MSP-Motivation Assessment Program
University of Michigan

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MSP-MAP established five goals in providing evaluation and technical assistance to MSP Comprehensive and Targeted Projects (MSP C&Ts). The first three were original goals and the last two added in response to MSP requests:

- Develop and make available reliable, valid, and practical tools to assess student motivational beliefs, strategies for self-regulated learning, beliefs about the epistemology of the discipline, and beliefs about teaching and learning that can be used by mathematics and science classroom teachers, and by MSP C&Ts, to evaluate the effectiveness of their interventions.

- Increase teachers’ and MSP C&Ts’ knowledge about the role of these beliefs and strategies as either mediators or moderators of instruction and how they are related to student achievement in mathematics and science, in a manner that informs the design and evaluation of interventions.

- Assist teachers and MSP C&T’s by providing information about how student beliefs and strategies, and their linkages to student achievement, generalize or may differ as a function of gender, age, ethnicity, and SES.

- Develop and deliver workshops for teachers as a means of disseminating empirical findings and practical knowledge of motivational processes to MSP partner audiences.

- Develop and test cognitive pretesting techniques to improve characteristics of extant scales, as well as those under development.
**Project Highlights**

MSP-MAP accomplished virtually all its goals and objectives. These include the following:

- Reviewed the motivation-related literature and assessment of constructs
- Developed and revised versions of numerous extant scales for assessing student and teacher motivation;
- Established and maintained collaborative relationships with several comprehensive and targeted MSPs
- Created custom instruments to meet the needs of individual MSPs
- Assisted MSPs with data collection and analysis
- Examined mediating and moderating effects of motivational variables
- Examined the moderating effects of gender and race/ethnicity groups
- Conducted use-inspired basic research
- Disseminated findings at national and international conferences, published and submitted work for publication
- Provided data for three PhD dissertations (to date)
- Developed and delivered workshops for teachers for the purpose of presenting: (a) contemporary theoretical perspectives and empirical findings regarding motivation, and (b) the results of data collected on motivation from the students in each MSP population.

Furthermore:

- Piloted, analyzed, and disseminated the results of cognitive pretesting techniques to improve characteristics of extant scales, as well as those under development
- MSP-MAP considerably expanded involvement with two MSPs (TASEL-M and TEAM-Math) in the areas of professional development and evaluation — motivation has become a significant focus of their interventions
- MSP-MAP is continuing to work with and support the evaluation of TEAM-Math;
- MSP-MAP continues to receive requests for assessment tools and remains part of the NSF MSP Network
General Motivational Framework

Context

Teachers’ Instructional Practices → Students’ Perceptions of Motivational Climate and Learning Opportunities → Motivation-Related Outcomes → Choice & Persistence → Achievement

Students’ Perceptions of Motivational Climate and Learning Opportunities → Task Value, Interest, Achievement Goals, Affect, Self-Regulation → Intensity, Quality → Achievement

Motivation-Related Outcomes

Competence Beliefs

Task Value

Interest

Achievement Goals

Affect

Self-Regulation
MSP-MAP Activities
### Table 1: Major MSP-MAP Activities and Timeline (Years and Quarters)

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<thead>
<tr>
<th>Activities</th>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
<th>Y4</th>
<th>Outcome</th>
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<td>Review existing literature and measures: Students</td>
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<td>Develop items and scales: Students</td>
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<td>Review existing literature and measures: Teachers</td>
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<td>Develop items and scales: Teachers</td>
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<td>Develop items and scales to assess family involvement</td>
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<td>Refine and revise scales and tools (students and teachers)</td>
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<td>Cognitive Pretesting (data collection and analysis)</td>
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<td>Data collection</td>
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<td>Data analysis</td>
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<td>Workshop development and presentation</td>
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<td>Publish findings</td>
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- **Completed or In Progress**: Blue
- **Planned Activity**: Yellow
- **Deleted Activity**: Red
- **Accomplished/Continuing**: Green
MSP-MAP collation and review of the literature was primarily completed during Y1 but continued throughout the project as new literature emerged. Summaries of the major literature reviews are appended (beginning on p. 51). In addition to a review of the interest literature, particular attention was devoted to children’s perceptions of the classroom context and teacher reports both of instructional practices and personal beliefs as they relate to the motivational climate of the classroom. These measures were developed with two main purposes in mind: to elicit reports of personal beliefs and perceptions and also to monitor the effectiveness of teacher workshops on motivation, a new activity that was undertaken during Y2. We continued to revisit issues of revision, as assessment data obtained in Y2 - Y4 were analyzed in conjunction with collaborations with TASEL-M and TEAM-Math. We also included a review of the literature on epistemological beliefs due to initial interest by the VIP K-16 MSP. We continue to monitor motivation-related literatures for relevant new developments, which will inform the iterative process of refinement of measures. A significant addition during Y3 was creating scales to assess several aspects of parent involvement and support. These included: (a) students’ beliefs about their parents’ achievement goals for them, and (b) ways their parents supported student self-regulated learning. In addition, we assessed students’ use of cognitive and metacognitive learning strategies, thus adding significantly to our knowledge about how students study and learn mathematics.

As a consequence of activities during Y1-Y3 we created, developed, tested and refined a suite of student and teacher scales for use in research and evaluation of mathematics and motivation, which continued into Y4. The data obtained through our collaborations with MSPs afforded exceptional opportunities to undertake extensive psychometric analyses. MSP-MAP was therefore positioned to respond to requests for the scales, which occurred during Y4, and further requests are expected. It should be noted that, although the scales are framed for mathematics and suited for middle and high school ages, they can be used for science classes with appropriate modification. The measures can also be used for older (college) students with no modification. Although not a planned activity during Y4, reviews of the literature and development of some of the scales did continue during Y4, and in fact is an ongoing process. As more data are obtained, analyzed and interpreted, we learn more about how the motivation-related measures perform, including across gender and race/ethnic groups.

The development and testing of cognitive pretesting procedures is undoubtedly one of the most significant outcome of MSP-MAP. The first major publication in a high impact journal (Educational Psychology) is, according to communications with those in the motivation research field, already mandatory reading (see Presentations and Publications). Not only has this suggested further scale refinement but also has created new knowledge.
MSP-MAP collected data from elementary, middle and high school populations, in collaboration with several MSPs. The populations were very diverse, with large proportions of African American and Hispanic students. Students completed their surveys, which typically required 20-30 minutes, in their regular mathematics classrooms. Surveys consisted primarily of structured statements and Likert or similar rating-scale responses. The list of scales and sample items are provided on pages 27-32. Additional formats included multiple choice and open-ended responses. The demographic and motivation-related variables assessed varied depending on MSP’s needs. Thus far MSP-MAP has been involved in the administration, processing and analyzing of over 90,000 surveys of students and teachers. Due to MSP-MAP’s continued involvement with TEAM-Math, that number will grow to well over 100,000 in the next two years. Several linked waves of data and access to district databases provide the possibility of testing numerous hypotheses and long-term trends, including during the critical middle to high school transition, the point at which students make significant curricular decisions and many begin their vocational trajectories. Furthermore, student data are linked to teachers/classes, which enable examination of how perceptions of their classes and teacher characteristics contribute to student motivation and performance. The continuing collaboration with MATH-Acts will also permit analyses of relations between student perceptions and classroom observations.

In addition to descriptive and standard multivariate techniques, data analytic approaches included structural equation modeling (SEM), multi-level modeling (MLM) and recently improved ways to perform person-centered analyses (i.e., cluster and latent class analysis). For example, with SEM across waves, examination of the cross-lagged paths provides inferential evidence of causation, especially when combined with MLM that takes advantage of the naturally occurring variability across teachers and classes. The large sample sizes also provide for tests with sufficient power even after stratification (e.g., by gender, grade, ethnicity). Indirect paths, mediation, and moderator effects have been included as well. As described subsequently, data analysis and reporting contributed significantly to professional development for MSPs with which MSP-MAP collaborated.
As a RETA, MSP-MAP resources were divided into supporting collaborating MSP’s and use-inspired basic research. For the most efficient and rapid dissemination of findings we focused first on providing information for MSP evaluation needs, then on conference presentations to the research and professional communities. In response to MSP requests, MSP-MAP added workshops and professional development to its activities, which included feedback of MSP-specific information to teachers (described below). Publication followed, and dissemination through web-based tools is in preparation.

In particular, most resources were devoted to the development of professional development workshops on motivation in collaboration with and for TASEL-M and TEAM-Math, with a major effort for the TASEL-M August (2006) teacher institute. By request, an entire day was devoted to motivation, which featured sharing results of data collection from 2005-2006 school year. School motivational profiles of student responses at the beginning, end, and changes during the year revealed differences between types of courses. Individual (confidential) profiles for teachers yielded information that in many instances suggested instructional changes to render classrooms more motivationally adaptive for learning. Importantly, the changes from beginning to end of the school year were more motivationally adaptive during Y2-Y3 than in Y1-Y2. Even in the absence of a control group, this finding provided critical evidence for the effectiveness of the intervention on motivation (see sample school profile on p. 41). Significantly, MSP-MAP provided over 125 teachers with individualized feedback that consisted of a profile of motivation variables (e.g., student efficacy, value, class perceptions) for each of their classes, measured both at the beginning and end of the school year, as well as changes over that time (see sample teacher profile on p. 43). The individualized data for nearly 500 classes were presented in such a way that teachers could relate the changes in profiles to their instructional practices. Workshops were also conducted for TEAM-Math teacher leaders at which MSP-specific data were presented, including structural models based on student self-reports (see example on p. 41).

MSP-MAP has disseminated results of research and development at research conferences (AERA, APA, European Association for Research on Learning and Instruction - EARLI) and professional organizations (AMTE, NCTM), some of which involved collaborating TEAM-Math and TASEL-M MSPs. Included were over 25 symposia, paper and poster sessions. MSP-MAP was invited to present at the 2005 MSP Evaluation Summit. Others articles have been submitted or are in preparation. A complete list to date is shown on pages 28 to 32. Journal publication has started, with a major article in the Educational Psychologist on cognitive pretesting, which researchers are beginning to adopt. Currently undergoing review is an article based on confirmatory procedures (CFA) that supported a 3-factor model of “catch” and “hold” components of situational interest, which will alter the way those dimensions are assessed in mathematics and science classes (or other subjects) learning (see p. 47 for final structural model). Numerous articles are currently in preparation. Requests for assessment instruments is expected to continue with further dissemination, and when the database is available online.
Collaboration and Links

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In all, MSP-MAP collaborated with 10 MSPs in some form during the grant period, with three major collaborations continuing (described in more detail subsequently). TEAM-Math remains the most stable collaboration and is expected to continue for an additional two years, with MSP-MAP providing ongoing technical support and collaborative dissemination at conferences and in publications. We continue to collaborate with Mathematical ACTS (UC-Riverside) on analyses that involve examining associations between observations of teachers’ use of reform practices and students’ perceptions. Considerable effort was devoted to the assessment of teachers’ and students’ epistemic beliefs about science in collaboration with VIP K-16, but without a tangible deliverable. There also was initial interest from and discussions with PRISM, but that collaboration never developed.

Several individual meetings were held with members of the local steering committee. Given their extensive experience, expertise, and insights, these were extremely productive during the first two years in helping to frame the issues and gain additional familiarity with math and science educational concerns. Meetings continued with selected members after that point. However, they became less important as MSP-MAP gained experience and capacity. The same can be said for National Advisory Committee members. Similarly, there were initial contacts, but it became immediately apparent that their professional responsibilities and schedules precluded meeting, and further contact was altered to email.

Hosting a dissemination conference was deleted because we believed it would not be as productive as would resources devoted to other activities that required considerable time and effort, such as faculty development workshops, and presentations at general and discipline-specific conferences.
Primary Collaboration and Research Activities
THE EAST ALABAMA PARTNERSHIP FOR THE IMPROVEMENT OF MATHEMATICS EDUCATION: TRANSFORMING EAST ALABAMA MATHEMATICS (TEAM-Math)

MSP-MAP has provided ongoing support for survey development beginning in Y1, as well as data analysis and reporting services. Our initial focus in working with TEAM-Math was to merge and analyze student and teacher survey and achievement data. As the collaboration developed, however, MSP-MAP assumed a more direct role in conceptualizing and operationalizing the measurement of motivation variables as well as the processing of student and teacher data. In addition, MSP-MAP collaborated with TEAM-Math to provide professional development workshops for teacher leaders, which featured the presentation of student data to illustrate the importance of student motivation for improving mathematics achievement.

Specifically, in Y3, MSP-MAP supported TEAM-Math through the assessment of the following constructs: interest and value, achievement goals, perceived goal structure, math beliefs, and math anxiety scales. For teachers, assessment included: efficacy, expectancy, beliefs about student motivation, and classroom goal structure. After a thorough review of Wave 1 and Wave 2 survey data, discussions with TEAM-Math personnel concerning the psychometrics they had included for students and teachers suggested revisions to ensure that the goals of the project were comprehensively assessed. For example, we recommended that authoritative teaching practices be included in both the student and teacher surveys. We also provided assistance with critical formatting and item ordering issues for the Wave 3 survey data collection and offered additional suggestions for survey administration and data management.

Data collection is ongoing for TEAM-Math (under subcontract) in the following areas:

- Surveys of elementary and secondary students and teachers
- Alabama state achievement test scores for elementary and secondary students (ARMT)
- High school graduation exam scores for secondary students (AHSGE)
- National achievement test scores for elementary and secondary students (SAT10)
- Assessment of teachers’ pedagogical content knowledge
- Reform Teacher Observation Protocol (RTOP)-based teacher observations
- Surveys of administrators (Wave 2 only)
- Surveys of teacher leaders (June, 2006)
- Surveys of Pre-Service teachers in the teacher education program at Auburn University

In Y3, MSP-MAP personnel made site visits to Auburn University to meet directly with researchers and teacher leaders to discuss data collection, handling, processing, and analysis, and to present a professional development workshop for teacher leaders, based on analyses of TEAM-Math student and teacher data. As part of this workshop, MSP-MAP personnel collected additional survey data from the teacher leaders.

Thus far we have received several databases from TEAM-Math, including data from students and teachers. These data reflect personal motivational characteristics, including academic self-efficacy in mathematics, interest in and utility of mathematics, and pursuit of mastery and performance goals in mathematics. Data are from elementary students ($N=1406$ for Wave 1, 643 for Wave 2), secondary students ($N=4440$ for Wave 1, 957 middle school students and 512 high school students for Wave 2), elementary teachers ($N=364$ for Wave 1 and 342 for Wave 2),
secondary teachers (N=107 for Wave 1 and 120 for Wave 2), and teacher leaders (N=60 for June, 2006). MSP-MAP has just received the Wave 3 teacher surveys (N=791) and we will receive the Wave 3 student surveys after the first of the year.

MSP-MAP personnel also initiated professional development during the TEAM-Math summer teacher workshops that, in part, were similar in format and content to those of TASEL-M. Statistical analyses were presented (descriptive statistics and structural equation models) of data collected from students. During the most recent summer teacher workshop, MSP-MAP personnel were able to offer two simultaneous workshops. An introduction to motivation attended by teachers and teacher leaders new to the TEAM-Math team, and a follow-up workshop intended for returning teachers that expanded on previous ideas for motivating students in the classroom. School level and teacher level descriptive statistics could not be provided due to a lack of available data. However, as TEAM-Math continues to expand and strengthen their data collection, MSP-MAP hopes to be able to provide more personalized and in-depth analyses to teachers and schools. Continued collaboration with TEAM-Math will include further professional development, with the potential for increased feedback of results from data collection.

Sample Research Findings

Confirmatory factor analyses were used to test the factor structure of items in the student motivation scales. Elementary and secondary students differentiated these concepts from one another, and analyses suggest that the motivational constructs that MSP-MAP provided to TEAM-Math function substantially similarly for African-American and Caucasian students at the elementary level but differ at the secondary level. Similar functionality is also evident for African-American boys and girls. One important next step for MSP-MAP is to use the data across waves to examine how the two groups differ. Initial analyses suggest that there may be Race x Gender interactions such that Caucasian boys are significantly different from Caucasian girls and both African-American boys and girls.

One of the goals of the MSP-MAP collaboration with TEAM-Math has been to comprehensively examine the motivation constructs with African-American students. TEAM-Math data from a sub-sample (N = 466) of Wave 1 African American secondary students support the influence of motivation on these students’ mathematics achievement, whether defined as SAT10 performance or as expected course grade. Importantly, analyses suggested that students who perceived aspects of the TEAM-Math teachers approach to teaching (e.g., more frequent use of reform practices, higher teacher expectations for all students, higher standards) were more interested and confident in math and less anxious about math than their peers (Wooley & Gilbert, 2006).

MSP-MAP analyses also suggest that the extent of teacher involvement in TEAM-Math is important for African-American secondary students’ reports of use of reform practices as well as students’ motivation in mathematics. Students who had teachers who were more involved in TEAM-Math reported significantly higher use of reform practices by their teachers, less performance avoidant behaviors, and less performance approach behaviors than students with teachers who were less involved in the project.

A central focus of TEAM-Math is to influence teacher beliefs about reform practices. Analyses suggest that these beliefs do affect TEAM-Math teachers’ implementation of those practices. African-American secondary students whose teachers reported greater endorsement of reform beliefs reported higher reform practices by their teachers and a trend toward less performance avoidant behaviors (Fell, Ammon & Karabenick, 2007).

Along these lines, MSP-MAP has examined the extent to which students reports of their teacher’s use of instructional practices align with teacher reports of their own instructional practices. Students report observing traditional practices far more frequently than teachers report using them in the classroom. However, the teachers that are more involved in TEAM-Math have students that report observing less use of traditional teaching practices and a higher use of reform teaching practices than students of teachers who are less involved (Martin, Strutchens, Gilbert, Karabenick & Musu, 2007). As MSP-MAP receives more information linking student and teacher data, similar analyses will continue. Thus, the analyses to be undertaken over the coming year by MSP-MAP in con
junction with TEAM-Math include use of SEM and HLM to examine students’ motivational and achievement outcomes across waves as well as the impact of TEAM-Math on teachers’ beliefs and practices.

Due to the ongoing data collection, analyses will be updated as more data is processed by MSP-MAP personnel. Working with TEAM-Math, MSP-MAP personnel developed a plan for current and future analyses. Questions that MSP-MAP plans to address for TEAM-Math include:

• How have teachers’ beliefs and attitudes changed across the project? How will they continue to change?
• How do teachers’ beliefs and attitudes vary depending on level of involvement and/or time spent on TEAM-Math activities?
• How do teacher leaders’ beliefs and attitudes change across time?
• Do teacher leaders’ beliefs and attitudes differ from teachers involved in the project that have not taken on a leadership role?
• How have students’ perceptions of the math classroom changed across time?
• How have students’ beliefs and attitudes regarding math changed across time?
• How do students’ beliefs, attitudes, and perceptions of the classroom vary in relation to their teachers’ beliefs, attitudes, and involvement in TEAM-Math?
• How have pre-service teachers’ beliefs and attitudes changed over time due to the refocusing of the teacher education department on more reform-oriented practices?
MSP-MAP provided all of the items for the TASEL-M survey. Scales included: subjective task value, personal goal orientation, classroom goal structure, situational interest, affect, efficacy, help seeking, teacher support, teacher fairness and respect, teacher caring and academic press to describe student motivation. A subset of high school students also responded to items assessing their perceptions of teacher-directed standardized test preparation, and students’ self-perceptions related to achievement on the test before and after test administration. Data were collected at six time points over two school years. Approximately 13,000 students were surveyed in each October and May/June waves, and approximately 4,000 were surveyed each March, for a total of more than 60,000 student surveys. MSP-MAP personnel and research assistants from nearby colleges and universities participated in data collection efforts. A seventh wave of data collection took place in Y4 and is being processed. Data from the first six waves have been processed and merged into a customized database solution designed specifically for this project. The database includes students’ standardized test scores and demographic information from the California Standards Tests administered in the spring of 2004 and 2005. Data from the 2006 administration is being integrated and longitudinal data management continues.

Teacher workshops were presented in March 2005, August 2005, and August 2006 to all TASEL-M teachers. In the introductory March workshops, teachers were presented with a general overview of motivational concepts as they apply to classroom instructional practice, as well as a description of some preliminary findings. We discussed preliminary analyses of student motivational characteristics and developmental (cross-sectional) trends, as well as variability in students’ perceptions of mathematics classroom contexts. We engaged teachers in practical discussions of how instruction can be more supportive of adaptive motivational characteristics.

In Y2 we implemented workshops for teachers who are participants in the TASEL-M professional development initiative. The purpose of the series of one-day workshops was to make the motivational concepts that form the foundation of the instruments used to assess student motivation useful to the teachers as they work towards improving instruction. The workshops aimed to build on teachers’ intuitive understandings of themselves and of students. Although they contained much theoretical content, the workshop emphasized for teachers matters pertaining to the practical application of motivational theories in classroom contexts. This work has continued, and expanded considerably, in Y3 and is now integrated into the TASEL-M intervention.

In August 2005, MSP-MAP personnel led off a week-long professional development workshop with a presentation that addressed big questions about student motivation in Orange County mathematics classrooms: How are students motivated (or not)? What reasons do they have for working (or not working) in their math classes? How do they perceive their classroom environments, and how are these perceptions related to how well they do? Data collected the previous year were presented and discussed. Importantly, in a series of small group activities, we used data from the first year of our collaboration to illustrate how students’ motivation changed across the school year, and how this change influenced performance and was influenced by teachers. We prepared
reports and discussion questions for individual schools and teachers to facilitate the data-driven dialogues that are a key component of TASEL-M’s intervention. Evaluations revealed how the presentation, reports, and activities played a role in the success of the 2005 August Institute. Example of our dissemination of findings is provided at the end of this report (see pp. 39 and 41).

MSP-MAP expanded its role in the August, 2006 teacher workshop. Once again, results were presented from the previous year's data collection. Each of the 14 schools received motivational profiles of students for each type of class (e.g., Algebra, Geometry). In addition, every teacher received their own (confidential) report for each of their classes. As in Y2, these data helped teachers understand the motivational concepts we presented, and provided them with information they can use formatively to improve classroom instruction. The workshop included video clips of exemplary math instruction (from Boaler). All indications are that the combination of the conceptual framework, video and accompanying discussion, and the data were effective — providing a model for professional development. In addition to our efforts to communicate findings with TASEL-M project staff and participants, we are collaborating with members of the TASEL-M staff to disseminate findings at several national conferences. We continue to enjoy a very strong working relationship with TASEL-M staff and participants.

Family Involvement

Beginning in fall of 2005, MSP-MAP partnered with TASEL-M to conduct a preliminary investigation of teacher beliefs and practices regarding family involvement, as well as children's perceptions of family support for motivation and achievement in mathematics. One of our goals was to provide a more complete picture of the motivational and instructional supports children experience across multiple learning contexts (e.g., school as well as family contexts), and to assess the simultaneous impact of home and school factors on children's outcomes in mathematics. A second goal was to investigate the relationship between family-oriented teacher initiatives and children's reports of family involvement. Are teachers’ invitations to families and practices supporting positive and efficacious family involvement related positively to family goals, values and involvement practices?

As part of a longer teacher survey, teachers were asked to report their beliefs regarding the utility and importance of family involvement, and their efficacy for supporting such involvement, during the fall of 2005. We then asked a subsample of middle and high school children to report on the goals and values families had communicated to them regarding mathematics in the spring of 2006. These students also responded to questions about how frequently and in what ways family members were involved in their mathematics learning at home or at school. Preliminary findings (descriptive statistics) were reported to TASEL-M teachers during their annual August Institute.

Sample Research Findings

Much of the MSP-MAP research has involved how the variables measured function as scales. The majority of items developed have been subjected to exploratory factor analysis, and scales have been constructed accordingly. Quite satisfactorily, we have found few instances thus far in which factors have deviated from the predicted structure. However, two such instances warrant mention, and will receive further attention as we continue to analyze the data. The first set of variables we will report on reflect student perceptions of teacher caring and support. Although variables such as teacher support of help seeking, teacher caring, and teacher fairness were created as separate constructs, they appear to be highly correlated; factor analyses suggested that the items in these scales indicate a single latent construct, teacher support.

The second set of variables concern the achievement goals students endorse. Items on the fall surveys assessed students’ perceptions of the classroom goal structure, in terms of a focus on mastery approach, performance approach, and performance avoid goals. Exploratory factor analysis indicated that these items form two scales, with both types of performance goals (approach and avoid) forming a single factor at the level of classroom perceptions. Previous research has yielded mixed results; although our findings mirror the results of several studies involving middle school populations, other researchers have reported that students are able to differentiate these constructs. We intend to examine our findings more closely, as we hypothesize that these items may be interpreted differently by students of
varying sociocultural backgrounds or with respect to developmental level (e.g., middle school vs. high school).

Preliminary analyses utilizing constructed scales have begun to shed some light on interesting grade-level trends with respect to student motivational characteristics as well as student perceptions of the classroom context. In general, mathematics self-efficacy, interest in mathematics, perceived utility of mathematics, mastery goals, help-seeking behaviors, and positive affect related to mathematics are higher for students in middle school than for students at higher grade levels. Although this trend was anticipated (and consistently found in the existing literature), future analyses will examine whether the professional development activities TASEL-M participants are engaging in effectively buffer this apparent decline in student motivation. Interestingly, the endorsement of performance goals shows a similar trend, indicating that students at higher grade levels are less likely to focus on their ability relative to others. We consider this a positive motivational trend, and look forward to conducting more rigorous longitudinal analyses.

Further cross-sectional analyses have demonstrated differences in student motivation with respect to level of achievement. Students who achieve at higher levels tend to feel more efficacious, are more interested in math, and feel that math is more important than do low achievers. Not surprisingly, high achieving students tend to espouse mastery goals more, and performance goals less, than do low achieving students. These findings indicate a more adaptive motivational profile for high achieving students.

We have also found that students’ perceptions of the classroom context are related to motivational characteristics, and that these relations do not vary as a function of achievement level. Specifically, when students perceive that a classroom environment emphasizes mastery-oriented goals, students report higher levels of efficacy, interest, and positive affect, are more likely to feel that math is useful.

Help seeking is an adaptive strategy of self-regulated learners that seems to be particularly affected by the achievement goals and level of teacher support students perceive at the classroom level. We have found that students are more willing to seek help and less likely to avoid help seeking when they perceive an emphasis on mastery goals and a high level of teacher support. In contrast, students are more likely to avoid seeking help when they perceive an emphasis on performance and relative-ability. Perceptions of challenge were also positively related to help-seeking behavior. These findings suggest that when students perceive a challenging yet supportive academic environment, in which the emphasis is on learning rather than outperforming others, students are more likely to engage in adaptive learning behaviors such as help seeking.

The students who have participated in the TASEL-M surveys represent a very diverse population, although primarily Latino/Latina. As we continue to build our database, we will be able to conduct more in-depth analyses of how motivational characteristics, perceptions of context, and the relation between the two vary across socio-economic and cultural subgroups. For example, we have begun to examine the different experiences of Latino, Caucasian, and Vietnamese students in our sample. Preliminary analyses suggest that these students respond differently to various classroom characteristics, such as teacher support and press for understanding (Ammon & Conley, 2006). Practices that promote interest in mathematics for some students may not be as effective in capturing the interest of others. We are hopeful that future work will shed light on these nuances in the relation between teacher practice and student motivation.

Initial analyses indicate that there are nuances within the cultural groups in our sample. English Learners reported higher levels of motivation than did their non-EL Latino peers (Musu, Mendez, Ammon & Karabenick, 2006). EL students also reported higher levels of perceived mastery goal emphasis within their families (Musu, Ammon, Karabenick & Friedel, 2007). Higher levels of personal motivation correlate with perceived parental mastery emphasis in the population as a whole as well (Friedel & Karabenick, 2007).

The relationship between teacher efficacy for supporting student motivation and student motivational beliefs and achievement in math was explored. Teacher efficacy for supporting student motivation was distinct from teacher efficacy in other domains (i.e., instruction and classroom management). Hierarchical linear modeling identified teacher efficacy for supporting student motivation as a significant predictor of between teacher variance in stu-
dents’ efficacy for math and students’ interest in math on average. Years of teaching experience was shown to be a significant negative predictor of teacher efficacy for supporting student motivation (Blazevski, 2006).

Students’ work on a performance assessment was compared with their scores on a multiple-choice readiness test and a state achievement test; the relationship of motivation to all three assessments was then examined. The analyses suggested that, in addition to students’ perceptions of value (including cost) and efficacy, their focus on learning and understanding (i.e., mastery-goal endorsement) is an important correlate of adaptive reasoning. The results also showed that students who score high on measures of both interest and efficacy are not necessarily high-achieving; rather, their performance depends on relative levels of other aspects of motivation, such as their perceptions of cost and their math achievement goals (i.e., personal goal orientation) (Gilbert, 2007).

Using a person-oriented approach, patterns of mastery and performance achievement goals, task values, and competence beliefs were explored. Cluster analysis revealed seven patterns of motivation associated with differences in negative and positive affect and later achievement. This approach identified different combinations goals and values to that were associated with positive affect and higher achievement. One adaptive pattern included students with moderate interest in math and a sole focus on mastery goals. In another pattern, students focused on both developing and demonstrating competence, suggesting that goals function differently for different students. Across all clusters, cost value discriminated among adaptive patterns, suggesting that perceptions of the time and effort required to learn math play an important role in motivation. Ethnic and linguistic differences favored Vietnamese students and proficient English speakers. Integrating goal and value constructs improved prediction of adaptive patterns (Conley, 2007).

There will literally be years of further analyses that emerge from this database, which is one of the most complete in existence in terms of motivational variables assessed.
Institute for Social Research, University of Michigan: Improving Distance Education for Adult Learners (Project IDEAL)

Over the past year a working collaboration project has developed between members of the MSP-MAP project and the Project IDEAL Support Center, a separately funded endeavor at the University of Michigan. As a whole, Project IDEAL is a collection of states working together to develop effective distance education programs for adult learners. The Project IDEAL Support Center at the University of Michigan assists this group by developing materials and web-based tools that can be used to improve the training of the instructional personnel. The Support Center provides technical assistance to improve such areas as teacher training, research design, data collection and analysis, and reporting. Hence, the Project IDEAL Support Center aims to improve distance education for adult learners by developing critical supports for the personnel more directly tied to providing instruction to this population, which includes mathematics.

The collaboration among these two projects was founded to address three inter-related goals. A first goal was to develop assessments of motivation and self-regulation that could be used with the population of students served by Project IDEAL. This population is different than most others addressed by the MSP-MAP in two key characteristics. One, Project IDEAL is targeted at adult learners, many of whom are working toward the completion of Graduate Equivalency Degree (GED). Two, the instructional activities completed by the population of students served by Project IDEAL are accomplished primarily through different forms of distance education.

A second goal of the collaboration was to evaluate whether knowledge of the motivation and self-regulation of students in this population could help to explain their learning, achievement and progress within the Project IDEAL framework. This goal was established because little research exists examining these relations within this population of students. Hence, little is known about whether motivational and self-regulation constructs can be used to explain and predict adult students’ behavior and achievement within a distance education context. Finally, a third goal of this collaboration was to assist the Project IDEAL Support Center in developing interventions and/or instructional materials that could be used to improve the motivation and self-regulation of their target population, and by way of these improvements, positively impact students’ learning and progress in their GED coursework.

In line with the overall goals of the Support Center, the underlying goal to the collaboration was to support the development of instructional materials, technologies, or other aids.

The overall collaboration and the specific goals described above were established through meetings and discussions over the 13 months. Initial discussions and exploration of a possible collaboration were accomplished through informal conversations and contact in August and September, 2004. These discussions indicated that a more formal collaboration might be productive, and subsequent meetings were held in October, 2004. There has since been a logical progression that included developing the goals of the collaboration, identifying individual roles and responsibilities, creating survey or assessment materials, and most recently designing and implementing a process to collect some initial data.

One result of the collaboration has been to develop a set of items/scales that could be used to assess motivation and self-regulation in the population of students served by IDEAL. The first step in this process was determining which motivation and self-regulation scales would be most relevant and informative for this population. The second step was to modify existing items/scales or to create new items/scales that were needed for this context and population.

In addition to the development of a set of scales for assessing key aspects of motivation and self-regulation, a second outcome of the collaboration has been to administer the assessment materials to a pilot set of approximately 100 participants. More specifically, data from approximately 100 participants were collected in June and early July 2005. This process was directed and overseen by personnel from Project IDEAL. At the end of Y2, data...
were being managed and cleaned so that preliminary analyses could be conducted. The respective roles and responsibilities of different project members for accomplishing these outcomes have been dictated by their respective areas of expertise. MSP-MAP took primary responsibility for initial identification of the aspects of motivation and self-regulation which were to be included, and they contributed expertise in the areas of motivation and self-regulation, and more generally in the area of survey development and research design. IDEAL personnel brought more intimate knowledge of the student population and the instructional context to be assessed, as well as detailed information about logistical and practical issues that would constrain the design of the study.

The data collections completed in May and June were envisioned as an initial pilot study to evaluate the reliability and validity of survey items/scales. To this end, analyses will focus on evaluating internal reliability of the scales, and examining the expected relations among the different motivational and self-regulation scales. In addition, these pilot data would provide valuable insight into the ongoing constraints and affordances available with regard to gathering data from the target populations. For instance, we expect to develop more refined expectations regarding how many items can be included on the survey, when and how best to administer surveys, and what level of participation we will get.

Plans for dissemination of results have also begun. These efforts will have two points. First, results will be integrated into the on-going efforts at the Support Center to develop improved technical, instructional, and procedural supports for the larger members of Project IDEAL. These efforts will be carried out under the auspices of the Support Center. Second, results will be used to develop research presentations for professional conferences and for publication in peer reviewed journals. These efforts will be spearheaded by MSP-MAP personnel and will focus more on using the data to investigate theoretical relations among the motivational and self-regulation constructs. We still consider this collaboration ongoing, as discussions occur regularly about its status.
Mathematical ACTS (Achievement and Collaboration for Teachers and Students) is a project that builds on an existing University of California - Riverside (UCR) and Jurupa Unified School District partnership, involving pre-service and in-service education of teachers. Mathematical ACTS focuses on emphasizing student mastery of Algebra I content (only 52% of the secondary school mathematics teachers have a mathematics major or mathematics teaching credential).

After initial contact in October 2004, and a further contact at the NSF MSP meeting in January 2005, we developed appropriate surveys which were administered in April 2005. These surveys were designed for student and teacher subjects and in accordance with the UC-Riverside observation protocol and project evaluation interests. The surveys emphasized motivation related measures of classroom context in addition to core groups of person scales, including efficacy, value and achievement goals. A student survey, including 42 items designed to assess the constructs of standards based reform, academic press, teacher support of help-seeking, collaboration, teacher caring, teacher fairness, classroom goal structure, interest, and efficacy in math, was administered in mid-April 2005 to approximately 4,800 4th, 5th, and 6th grade students.

The survey was administered by teachers who did not administer to their own classes. Data entry following this survey was completed by Mathematical-ACTS and sent to MSP-MAP in late summer 2005, for initial analysis (for example, CFA). MSP-MAP then provided feedback. An additional round of data collection occurred in April 2006. MSP-MAP is still working with Mathematical-ACTS, which is anticipated to involve data analysis, interpretation, reporting, and potentially professional development.

The Mathematical-ACTS collaboration is extremely important because of its eventual contribution to research on the relationships between classroom observations and student perceptions. As of the final report, MSP-MAP is entering the phase of data analysis and interpretation.

**Additional Short-Term Collaborations and Technical Assistance**

- VIP K-16 – University of Maryland System
- PRISM
- University of Wisconsin-Milwaukee
- Colorado State University
- Aims Community College
Motivation-Related Assessment Tools

As a RETA, MSP-MAP provided suggestions for ways to assess motivation-related characteristics and outcomes in populations involved with MSPs. Beyond the recommendation of appropriate assessment tools, we also often provided protocols for survey administration and assistance with administration and data collection. Finally, we offered analytic services to those MSPs who requested it. As a consequence, based on the existing literature and further research in collaboration with MSPs, MSP-MAP now has a wide range of motivation-related assessment tools to recommend for which there is adequate psychometric evidence. Specifically, we have measures to address student and teacher motivational characteristics, which are framed with respect to learning and teaching in mathematics and, with suitable modification, are applicable for the sciences.

In the process, it should be noted that we were flexible in the revision of assessment tools by MSP researchers to accommodate MSPs specific needs. Thus, some items used to assess a specific motivation-related construct, such as interest or efficacy, varied slightly across partnerships. In addition, the number of items used by some MSPs to assess a specific construct varied to accommodate time constraints for survey administration; some item wording also varies to accommodate MSP population developmental differences in reading comprehension. In spite of these inconsistencies, to the extent possible, the guiding principle was to ensure that constructs maintained their theoretical integrity. The following pages provide a listing of the motivation-related assessment tools (and sample items) employed at some point in the process of MSP collaboration.
Student Personal Beliefs and Behaviors

Ability

• Self-Efficacy
  How certain are you that you can learn everything taught in math?

Value

• Interest
  I enjoy the subject of math.
• Utility
  Math will be useful for me later in life.
• Attainment
  It is important to me to be a person who reasons mathematically.
• Cost
  Success in math requires a big investment of my time.

Emotion and Affect

• Math Anxiety
  Math tests scare me.
• Positive Affect
  How often do you feel happy in your math class?

Achievement Goal Orientation

• Mastery Approach
  Learning a lot of new things is what is important to me in math.
• Performance Approach
  In math, doing better than other students is important to me.
• Performance Avoid
  My goal is to keep others from thinking I’m not smart in math.

Self-Regulation

• Cognitive Strategy Use – rehearsal
  When I study for math, I read my notes, my homework, and the textbook over and over.
• Cognitive Strategy Use – organization
  I outline my notes from math class or the textbook chapter.
• Metacognitive Strategy Use – planning, monitoring, regulating
  During math class I think about whether I understand what the teacher is trying to explain.
• Social/Contextual Strategy Use – help-seeking
  If I didn’t understand my math homework I would ask someone in my class for help.
• Time Management
  I spend my time memorizing key equations or facts when I study for math.
Student Perceptions of the Teacher or Class

Teacher Support

• Teacher Caring
  *Our math teacher cares about how we feel.*

• Teacher Fairness and Respect
  *Our math teacher wants students in this class to respect each others' ideas.*

• Teacher Support for Collaborative Work
  *Our math teacher encourages us to share ideas with one another in class.*

• Teacher Support for Help-Seeking
  *Our math teacher encourages us to ask questions when we do not understand.*

Teacher Focus on Student Success

• Academic Press
  *Our math teacher makes sure that the work we do really makes us think.*

• Teacher Expectations for Class Success
  *My teacher thinks all students can learn.*

Classroom Achievement Goal Structure

• Mastery
  *In our math class, it’s OK to make mistakes as long as you are learning.*

• Performance Approach
  *In our math class, it’s important to get higher scores on tests than other students.*

• Performance Avoid
  *In our math class, it’s important that you don’t make mistakes in front of everyone.*

Student Perceived Parental Involvement

Motivation

• Family Values Math
  *According to my family, it is important for me to be able to think and reason mathematically.*

• Family Confidence in Student’s Math Ability
  *My family tells me I can learn math.*

• Family Norms
  *My family expects me to continue with math in the future.*

• Mastery Achievement Goal Emphasis
  *According to my family, the main goal in math is for me to learn as much as I can.*

• Performance Achievement Goal Emphasis
  *My family wants me to get better grades than other students.*

• Family Encouragement for Academic Risk-Taking
  *My family would like me to do challenging math problems, even if I make mistakes.*
Support for Learning

• Family Support for Student Self-Regulation
  *People in my family encourage me to go through the book and my class notes to find the most important ideas.*

• Family Role Construction
  *According to my family, it is not their job to help me when I have difficulty in math.*

• Homework Monitoring
  *During this school year, how often has someone in your family asked you about your math homework?*

Other

• Help Giver Competence
  *If I needed help with my math homework, my family would know how to help me.*

• Family-Teacher Communication
  *During this school year, how often has someone in your family asked your math teacher how you are doing?*

Teacher Scales

Math Teacher Identity

*Being a mathematics teacher is a major part of who I am.*

Approach to Teaching

• Academic Press
  *In my class, students are pushed to take on challenging work in math.*

• Mastery Approach
  *I emphasize the importance of learning from mistakes.*

• Performance Approach
  *I help students understand how their performance compares to others.*

• Performance Avoid
  *I make an example of students who are not prepared to answer questions in class.*

Efficacy (Personal)

• Classroom Management
  *How confident are you that you can prevent disruptive behavior in the classroom?*

• Teaching Mathematics
  *How confident are you that you can teach students how to do difficult math problems?*

• Supporting Student Motivation
  *How confident are you that you can get students excited about mathematics?*

• Enlisting Parent Involvement
How confident are you that you can increase parents’ involvement in helping students with their math work?

- Teaching English Language Learners
  How confident are you that you can help students who are English Language Learners understand the material in class?
- Teaching Students with Learning Difficulties
  How confident are you that you can help students with learning difficulties understand the material in class?
- Constructivist Instructional Approaches
  How confident are you that you can develop students’ conceptual understanding of mathematics?
- Personal Efficacy for Doing Mathematics
  I am sure that I can learn how mathematical ideas are connected to each other.
- Skepticism Regarding Teacher Impact on Success
  Teachers are not a very powerful influence on student achievement when all factors are considered.

Teacher Collective Efficacy

- General – Department Level
  In this math department, teachers are able to get through to difficult students.
- General – School Level
  In this school, teachers have the necessary skills to effectively enact the current curriculum.
- Involve Parents – Department Level
  In this math department, teachers are good at getting parents involved in school activities.
- Involve Parents – School Level
  In this school, teachers work hard to ensure that parents feel comfortable coming to school.

Collective Teacher Caring

- Department Level
  In this math department, teachers treat all students with respect.
- School Level
  In this school, teachers treat students who get good grades better than they treat other students.

Achievement Goal Structure

- Mastery – Department Level
  In this math department, the importance of trying hard is really stressed to students.
- Mastery – School Level
  In this school, the emphasis is on really understanding the subject matter, not just getting the right answers.
- Performance Approach – Department Level
  In this math department, students who do well are pointed out as a model for other students.
- Performance Approach – School Level
  In this school, special privileges are given to students who do the best work.
- Performance Avoid – Department Level
  In this math department, student work that is incorrect or poorly written is shown as an example of what not to do.
• Performance Avoid – School Level

*In this school, students are told it is important not to be the worst in their class.*

Student Support

• Support of Student Collaboration

*How often do students work together on collaborative math activities in your math class?*

• Support of Student Help Seeking

*How often are student questions answered completely in your math class?*

• Teacher Support for Situational Interest

*When I teach mathematics in my classroom, I design tasks and activities that make math class entertaining.*

Beliefs About Mathematics

• Simplicity of Mathematics

*Mathematics is a collection of rules and formulas.*

• Understanding Concepts is Important in Mathematics

*In addition to getting the right answer in mathematics, it is important to understand why the answer is correct.*

• Value of Math for Students

*Students need to have good mathematics problem-solving skills to be successful in the future.*

• Value of Math for Teacher (personal)

*Knowing advanced mathematics is important to me, even if it’s not necessary for the classes I teach.*

Teacher Perceptions of Family Involvement

• Teacher Invitations to Parents and Families

*How often have you sent home letters telling families what students have been learning and doing in class?*

• Reasons for Contacting Parents and Families

*How often have you contacted a student’s parent because the student is struggling with a particular math concept?*

• Specific Strategies for Promoting Family Involvement

*How often have you provided a parent or family member with specific math activities to do with the student?*

• Teacher Perception of Family Involvement Practices

*What percentage of your student’s families helped the student feel motivated to learn math?*

• Reasons Why Families Become Involved

*How likely are families to contact you personally when the student is having a problem with learning math?*
Dissemination
Professional Conference Presentations, Proposed and Forthcoming

American Educational Research Association

Karabenick, S. A. (2005, April). Evidence-based motivation-related outcomes of mathematics improvement interventions: Collaborative adventures in Pasteur’s quadrant. Symposium presented at the annual meeting of the American Educational Research Association, Montreal, QC. The following individual presentations were:

- Friedel, J., & Blazevski, J. Measure development and customized technical assistance: A process analysis.
- Gilbert, M. C., Woolley, M., & Conley, A. Validity, reliability, and initial findings: TEAM-Math elementary students.


**MSP Evaluation Summit**


**SELF Conference**

Association of Mathematics Teacher Educators


National Council of Teachers of Mathematics


Society for Research on Child Development


Southwest Consortium for Innovations in Psychology and Education


Society for Research on Adolescence

European Association of Research on Learning and Instruction


International Congress of Applied Psychology

International Conference on Motivation

American Psychological Association

TEAM-Math Partnership Conference
Publications


Abstract

Concerns about the validity of test scores derived from motivation-related self-report instruments prompted research and development to examine ways that individuals understand, interpret, cognitively process, and respond to survey items. At issue was whether these events are consistent with researchers’ assumptions and intended meanings given the constructs the items are designed to measure. Adopting an information-processing theoretical perspective, we describe cognitive pretesting methods and procedures employed and summarize results of studies that quantify the cognitive validity of measures of motivation for mathematics, specifically real-world instructional practices, mastery classroom goal structure, and student self-efficacy. We propose a confirmatory qualitative analytic approach to improve the validity of motivation-related assessment, and consequently greater precision regarding the meaning of the theoretical constructs assessed. Implications and challenges for motivation-related assessment and theory are discussed.

Submitted Manuscripts


Gilbert, M. C. & Musu, L. Using TARGETTS to create learning environments that support mathematical understanding and adaptive motivation. Submitted to Teaching Children Mathematics.

Professional Development

TASEL-M


Motivation Students: Data from TASEL-M 2004-05. Presented August, 2005 in Irvine, CA.

Motivation and Mathematics Presented August 2006 in Irvine, CA

TEAM-Math

Supporting Motivation through Classroom Practice. Presented June, 2006, Auburn, AL.

Supporting Student Motivation to Learn Mathematics. Presented June, 2007, Auburn, AL.

Supporting Motivation through Teacher Practice: Part II. Presented June, 2007, Auburn, AL.
PhD Dissertations

Undergraduate Honors Thesis
TASEL-M Workshop
School-Level Motivation Profile Feedback
TASEL-M Workshop
Class-Level Motivation Profile Feedback
Fall Motivation

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Spring Motivation

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TEAM-Math Workshop Structural Model
Structural Equation Model

High Standards

Teacher Expectations

Reform Practices

Study Time

Expected Math Grade

SAT10 Math Performance

Self-Confidence

Interest

Understanding/Mastery

Anxiety

Ego/Competition

Reform Practices

Teacher Expectations

High Standards
**Structural Model of Personal and Situational Interest**

Table 3. Correlations and Standardized Regression Weights for Motivation Constructs and Readiness Test Raw Scores

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<td>-.16b</td>
<td>.05</td>
<td>-.10</td>
<td>-.15a</td>
<td>-.13a</td>
<td>-.11</td>
</tr>
<tr>
<td>R²</td>
<td>.14</td>
<td></td>
<td>.08</td>
<td>.07</td>
<td>.09</td>
<td>.10</td>
<td>.09</td>
</tr>
</tbody>
</table>

Note. TOTAL refers to combined readiness test score; FRDM refers to rational number strand; GEOM refers to geometric measurement strand; GRDA refers to graphing/data analysis strand; INTG refers to integers strand; LITS refers to algebraic symbols strand; PROP refers to proportional reasoning strand.

## Exploratory Factor Analysis of Scale Items to Assess Student Motivation for Math

### Table 6: Factor Structure for Final Measures of Self-Perceptions

<table>
<thead>
<tr>
<th>Scale items and factor loadings&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Interest</th>
<th>Utility</th>
<th>Efficacy</th>
<th>Negative Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interest (α = .95)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoy doing math.</td>
<td>.94</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like math.</td>
<td>.93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math is exciting to me.</td>
<td>.93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much do you like doing math?</td>
<td>.87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoy the subject of math.</td>
<td>.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Utility (α = .85)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math will be useful for me later in life.</td>
<td>.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math concepts are valuable because they will help me in the future.</td>
<td>.84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How useful is learning math for what you want to do after you graduate and go to work?</td>
<td>.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In general, how useful is what you learn in math?</td>
<td>.70</td>
<td>.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compared to most of your other school subjects, how useful is what you learn in math?</td>
<td>.59</td>
<td>.23</td>
<td>.11</td>
<td></td>
</tr>
<tr>
<td><strong>General Self-Efficacy (α = .86)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How sure are you that you can do even the most difficult homework problems in math?</td>
<td></td>
<td>.81</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How confident are you that you can do even the hardest work?</td>
<td>-.15</td>
<td>.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How sure are you that you can figure out the answers to problems your teacher gives you in class?</td>
<td>.73</td>
<td>-.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How confident are you that you know enough to help other students understand the math concepts taught in class?</td>
<td>.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How certain are you that you can learn everything taught in math?</td>
<td>.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Even if a new topic in math is hard, how confident are you that you can learn it?</td>
<td>.12</td>
<td>.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How confident are you that you can do all the work in math class...</td>
<td>.21</td>
<td>.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Negative Affect (α = .71)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often do you feel irritated in your math class?</td>
<td></td>
<td>.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How often do you feel exhausted in your math class?</td>
<td></td>
<td>-.13</td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>How often do you feel bored in your math class?</td>
<td></td>
<td>-.58</td>
<td>.40</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Results for EFA pattern matrix. Factor loadings below .10 not reported in the table.

INTEREST & VALUE

Overview
This is an executive summary of the work of the group studying interest and value related constructs. To date we have conducted a thorough, if not exhaustive, search of the relevant literature. We have defined constructs, specified models, gathered measures, and made some suggestions for operationalizing important constructs. A full account of the reviews may be found in Appendices A and B. This summary highlights important points from the reviews and group discussions from the mini-conference on May 27, 2004. We review the reasoning behind studying these constructs, summarize our activities and findings thus far, and describe ongoing work in this area.

Definitions

**Interest.** Personal interest refers to an individual’s attraction, general liking, and enjoyment of a specific activity or domain (Pintrich & Schunk, 2002). This general attraction or enjoyment consists of both an affective or feeling component (e.g., liking) as well as a value component (e.g., the personal meaningfulness or relevance of the domain) (Schiefele, 2001). While personal interest can be thought of as arising out of a relatively stable and enduring relation between a person and an area of study (e.g., science), situational interest refers to interest that arises from the context or environment that may or may not last. Both catch and hold components are important. Catch refers to the stimulation of interest, which may be cognitive or sensory. In mathematics, catch could involve cognitive stimulation (puzzles), social stimulation (group work), and/or technology (most likely a form of cognitive stimulation). These catch aspects are distinct from hold in that they only momentarily grab attention but do not maintain engagement. Hidi et al., (2004) refer to these as “triggering” aspects of situational interest. In contrast, hold relates to the empowerment of students (e.g., Does the material help the students to see use the material to reach a goal or purpose? Does it have personal meaning for students?) (Mitchell, 1993). Within the domain of mathematics, hold can be categorized in terms of meaningfulness (are the math topics meaningful to their personal lives) and involvement (engaging students in the act of learning).

**Task Value.** Task value beliefs focus on the general question “Why do I want to do this task?” (Eccles et al., 1998; Pintrich & Schunk, 2002). Four components of task value have been posited: attainment value, intrinsic or interest value, utility value, and cost (Eccles, 1983; Wigfield & Eccles, 2000). Intrinsic or interest value is the enjoyment the individual gets from performing the task, or the subjective interest they have in the subject. Utility value is how the task relates to future goals, and can be seen as capturing more extrinsic reasons for doing the task (e.g., valuing an organic chemistry class because of future plans to be a doctor). Attainment value is the importance to the self of doing well on a task. It is linked with identity and confirming or disconfirming salient aspects of the self, and represents more intrinsic reasons, as the task is valued in itself, not because it will get the individual some other valued goal. Cost refers to the accumulated negative aspects of engaging in the task, including anticipated emotional states (performance anxiety, fear of failure), and the amount of effort required to succeed at the task.

Why is it important to consider task value and interest?

**Task Value.** Students who believe that the domain is important to them personally and that the domain has some usefulness to them in terms of their future career goals have high task value beliefs. Longitudinal research by Eccles and her colleagues (e.g., Eccles, et al., 1998; Wigfield & Eccles, 2001) has shown that student beliefs about the impor-
tance and utility of mathematics lead them to enroll in more math courses in the future. In addition, this motivational research has shown that task value beliefs lead to enrollment or choices to take more mathematics courses, but that once enrolled in the actual course, efficacy beliefs are more strongly related to actual performance or achievement. This differential role of efficacy and value beliefs is an important finding in motivational research, but still needs to be replicated with science courses as well as with different groups of students. While there is evidence that efficacy and value beliefs work in this manner in a generally white, middle class sample, it is not clear how they may operate with more diverse samples.

**Interest.** Eccles and her colleagues (Eccles, et al., 1998) have shown that personal interest is an important component of motivation and functions similarly to importance and utility value beliefs. In addition, other researchers have shown that high levels of personal interest lead to more cognitive engagement, self-regulation, and achievement (e.g., Hidi, Renninger, & Krapp, 2004; Koller, et al., 2001; Pintrich & Schunk, 2002) and that personal interest is also associated with the choice to take more courses, at least in the area of psychology (Harackiewicz, Barron, Tauer, & Elliot, 2002). Given the potential benefits of personal interest in predicting engagement, interest researchers (e.g., Hidi et al., 2004; Renninger & Hidi, 2002) have also begun to consider how situational interest might lead to long-term personal interest; however, there is very little empirical research documenting the development of personal interest through situational interest.

In many mathematics and science reform projects, the goal is to increase student interest and positive attitudes towards mathematics and science domains as well as interest in careers in these areas. Interest is an important outcome in its own right, as well as a potentially important mediator of achievement (Koller et al., 2001). The development of a good, valid measure of personal interest in mathematics and science would provide a very useful tool for MSP projects to document the effectiveness of their interventions in changing interest in mathematics and science.

**What findings or recommendations have been made thus far?**
- Though the original proposal to NSF discussed only personal interest constructs, it is clear that situational interest also is important to include. There are important distinctions between contexts that catch and hold students’ interest. In addition, the hold component of situational interest needs to be considered in terms of both cognitive and affective components (e.g., value, feeling).
- Developmentally, research shows declining interest in math. Krapp’s (2002) view of the development of interest is that perhaps students are not experiencing a decline in interest, but rather that they have well-developed interest in specific areas (e.g., algebra) but this is not tapped by general questions about “math.” It is possible that students’ interests become more differentiated over time, which would be difficult to assess using current measures. As we learn more about the curricula that are being implemented it will be possible to design more specific measures.
- There is a gap in research on interest in math and science. Indeed, a qualitative analysis conducted by Renninger, Ewen, and Lasher (2002) showed a different pattern regarding the relation of personal interest (including knowledge and value) with the way that students engaged in solving word problems in math, and their success in solving these problems, compared with the patterns observed between personal interest and text comprehension. This suggests the importance of more carefully examining the role of interest in these contexts. Furthermore, one might expect that the domains of math and science have a high likelihood of promoting situational interest given the current emphasis on authentic tasks. Yet, whether this situational interest eventually fosters personal interest is not clear. A developmental analysis of this process in the domains of math and science would be especially useful.
- Task value is a multifaceted construct, and there are at least three, and perhaps four, important components to consider: attainment value, intrinsic or interest value, utility value, and perhaps cost. The items currently used to measure utility and attainment value can sometimes be quite similar, and our project will need to revise some items (especially those that reference “importance”) to better capture this theoretical distinction.
- Eccles et al., have been arguing recently that both absolute and relative values are important to consider. It matters not just whether students value math, but on how they value math compared to how they value other topic areas. These hierarchies likely exist for interest as well, but neither have received much attention to date.
• There is considerable overlap between interest and value constructs, but the terminology can make this difficult to see. When value theorists talk about interest, they consider a very limited construct that deals mainly with affective responses to tasks or topic areas. When interest researchers consider value, they make no distinction between intrinsic and extrinsic reasons for valuing. We recommend drawing on both of these literatures to get a more complete picture of the motivational dynamics involved in students’ decisions about whether they want to do particular tasks.

What work is ongoing?
Discussions at the mini-conference clarified two avenues for future work. First, it was agreed that the interest and value group should adapt and develop measures for personal interest and task value constructs. These measures should tap feeling, value, and knowledge components of interest, and attainment and utility components of task value. Measures of cost components are also being gathered and considered. Second, given the notable overlap between situational interest and measures of context, it was agreed that these two groups would work together to consider how interest is caught and held at the level of the context. The goal will be to have measures of context that incorporate important principles from these different literatures, particularly the larger catch/hold distinction and the different components of hold (feeling, value, involvement).

References
SELF-PERCEPTIONS OF ABILITY

Overview
MSP-MAP’s work in the area of self-perceptions of ability has involved a comprehensive review of recent literature on ability-related constructs including self-concept, perceptions of competence, self-esteem, self-worth, self-efficacy, outcome expectations, expectancy for success, and perceived task difficulty. Efforts were made to clearly define each construct, compare across constructs to highlight conceptual similarities and differences, locate and begin to evaluate available measures, and establish a rationale for why MSPs should or should not include an assessment of each construct in its evaluation plan. Questions and issues in need of further discussion also were posed. A detailed account of this review is attached (see Appendices C and D).

Constructs & Definitions

Self-Concept and Related Constructs. Self-concept refers to a person’s appraisal of characteristics of the self, encompassing perceptions of competence in or across multiple domains as well as self-evaluative reactions to such appraisals (Bong & Skaalvik, 2003). Self-concept is most commonly conceptualized at a domain-specific level; however, these appraisals (both cognitive and affective) serve as a basis for general or global evaluations of self (Bandura, 1981; Bong & Skaalvik, 2003; Harter, 1982; Marsh, 1993; Shavelson et al., 1976). Self-concept is considered to be organized, multifaceted, hierarchical, stable, developmental, evaluative, and differentiable. It is primarily derived from social experiences (including opportunities for comparison with others of differing ability as well as feedback or evaluation received from others regarding performance), mastery experiences (including opportunities to test skills) and attributions for success and failure (Covington, 1992; Skaalvik, 1997). These self-beliefs appear to have strong reciprocal relations with achievement, particularly at the domain-specific level (Skaalvik, 1997).

The cognitive component of self-concept is often assessed by itself (without the affective component) as competence (Harter, 1982), task-specific self-concept or self-concept of ability (Eccles, Wigfield, and colleagues, various studies), and academic self-esteem (Skaalvik, 1986, 1990a, 1990b). All of these terms are intended to capture an individual’s estimation of current ability given past experiences or relative to others in a particular domain. This estimation is considered to be relatively stable, although subject-specific self-perceptions of ability have been found to gradually decline over time (Eccles, Midgley, & Adler, 1984; Pintrich & Schunk, 2000).

The affective component of self-concept is generally assessed with measures of self-esteem or self-worth (e.g., “Overall, I have a lot to be proud of”). Self-esteem is more stable over time than are competence beliefs (i.e., the cognitive component of self-concept). Self-esteem is also relatively resistant to changes in self-perceptions of ability (Wigfield, Eccles, & Rodriguez, 1998), however, changes in self-esteem are more likely to occur when ability perceptions decline or improve for a domain which is deemed particularly important to the individual (Harter, 1985, 1990).

Self-Efficacy and Related Constructs. Self-efficacy is defined as a person’s belief about what she can accomplish with whatever skills and abilities she possesses (Bong & Skaalvik, 2003). They represent beliefs in one’s capability to organize and execute the courses of action required to manage prospective situations and to attain designated types of performances (Bandura, 1986, 1997). Self-efficacy beliefs are future-oriented (short-term or long-term), domain-specific / context specific, and are malleable. Sources of these beliefs include mastery experiences, vicarious experiences (e.g., modeling), social persuasion (e.g., pep talk), and somatic and emotional states (e.g. anxiety) (Bandura, 1997). Self-efficacy beliefs influence a range of behavioral outcomes (e.g., choice, effort, persistence, self-regulation, and performance) and have been found to mediate the effect of prior achievement on performance, and moderate the effect of other motivation-related variables on performance (see Pajares 1997, Pajares & Schunk, 2001 for reviews).

Outcome expectations are defined as the anticipated result of engaging in a task and/or perceived environmental contingency (Bandura, 1986). Outcome expectations can be determined entirely, partially, or not at all by efficacy beliefs. For example, one can have high efficacy for doing math, and hold the expectation that he will get a majority of problems correct. However, any expectation regarding what grade he will likely receive may depend on (be contingent upon) environmental constraints beyond the subject’s control (e.g., grading system, teacher bias) (Pajares, 1997). Outcome expectations are related to performance, but are weaker predictors than self-efficacy (Shell et al., 1989).
Expectancy for success is an individual’s subjective belief about the probability of “success,” however that is defined (Pintrich & Schunk, 2000). This construct is similar to outcome expectations in that they both involve the anticipated outcome of engaging in a task, however expectancy for success represents the assignment of a probability of a “successful” outcome expectation. Expectancies are assumed to be influenced by task-specific beliefs, such as self-concept of ability, perceived task difficulty, goals, self-schema (e.g., sex-role identity), affective memories, individuals’ perceptions of previous achievement experiences, and by other socialization influences (Wigfield & Eccles, 2000). For example, a girl’s expectancy for success (e.g., how well she expects to do in math this year), may in part be determined by how competent she perceives herself to be in that domain, as well as by the extent to which she endorses stereotypic beliefs about how well girls perform relative to boys in math.

Perceived task difficulty represents students’ judgments of the difficulty or demands of a task, particularly in relation to other domains. “Task” is operationalized at a domain-specific level (i.e., doing math) in this scale (Eccles & Wigfield, 1995). According to Eccles (1983), self-concept of ability and perceived task difficulty interact in predicting expectancies for success (although self-concept of ability appears to be the more critical construct). Effects of this variable are consistent but small in terms of predicting achievement expectancies or achievement behavior (Eccles, 1983).

Rationale for Including Constructs in Evaluation

Academic Self-Concept. Academic self-concept is now most commonly assessed using various measures of subject-specific self-perceptions of competence or ability, sometimes combined with items assessing affect or interest (e.g., Self-Description Questionnaire (SDQ); Marsh, 1992). Although research utilizing the SDQ is still quite common, Eccles and her colleagues have shown repeatedly that interest and competence in particular subjects are predictive of different outcomes. Thus, it seems most appropriate to utilize separate constructs, rather than comprehensive measures like those that appear in the SDQ.

Academic Self-Concept vs. Self-Efficacy. When self-efficacy and self-concept beliefs are assessed at the same level of specificity (such as the domain level of mathematics), they tend to predict achievement equally well (Skaalvik & Rankin, 1996). But when efficacy is assessed at a task-specific level (e.g., “How confident are you that you can get all of the following math problems correct?”), it is a stronger predictor of performance than domain-level self-concept (e.g., “I am good at mathematics.”) (Pajares & Graham, 1999; Pajares & Miller, 1994). Self-efficacy may be more resilient to changes in achievement than academic self-concept, as it is often focused on specific tasks rather than general abilities. Research suggests that self-efficacy can be improved in relatively short periods, by teaching students to use more efficient learning strategies and to set goals, and by providing appropriate attributional and progress-related feedback. Increases in efficacy were found to relate to increases in achievement (Schunk, 1982, 1993). Competence beliefs, however, may change more slowly, and show less change with respect to teacher practices or interventions.

Outcome Expectations. The assessment of outcome expectations is probably of low priority unless MSPs are particularly interested in students’ perceptions of environmental constraints that influence the contingency between effort/capability and “success” (e.g., teacher bias). Otherwise, since 1) the effect of outcome expectations on achievement-related behaviors is assumed to be mediated by self-efficacy judgments, 2) these beliefs are weaker predictors of academic performance than are self-efficacy beliefs, and 3)
outcome expectation scales are operationally similar to perceptions of utility value, there seems to be few other reasons to offer such a measure.

*Expectancy for Success.* Measuring expectancy for success may be preferable to measuring self-efficacy in the following situations: 1) when exploring research questions aligned with an expectancy-value framework, 2) when outcome variables involve course selection or career choice, which are influenced by whether or not the student expects to get a good grade or achieve “professional success,” particularly when contingency is between one’s capability to perform requisite skills and success is perceived to be low (e.g., women in mathematics-related careers).

*Perceived Task Difficulty.* Perceived task difficulty would not be a suitable substitute for any of the other constructs discussed in this document. However, since it is one of a set of variables that directly influence expectancy for success it may be useful in situations in which MSPs are 1) very interested in the nature of students’ expectations for success, or 2) implementing challenging curricula and are interested students’ perceptions of such curricula relative to other subjects.

**Questions/Issues**
- Appropriate use of self-efficacy measures would require a detailed account of the MSPs intervention (in order to make the assessment task-specific and aligned with the performance / achievement outcomes); however it has been difficult getting this level of detail from our collaborators.
- Would we include task-level efficacy statements as well as domain-level efficacies? For example, if interventions are targeted at improving specific mathematical or scientific skills through teacher training interventions? If so, then an efficacy scale that captures greater specificity than competence or efficacy at the domain level would be appropriate.
- We could assess both domain and task-specific efficacies, testing the theory that efficacy, like self-concept, is hierarchical in nature; i.e., that specific efficacies predict variance in general efficacies.
- Is it redundant to assess both efficacy and expectancy? Expectancy is generally domain-specific, can include comparisons to others, and is focused on the outcome; whereas efficacy is often task-specific, goal-referent, and focused on what it takes to get to a successful outcome (capability). However, both are predictive of achievement-related outcomes. How do we make this decision?
- Should competence beliefs be assessed in addition to efficacies? Are we as a group interested in helping to clarify the relation between competence, efficacy, and achievement, for either teachers or students?

**Future Directions**
Discussions clarified two avenues for future work. First, it was agreed that MSP-MAP should create self-efficacy scales at a “middle-level” of specificity. That is something more specific than “I’m certain I can do everything taught in math this year” but not quite as specific as “I’m certain I can correctly answer the following problem...” Second, we decided that it would be helpful to create a list of situations in which the use of academic self-concept (competence) would be preferable to self-efficacy and vice versa. A similar procedure will be followed for the expectancy for success construct. Rationale will need to accompany these recommendations.
Overall Model of Self-Perceptions and Achievement

Contextual Factors
- Feedback from peers and teachers
- Goal structure of classroom
- Opportunities for challenge and mastery

Measures Reviewed
- Self Description Questionnaire (SDQ) (Marsh, 1992)
- Academic SDQ (ASDQ I and II) (Marsh, 1992)
- Task-Specific Self-Concept (Wigfield et al., 1997)
- Perceived Competence Scale (Harter, 1982)
- Academic Self-Esteem Scale (Skaalvik, 1986)
- Rosenberg Self-Esteem Inventory (Rosenberg, 1965)
- Academic Self-Efficacy (PALS; Midgley et al., 2000)
- Problems Self-Efficacy (Pajares & Graham, 1999)
- Tasks Self-Efficacy (Pajares & Miller, 1995)
- Writing Self-Efficacy Instrument (Shell et al., 1989)
- Efficacy Beliefs in Science (CRESST, 2000)
- Outcome Expectations (Shell et al., 1995)
- Expectancy Beliefs (Wigfield et al., 1997)
- Perceived Task Difficulty (Eccles & Wigfield, 1995)
References


Marsh, H. (1992). Self Description Questionnaire (SDQ) II: A theoretical and empirical basis for the measurement of multiple dimensions of adolescent self-concept. Macarthur, New South Wales, Australia: University of Western Sydney, Faculty of Education.


Classroom Context

Overview
The primary objective of the context review involved examining established measures of students’ perceptions of the classroom context that have been found to relate to student motivation (see Appendix E). (Note that while there are also scales that assess students’ perceptions of the school context and those that assess teacher’s perceptions of both the classroom and school context, we do not include these scales in our review.) As a portion of this review, we created an accompanying heuristic schematic to represent the collected classroom context measures (see Figure 1). This schematic provides a visual representation given our collected measures and review of the literature on perceptions of the classroom context. A major reason for this current effort is that the perceptions of context literature presents such a wide range of constructs assessing the various features of the context. Our next steps involve reviewing these measures with a different lens focused on grappling with the theoretical and measurement issues raised by these scales.

Perceptions of the Classroom Context
As a first level of organization, we distinguish between measures that assess students’ perceptions of the classroom environment (e.g. academic tasks, climate) from those scales that specifically relate to perceptions of the classroom teacher (e.g. quality of teacher’s instruction, teacher support). As a second tier of this organization, we have classified scales specific to perceptions of the classroom environment into 3 primary categories (see Figure 1). The TARGET acronym, first coined by Epstein in 1989, has since been used by numerous researchers to describe six primary features of the classroom that are believed to affect motivation (Ames, 1992). They include Task, Autonomy, Recognition, Grouping, Evaluation, and Time. Because different motivational theories and their perspectives have contributed to this literature on classroom perceptions we include their work subsumed under the TARGET framework as well. For example, while the research emerging from Self-Determination Theory (SDT) does not use the language of TARGET per se, their proposed construct of autonomy relates to that conceptualized by Epstein and Ames. Also classified under the TARGET acronym are measures of perceived classroom goal structure. Classroom goal structure is intimately related to many of the TARGET dimensions. For example, Ames (1992) argues that a mastery-focused classroom (as assessed by a classroom mastery goal structure scale) would be characterized by challenging tasks that allow students to develop their understanding/skills, non-normative evaluation practices, the promotion of autonomy and decision making, and cooperative reward structures. In contrast, a performance-focused classroom (assessed by a classroom performance goal scale) is one that emphasizes competition, social comparison, and normative grading practices. Due to the highly interrelated nature of these two types of measures, we have aligned them closely within the flow chart.

A second category under perceptions of the classroom environment is standards-based reform measures. In particular, the standards-based reform movements in the areas of math and science have generated new curricula that reflect current standards and have created professional development efforts to encourage teachers’ familiarity with standards (e.g., Race & Powell, 2000). These reform efforts draw heavily from a social constructivist philosophy and hands-on learning, inquiry and problem-based instruction, and an emphasis on student construction of knowledge (e.g. through group work and discourse). A few of these reform efforts also have created or collected survey measures to assess students’ perceptions of these instructional practices and aspects of the classroom climate. While we have subdivided this broader category into sub-emphases (i.e., real world applications), the general category is designed to hit measures that assess students’ perceptions of these reform efforts at a more global level. One of the major questions that we have been considering regarding these standards-based reform measures concerns those issues that arise when working with measures that assess multiple constructs within one scale. We are currently grappling with the utility, advantages, and disadvantages posed by such scales (discussed during the mini-conference on May 27, 2004).

A third category classified under students’ perceptions of the classroom environment is classroom management. The notion of classroom management includes the presence of rules and procedures used in classrooms, teacher control, and time on task (e.g. Moos, 1980). Because these components also may draw on students’ perceptions of their teacher (and not just perceptions of the classroom environment), the operationalization of the classroom management construct may fall under both of these classifications.
Teacher-Related Perceptions

Measures that specifically relate to students’ perceptions of their teacher were included in this category of classroom context. The three main subcategories under this heading include students’ perceptions of the quality of instruction, teacher support, and teacher motivation.

In terms of measures assessing the quality of instruction, it is important to note that many of the established measures rely on objective accounts of instructional practice, and therefore rely on classroom observations. We conceptualized quality of instruction as encompassing such teacher strategies as scaffolding student understanding and pressing for student understanding, because these are representative of the few instructional practices that have survey measures. Here, we assert that it is the students’ perceptions of what is occurring in the classroom that will ultimately impact their learning and achievement, regardless of what an objective measure may conclude; therefore, it is important to note that while these measures can be assessed from teacher questionnaires and observations, we have focused mainly on how students perceive teacher actions and attitudes as influencing the classroom context. One concern of this particular subcategory is the relatively few measures that have been designed to assess student perceptions of the quality of instruction. In particular, there are a variety of features of a teacher’s instruction that are not being tapped by these survey measures and a heavier emphasis on social constructivist practices.

The second subcategory is teacher support with a focus on students’ perceptions of their relationship with their classroom teacher. These scales range from teachers’ support of group work to students’ perceptions that their teacher is respectful, fair, caring, and helpful when students have questions. Given the reviewed measures, we make a distinction between classroom level and individual level teacher support. This dichotomy was maintained because of the framing of different scales that examine perceptions of teacher support. For example, some measures assess how students feel the teacher treats them as an individual (e.g., “My teacher really cares about me”), while others assess more classroom level support (e.g., “My teacher encourages us to ask questions when we do not understand something”).

The third subcategory is teacher motivation. Within our review, we have found only a few scales that assess students’ perceptions of their teacher’s motivation for teaching or the subject area. We conceptualize this particular category as incorporating those survey items that ask students to report on their teacher’s levels of enthusiasm and energy when teaching and their general affect in the classroom. Thus far, however, we have only found a few items that can be classified here. These items ask students to report on their teacher’s liking of their subject area (e.g. “The teacher likes math”). We continue to search for the literature for related scales.

Future Directions

Discussions at the mini-conference focused mainly on two recommendations for future work. First, there is an issue concerning the considerable conceptual overlap among scales. In particular, as was noted in issues related to standards-based reform assessment above, there are classroom perception scales that incorporate multiple constructs. This issue calls for us to re-classify scales into our proposed organization system before embarking on a more thorough review of theoretical issues related to these measures.

Second, as noted in the interest/value report, the overlap of context measures and components of situational interest warrants further work to identify whether and how a distinction between the two constructs is warranted. The need for conceptual clarity when referring to various constructs is extremely important and will serve as a useful and necessary tool when discussing the influence of classroom context on student achievement.

In terms of next steps, the classroom context group intends to continue the collection and organization of appropriate measures. In addition, we will continue to consider which of these measures are most appropriate for recommending to participating MSPs. Again, given the wide range of potential scales and constructs that could be assessed in science and mathematics classrooms, it is critical to consider the relevance and influence of measures on student achievement and motivation-related outcomes. Finally, a large portion of our upcoming work will be to highlight and explore the issues of currently employed measures.
Figure 1. Schematic of context-related constructs and their relationships.
Teacher Identity

Overview
The teacher identity group has been focused on developing a substantive conceptual analysis of the link between identity and teacher practice. This analysis stands as a precursor to the development of an appropriate measure of teacher identity that has relevance to the existing MSP projects that we support. The clear rationale for including measures of identity in the measurement bank is that how teachers teach is affected by who they believe themselves to be. Teacher identity is thus the filter for, and determinant of, teacher practice.

This rationale is developed in extant models that present teacher identity as a way of seeing, defining or being a self (Beijaard, Verloop, & Vermunt, 2000; Eick & Reed, 2002; Friesen, Finney, & Krentz, 1999; Helms, 1998; Volkmann & Anderson, 1997). A distinction is often drawn between personal identity and professional identity, where the former is a unique self that is a counterpoint to the latter, which is described in terms of social roles and expectations. These models of teacher identity reflect an underlying division between the personal and social determinants of identity. This is an overarching theme pervading all theory and research upon identity, which does not have teacher identity as its sole subject.

This distinction between personal and social determinants of identity runs through familiar and popular identity constructs that have not specifically treated teachers as a subject, such as Erikson’s psychodynamic model (Erikson, 1959; Erikson, 1968; Erikson, 1982), followed by Marcia’s and then Adams’s ego identity status model (Adams, Shea, & Fitch, 1979; Marcia, 1966). Models which specifically highlight the distinction are Cheek’s (Cheek & Briggs, 1982) and Côte’s (Côté & Schwartz, 2002): others include identity theory (Burke & Tully, 1977; Stryker & Burke, 2000), social identity theory (Tajfel, 1982; Turner, 1978) and approaches that highlight narrative (McAdams, 1988) or social construction (Vygotsky, 1978; Wenger, 1998).

There are few established empirical measures of identity. Paper and pencil measures include the Twenty Statements Test (Kuhn & McPartland, 1954), the Aspects of Identity Questionnaire (Cheek & Briggs, 1982), the Objective Measure of Ego Identity Status (Bennion & Adams, 1986). None of these was formulated specifically with teachers in mind and none is particularly suitable for the measurement of teacher identity. Measurement of teacher identity has predominantly been conducted using qualitative techniques and has relied in the main upon interview data. The primary task of the identity group, then, is to develop items for a new teacher identity measure that will capture both the social and personal determinants of identity formation as they relate to the particular context in question, that is the mathematics or science classroom.

References


**Epistemological Beliefs**

**Overview**

Beliefs about knowledge and knowing, or what has been called “epistemological beliefs” or “personal epistemology,” appear to influence achievement in math and science, and thus this is one of the areas in which we are working to review and develop assessment instruments for math and science educators. The first year of the project has been focused on initiating a review of the extant literature, examining existing instruments that measure beliefs in math and science, discussing the needs of interested project directors, and working on development of instruments that may be useful to MSP projects.

We have reviewed three approaches to measuring epistemological beliefs through written instrumentation that could be potentially germane to this project: 1) use of a domain-general instrument (Schommer, Crouse, & Rhodes, 1992; Schraw, Bendixen, & Dunkle, 2002); 2) use of domain-specific instruments that can be adapted to particular disciplines (Buehl, 2001; Hofer, 2000); and 3) use of instruments that are specific to beliefs in particular disciplines, e.g., “math beliefs” (Peterson, Fennema, Carpenter, & Loef, 1989; Schoenfeld, 1992; Schommer et al., 1992) and “science beliefs” (Conley, Pintrich, Vekiri, & Harrison, 2004; Elder, 2002; Songer & Linn, 1991). Earlier work in this area suggests that the domain-general approach is likely to be least productive or theoretically sound (Hofer & Pintrich, 1997) and that students do have differing beliefs both by discipline (Buehl, Alexander, & Murphy, 2002; Hofer, 2000) and about disciplines (Hammer, 1994; Hofer, 1999; Schoenfeld, 1983). We have concluded that a domain-specific instrument that combines elements of the second two approaches identified above would be of most use to math and science educators.

Our current working strategy is to adapt an existing domain-specific instrument (Hofer, 2000) to uses within the MSP projects. This instrument, devised from a thorough review of the literature on epistemological beliefs, has 35 items measured on a Likert-type scale. Students are asked to indicate level of agreement with such items as “In this subject, most questions have only one right answer.” The instrument has a header that specifies the subject under consideration, and can be used in a general manner to distinguish disciplines such as “math” or “science” or can be directed toward more specific subfields such as “geometry” or “chemistry.” We have been continuing to refine this instrument to increase reliability of the measures and plan further testing and analyses this coming year. Although our review of the literature suggests that most of the epistemological beliefs pertinent to math and science learning can be captured in this way, we are also identifying beliefs that are more specific in nature. Thus the instrument will also include the addition of beliefs about math and science (e.g., “Scientific knowledge is verified by experiment,” and “Mathematics is a solitary activity, done by individuals in isolation”).

During the second year of the project we plan to continue refining the instrument, testing it within interested projects, working on the relation between teacher and student beliefs and how teacher belief instruments can be utilized within those projects focused on teacher training, and identifying how epistemological beliefs serve as mediator and moderator of achievement in mathematics and science.
References


