to succeed that was grounded in their relationships with significant others, the obstacles they encountered might have easily deterred them from their goals. But these women did not consider giving up or giving in as options. Lily put this most eloquently.

> If my dad wasn't there telling me, "Yeah, you can get this," I would have been influenced by some teachers that if they explained it to me one way and I didn't get it, that would be it. Everybody growing up has somebody telling them that you can't do something. It's having the resilience to come back and say, "I don't care what you say. I'm going to try it anyway."

Messages as Instrumental in Developing Self-Invitations

What is also notable from the excerpts above is how messages served to make the women personally and academically *self-inviting*. Because their confidence was developed through the caring of others at the same time that their competencies were taking shape, the women in our sample developed strong self-beliefs and self-invitations that carried them through the tough times in their academic and career history that otherwise could have been potentially devastating. Without purposeful and proactive self-invitations, women could have been easily discouraged in their pursuit of math-related majors and careers. Mary described her experience in college as a mathematics major at a time when academic material started to become very difficult for her.

> I never thought, "Well, I just can't get this." When I went to college I did experience that more, where I didn't understand as much as I used to. But never did I think, "I'm just not good at this." I always thought, "I just don't get this right now. I haven't figured out the right way to look at this to get it." And I had no qualms about going to professors and they never intimidated me. They never scared me. It's like, "I just don't get this and you need to find a better way to explain it to me."

Tammy spoke about the difficulties she encountered in engineering classes and how she overcame these impediments by, in essence, inviting herself to succeed.

> I knew how to work hard. And so I would study and a couple of times. I remember one or two classes I just said, "I'm going to try this later." And dropped out of it before the halfway mark. And then came back a year or two later and took it and it was no big deal. It was just the first time I had seen stuff like that and it scared me. More scared than anything. And so when I came back, then it was okay."

It is noteworthy, but certainly not unusual, that all of the women spoke of encountering obstacles along their paths. Two of them dropped out of college but returned to finish their degrees. Others recalled people in their lives whom they felt had been extremely negative influences, but they found ways to counteract potential harm. For example, Lynn overcame a powerful and intentional disinvitation and had to pursue her own scholarship sources to enable her to go to college:

> I had a very, very poor guidance counselor who, even though I was valedictorian, he told me I really ought to find something easier to do and never helped me with trying to get scholarships or things like that, I had to do that on my own."

Discussion and Implications

In summary, the mathematics self-beliefs of the women in our sample were nurtured by familial, academic, and work-related influences, and these influences were recalled primarily in terms of the encouragement received from people about whom the women cared. The self-beliefs, in turn, nurtured the effort, persistence, and resilience required to overcome personal, social, and academic obstacles. The women consistently recalled experiences that involved an invitation received from an influential person, often during a critical time, who helped them develop their beliefs about their capabilities.

One prominent theme to emerge from the narratives was that, just as important as it was for the women to believe in themselves, it was also

important that *others believe in them.* Bandura (1997) has suggested that the "self-affirming beliefs of others promote development of skills and a sense of personal efficacy" (p. 101). This is reminiscent of Cooley's (1902) metaphor of the *looking-glass self*, the idea that individuals' self-conceptions are, in part, formed as a result of their perceptions of how other people perceive them. That is, the perceptions and judgments of others act as mirrors through which individuals view and define their own self-beliefs. This is also consistent with Purkey and Novak's (1996) description of the influence of significant parents, teachers, and peers on one's own beliefs. All of which is to suggest that other people have a powerful hand in the mental habits that an individual creates and develops.

We also found that our participants were especially attentive and susceptible to the encouragement of those about whom they cared and with whom they felt a relational bond. This is consistent with Bandura's (1997) assertion that the impact of verbal persuasions on one's own self-beliefs is likely to be only as strong as one's confidence in the person who issues them as well as with Purkey and Novak's (1996) contention that, for others to exercise maximum influence, the environment must be carefully prepared. Critical to this preparation is the development of a trusting, caring, and respectful relationship.

The women in our study demonstrated through their experiences with their families, teachers, peers, and supervisors that insights related to their academic competence and career decisions can be provided by understanding the role played by the invitations provided by significant people in their lives. When women struggled with obstacles, they were naturally inclined to remember episodes involving people about whom they came to care or who came to care about them.

Invitations influenced the self-efficacy beliefs that were important factors in helping the women we interviewed to select a nontraditional career. It is evident that educational programs should be geared to helping girls develop stronger self-efficacy beliefs during critical periods in their lives. Girls will develop higher mathematics self-efficacy in classrooms in which teachers break down stereotypical conceptions regarding academic domains, convey the message that success in an academic area is a

matter of desire, effort, and commitment rather than of gender or established social structure, and provide models that verify that message. The women in our study suggested that female models could provide an important vicarious experience for girls considering careers in mathematics and science. It seems especially critical to emphasize that parents, teachers, and those who would seek to be caring agents in the lives of young women be especially reflective and proactive in this regard, especially given the fact that individuals often convey stereotypical and maladaptive messages to girls in unintentional but subtle ways (Eccles, 1989; Bandura, 1997). It is evident that "educators should strive to be intentionally inviting" (Purkey & Novak, 1996, p. 59) if they hope to nurture and maximize their students' self-efficacy beliefs. Inviting school and teaching practices that foster both competence and the necessary accompanying confidence should be identified, as well as practices that "convert instructional experiences into education in inefficacy" (Bandura, 1997, 175).

To women pursuing careers in math-related areas, low self-efficacy may be particularly detrimental because it can result in lower enrollment in advanced college mathematics and science courses, lack of participation in math-related college majors, and failure to pursue math-related careers. When women do not pursue the potentially lucrative math-related careers of which they are capable, they also decrease their chances for a financially stable career future and cannot take advantage of the personal challenge and fulfillment that these types of opportunities represent (Hackett, 1995). Moreover, a society unable to correct its inequities cheats itself out of important and meaningful contributions from a significant portion of its citizens. This is especially critical at a time when there is a proportional decline of male students in college populations and a proportional increase of female students. If this trend holds, it seems evident that American society will have to increasingly rely on the mathematical talents of women to maintain its scientific, technological, and economic viability (Bandura, 1997; Hackett, 1995).

What our findings suggest with some clarity is that these practices should include the types of invitations likely to nourish the self-efficacy beliefs of girls and women as they set out to meet the challenges required to succeed in male-dominated academic domains. Girls will develop

higher academic self-efficacy in homes and classrooms in which parents and teachers stress the importance and value of math skills, encourage girls to persist and persevere in the face of academic and social obstacles, break down stereotypical conceptions regarding academic domains, convey the message that success in an academic area is a matter of desire, effort, and commitment rather than of gender or established social structure, and provide models that verify that message. It seems especially critical to emphasize that parents, teachers, and those who would seek to be caring agents in the lives of young women be especially reflective and *proactively* inviting, especially given the fact that individuals often convey stereotypical and maladaptive messages to girls in unintentional but subtle ways. It is evident to us that self-efficacy beliefs enable women in male-dominated domains to develop and maintain their will. It is equally evident that these beliefs are themselves created and nourished by the invitations that caring individuals extend to their children, their students, their colleagues, and their friends.

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Appendix A
Background of Participants

Name	Age	Ethnicity	Educational Background	Occupation
Lynn	40	Caucasian	BA, MD, Ph.D. candidate, Genetics Epidemiologist, Geneticist	
Suzanne	53	Caucasian	BA, MS, Ph.D. Chemistry	Research Chemist, Epidemiologist
Anne	26	Caucasian	BA Sociology and Communications	Software Test Engineer
Patty	42	Caucasian	BA Chemistry, MA Mathematics, Measurement, Statistics Professor Ph.D. candidate,	
Katy	41	Caucasian	BS, MA Nuclear Engineering	Nuclear Engineer, radiation studies
Dinah	32	Caucasian	BS, Ph.D. Computer Science Computer Science Professor	
Eve	38	Caucasian	BS, Ph.D. Mathematics	Mathematics Professor
Laura	30	Japanese American	BS Electrical Engineering	Software Engineer, Project Manager
Cindy	27	Caucasian	BS Mathematics	Software Programmer, Technical Editor
Tammy 44	Caucasian	On-the-job Technical Training		Software Development, ProjectManager

Appendix A continued

Jean	32	Caucasian	BS Chemical Engineering MBA Business Administration	Chemicat Engineering High-Tech Organizational Consulting
Martha	34	Caucasian	BS Chemistry MS ExperimentaJ Polymer Chem. Ph.D. Theoretical Chemistry	University based Research Chemist Chemistry Software Developer and business owner
Mary	34	Caucasian	BS Mathematics	Program Manager for Technical Exam Development and Certification
Julie	30	Caucasian	BS Computer Science	Software Design Engineer
Lily	31	Latina American	BS Nuclear Engineering MA Metallurgical Engineenng	Technical Engineer, Applications Engineer

Appendix B

Interview Protocol

1. Background information — age, schools attended, family, previous occupations and how many years at current occupation?
2. Please describe your current occupation?
3. What experiences contributed to your decision to pursue your occupation?
4. How were you influenced by others?
5. What did people say to you as you were pursuing mathematics (science or technology)? (Family/Teachers/Peers/ and Culture) What sort of sociocultural messages did you get?
6. How would you describe your feelings and beliefs about mathematics (science or technology) as you were pursuing it?
7. Tell me one memorable story that would really help me understand how you came to do what you do.
8. Why do you think that so few women pursue mathematical-related careers? What could be or should be done to alter that?
9. Considering your academic and career history, if you could have done anything differently, what would that be?

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