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ABSTRACT

Data for this study were obtained from the second follow-up of the sophomore cohort of the High School and Beyond Study, with 14,825 students from 1,015 schools involved. Mathematics and English self-concepts were found to be: (1) uncorrelated despite a substantial correlation between mathematics and English test scores; (2) influenced by internal and external frames of reference; and (3) negatively affected by school-average achievement. The internal/external frame of reference model posits that a student's self-concept in a particular academic subject area is formed in relation to performances by other students in the same subject (external) and in relation to the performance by the same student in other academic subjects (internal). As predicted by the model, better mathematics skills were associated with substantially higher mathematics self-concepts, but slightly lower English self-concepts, whereas better English skills were associated with substantially higher English self-concepts, but slightly lower mathematics self-concepts. School-average achievement was one determinant of the external reference in that equally able students had higher academic self-concepts in schools with lower school-average achievement. Further, this school context effect was also content-specific. School-average mathematics achievement negatively affected only mathematics self-concept, and school-average English achievement negatively affected only English self-concept. (Author/MNS)

The Influences of Internal and External Frames of Reference on the Formation of Math and English Self-concepts

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# The Influences of Internal and External Frames of Reference on the Formation of Math and English Self-concepts


## ABSTRACT

For a large nationally representative sample (N=14,825 students from 1015 high schools) math and English self-concepts were shown to be: (a) uncorrelated despite a substantial correlation between math and English test scores; (b) influenced by internal and external frames of reference; and (c) negatively affected by school-average achievement. The internal/external frame of reference model posits that a student's self-concept in a particular academic subject area is formed in relation to performances by other students in the same subject (the external reference) and in relation to the performance by the same student in other academic subjects (the internal reference). As predicted by the model, better math skills were associated with substantially higher math self-concepts but slightly lower English self-concepts, whereas better English skills were associated with substantially higher English self-concepts but slightly lower math self-concepts. As previously demonstrated with the big-fish-little-pond effect (Marsh,1987; Marsh & Parker, 1984) school-average achievement was one determinant of the external reference in that equally able students had higher academic self-concepts in schools with lower school-average achievements. Furthermore, this school context effect was also content specific. School-average math achievement negatively affected only math self-concept, whereas school-average English achievement negatively affected only English self-concept.

# The Influences of Internal and External Frames of Reference on the Formation of Math and English Self-concepts

Particularly for school-aged subjects, academic achievement is one of the most frequently posited determinants of self-concept. This stems in part from the assumed importance of academic achievement for students, but also from the ready availability of objective measures of achievement against which to evaluate self-concepts. Self-concepts are, however, only moderately correlated with academic achievement. Even when researchers specifically measure academic self-concepts, correlations with academic achievements rarely approach the reliabilities of the measures. This has led some to question the validity of the academic self-concept reports or to suggest that the self-reports are biased. Such suggestions, however, typically reveal a fundamental confusion about the nature of self-concept.

Academic self-concept measures are designed to reflect individuals' true self-perceptions whether or not they agree with objective indicators of academic achievement or the perceptions of others. Academic self-concept measures may lack validity for the purpose of predicting academic achievement, but this is not their intended purpose. It also follows that academic achievement measures lack validity for the purpose of predicting academic self-concept. When there are systematic differences between academic achievement indicators and academic self-concepts, it is important to determine why these differences exist in order to better understand the formation of self-concept. One such explanation is that self-perceptions must be evaluated in relation to frames of reference and these frames of reference may differ from those used to evaluate objective indicators of achievement or those used by external observers. Social psychological and psychophysical research provides ample evidence that changes in the frame of reference can substantially alter psychological judgments. In a school setting the context established by the achievement levels of other students in the same school provides a particularly salient frame of reference.

The focus of the present investigation is on how frames of reference influence math and English self-concepts. The purposes are to examine: (a) the content specificity of math and English self-concepts and their relations to math and English achievements; (b) predictions based on the internal/external frame of reference model (Marsh, 1986) designed to account for this content specificity; (c) a particularly salient example of frame of reference effects called the Big-Fish-Little-Pond Effect (BFLPE; Marsh, 1987; Marsh & Parker, 1984) in which equally able students have higher academic self-concepts in schools where school-average achievements are lower; and (d) the content specificity of this BFLPE with respect English and mathematics.

<u>The Multidimensionality of Self-concept: The Shavelson Model</u>

Historically, self-concept research has emphasized a general, overall or total self-concept. More recently, self-concept theory (e.g., Byrne, 1984; Marsh, Byrne & Shavelson, in press; Shavelson, Hubner & Stanton, 1976) has emphasized the multidimensionality of self-concept, and empirical studies have identified distinct, a priori facets of self-concept (e.g., Boersma & Chapman, 1979; Byrne & Shavelson, 1986; Dusek & Flaherty, 1981; Fleming & Courtney, 1984; Harter, 1982; Marsh, 1986; Marsh, Smith, Barnes & Butler, 1983; Marsh, Barnes, Cairns & Tidman, 1984; Marsh, Barnes & Hocevar, 1985; Soares & Soares, 1982). In a review of this research, Marsh and Shavelson (1985) concluded that the relations between self-concept and other constructs cannot be adequately understood if this multidimensionality is ignored. Support for this conclusion was particularly strong for academic self-concept and its relation to academic achievement (Byrne, 1984; Byrne & Shavelson, 1986).

Shavelson, Hubner and Stanton (1976) posited self-concept to be a multifaceted, hierarchical construct. They presented a possible representation of this hierarchy in which general self-concept appeared at the apex and was divided into academic and nonacademic self-concepts. According to this model self-concepts in particular academic areas (e.g., math, English, etc.) combine to form a higher-order academic self-concept. Shavelson et al. based their model, in part, on conceptually similar models of ability that posit a higher-order ability factor as well as more specific components of ability (e.g., Vernon, 1950). Also, mathematics and English achievements are highly correlated and so it is reasonable to except that the corresponding self-concepts should also be highly correlated. Based on such reasoning, Shavelson et al. posited that the different academic self-concepts would be substantially correlated and could be incorporated into a single facet of academic self-concept.

Tests of the Shavelson model (e.g., Marsh, Byrne & Shavelson, in press; Marsh & Shavelson, 1985) generally supported the model. The hierarchy, however, was weaker and more complicated than originally anticipated. This led to a revision of the model. Of particular relevance to the present investigation, English and math self-concepts were found to be nearly uncorrelated and did not combine to form a single, second-order academic factor. The lack of correlation between math and verbal self-concepts generalizes across preadolescent to young adult ages (Marsh, 1986) and across responses to three different academic self-concept instruments (Marsh, Byrne & Shavelson, in press). The internal/external frame of reference model described in the next section was developed to account for this extreme separation in math and English self-concepts.

The Internal/External Frame of Reference Model.

Marsh (1986) proposed the internal/external frame of reference model to describe why English and math self-concepts are so distinct from each other and so content specific in their relations to English and math achievements. According to the internal/external model, math and English self-concepts are formed in relation to both external and internal comparisons, or frames of reference. Using an external reference, students compare self-perceptions of their own math and English skills with the perceived skills of other students. This external, relativistic impression serves as one basis for their math and English self-concepts. The model further posits an internal comparison process for which each student compares his or her self-perceived math skills with his or her own self-perceived English skills. This internal, relativistic impression serves as a second basis for math and English self-concepts. To clarify how these frames of reference work, consider students who accurately perceive their math and English skills to be below average, but whose math skills are better than their English skills. These students have math skills that are below average relative to other students (an external comparison) but that are above average relative to their English skills (an internal comparison). Depending on how these two components are weighted, these students may have average or even above-average math self-concepts despite their poor math skills. According to this model, poor students will have what appears to be unrealistically high self-concepts in their best academic subjects whereas good students will have what appears to be unrealistically low self-concepts in their poorest academic subjects.

The external process posited in the internal/external model has been well documented in self-concept research (e.g., Marsh, 1987; Marsh & Parker, 1984; see subsequent discussion of the BFLPE) and more generally as a social comparison process (Suls & Miller, 1977). English and math achievements are substantially correlated. Hence, this external comparison process should lead to a positive correlation between English self-concept and math self-concept as originally anticipated in the Shavelson model. The internal comparison process, though more unusual in other theoretical accounts, is like the compensatory model described by Byrne (1984) and by Winne and Marx (1981). Since self-perceptions of math achievement and of English achievement are compared with each other, it is the difference between the two that contributes to a high self-concept in one area or the other. Hence, the internal process should lead to a negative correlation between English self-concept and math self-concept. The joint operation of both processes, depending on the relative strength of each, will lead to the near-zero correlations that have been observed in empirical research.

The internal/external model also predicts a negative direct effect of math achievement on English self-concept, and of English achievement on math self-concept. For example, a high math self-concept will be more likely when math achievement is good (the external comparison) and when math achievement is better than English achievement (the internal comparison). According to the model, perceiving oneself to have good mathematics skills detracts from English self-concept at all levels of math and English achievements, and perceiving oneself to have good English skills detracts from math self-concept at all levels of math and English achievements. Tests of the internal/external model (Marsh, 1986) have used path analyses in which English and math achievements are regressed on English and math self-concepts. In this model, academic achievement is hypothesized to be one causal determinant of academic self-concept, but does not argue against the a more dynamic model where subsequent levels of academic achievement and self-concept are each determined by prior levels of achievement and self-concept. The I/E model predicts that: (a) English and math self-concepts will be nearly uncorrelated or at least substantially less correlated than English and math achievements, (b) English achievement will have a strong, positive effect on English self-concept but a weaker, negative effect on math self-concept, and (c) math achievement will have a strong positive effect on math self-concept but a weaker, negative effect on English self-concept.

The Big-Fish-Little-Pond Effect (BFLPE)

Students, due to de facto or systematic selection processes, often find themselves in a school setting where the average ability of their classmates differs substantially from the average ability levels in other schools. Logic and theory suggest alternative, competing effects that this situation may have on academic self-concept (e.g., Felson, 1981; Felson & Reed, 1986; Festinger, 1954; Kelley, 1952; Goethals, 1986). For example, being an average-ability student in a high-ability group of classmates may affect academic self-concept such that it is: (a) below average because the basis of comparison is the performance of above-average students (i.e., a BFLPE or contrast effect); (b) above average by virtue of membership in the high-ability grouping (i.e., a reflected glory, group identification, or assimilation effect); or (c) average because it is unaffected by the immediate context of the other students, or because "a" and "b" occur simultaneously and cancel each other. The net effect of school-average ability on academic self-concept represents the combined influence of these competing effects (see Felson & Reed, 1986).

Marsh (1987; Marsh & Parker, 1984) found that equally able students have lower academic self-concepts when they attend schools where the school-average ability level is higher. He labelled this effect as the BFLPE and posited a frame-of-reference model to explain it. In this respect, the BFLPE is a special case of the external comparison process posited in the internal/external model described earlier. The BFLPE is also one specific example of more general frame of reference effects that have been studied widely by social psychologists (e.g., Sherif & Sherif, 1969; Upshaw, 1969) and psychometricians (e.g., Helson, 1964). Consistent with this previous research, the standard of comparison was operationalized as the average ability level of students in the school (hereafter called school-average ability). The theoretical model used to explain the BFLPE (Marsh, 1984b) posits that students will use this standard of comparison in forming self-concepts. Thus, equally able students will have lower self-perceived academic skills and lower academic self-concepts in high-ability schools than in low-ability schools because students in high-ability schools compare themselves with more able students than do students in low-ability schools.

Study of the BFLPE is important in determining how self-concept is formed, but it also has important practical implications. Marsh (1987; Marsh and Parker, 1984) described the practical implications for parents who consider the possibility of placing their children in selective, high-ability schools, because this will apparently produce a lower academic self-concept. At least for some children, the early formation of a self-image of themselves as a poor student may be more detrimental than the possible benefits of attending a high-ability school. Davis (1966) described an effect similar to the BFLPE in a study of the career aspirations of college men. He concluded: "The aphorism 'It is better to be a big frog in a small pond than a small frog in a big pond' is not perfect advice, but it is not trivial" (p. 31) and warned that "counselors and parents might well consider the drawbacks as well as the advantages of sending their boy to a 'fine' college, if, when doing so, it is fairly certain that he will end up in the bottom ranks of his graduating class" (p. 31)

Empirical support for the BFLPE.

The existence of the BFLPE has been supported by research using a wide variety of different experimental and analytical approaches. Using path analysis, Marsh and Parker (1984) found that when individual ability level was controlled, school-average ability affected academic self-concept negatively; equally able students had lower academic self-concepts when they attended high-ability schools. Marsh (1987) and Bachman and O'Malley (1986) found similar effects in path analytic studies of high school students using the large, nationally representative Youth in Transition data. Bachman and O'Malley (1986), however, excluded all black students and all predominantly black schools, thereby reducing the variability of school-average ability. For this truncated sample, they reported a smaller BFLPE than did Marsh (1987) for his analysis of the entire sample. Marsh (1987) demonstrated that the theoretical model used to explain the BFLPE predicts that the size of the BFLPE will be directly related to the variability of the school-average means. Thus, the model is consistent with both the Bachman and O'Malley (1986) and Marsh (1987) results.

Schwarzer, Jerusalem, and Lange (1983) examined the self-concepts of West German students who moved from nonselective, heterogeneous primary schools to secondary schools that were streamed on the basis of academic achievement. At the transition point students who were selected to enter subsequently the high-ability schools had substantially higher academic self-concepts than those entering the low-ability schools, but the two groups did not differ in academic self-concept by the end of their first year in the new schools. Path analyses indicated that the direct influence of school type on academic self-concept was negative.

Felson and Reed (1986) posited that the frame-of-reference is better inferred from the average ability levels of other students in the same track and school instead of just the same school. Using a path-analytic model similar to that posited by Marsh and Parker (1984), they found that track-average test scores negatively influenced self-appraisals of academic ability. Consistent with earlier proposals that the BFLPE may represent the net effect of counter-balancing influences, they further suggested that "some students in college preparatory tracks may attribute more ability to themselves because of their membership in this group and that this may offset some of the negative effects of social comparison" (1986, p. 108).

Strang, Smith and Rogers (1978) tested the self-concepts of academically disadvantaged children who attended some classes with other disadvantaged children and other classes with nondisadvantaged children. These academically disadvantaged children were randomly assigned to experimental and control groups. The experimental group was given a manipulation to enhance the saliency of their membership in the regular classrooms with nondisadvantaged children, and these children reported lower self-concepts than their control group. Rogers, Smith and Coleman (1978) ranked a group of children in terms of academic achievement across their total sample and then in terms of their academic achievement within their own classroom (i.e., relative to their classmates rather than to the larger, more representative sample). They found that the within classroom rankings were more highly correlated with self-concept.

In a meta-analysis of studies of the effect of homogeneous ability grouping on self-concept, Kulik (1985; also see Kulik & Kulik, 1982; Marsh, 1984a) found that high-ability students tended to have lower self-concepts, when placed in streamed classes of students with similar abilities than did ungrouped comparison groups. In contrast, low-ability students tended to have higher self-concepts in streamed classes than in the ungrouped comparison groups.

The Content Specificity of the the BFLPE

Marsh and Parker (1984) argued that the context effects due to school-average ability should affect academic self-concept, but should have little effect on non-academic or general self-concept. Support for these predictions comes from three studies (Bachman & O'Malley, 1986; Marsh, 1987; Marsh & Parker, 1984) that examined the effects of school-average ability on both academic and non-academic or general measures of self-concept. In this respect, the effect of school-average academic ability appears to be reasonably content specific to academic self-concept.

Whereas research has demonstrated the content-specificity of the BFLPE with respect to academic constructs, no research known to the author has considered the possibility of BFLPEs that are specific to particular academic subjects such as mathematics and English. In each of studies described earlier, the school achievement context was inferred from global academic performance measures and the context effects were inferred from global measures of academic self-concept. This use of global achievement, school-average global achievement, and global academic self-concept is consistent with the historical tendency to consider academic self-concept as a relatively unidimensional construct. More recent research, however, such as that leading to the development of the internal/external model considered earlier, indicates that math and English self-concepts are relatively uncorrelated and cannot be adequately represented as a single dimension of academic self-concept. An extension of the internal/external model suggests the possibility that school-average measures of mathematics and English differentially affect math and English self-concepts.

There is ample evidence that multiple frames of reference can exist simultaneously. The study by Strang, Smith and Rogers (1978), for example, implied that academically disadvantaged children who attended some classes with other disadvantaged children and other classes with nondisadvantaged children had multiple frames of reference. In another example from psychophysical research, Watson (1957) asked subjects to judge the size of circles that also differed in color such that circles of one color (e.g., yellow) were systematically larger than those of a second color (e.g., green). After a preliminary series of 100 trials in which subjects compared yellow circles to other yellow circles and green circles to other green circles, they were then asked to compare yellow and green circles that were identical in size. The color yellow had been associated with larger circles and the yellow stimulus was judged to be systematically smaller than the green circle of the same size. These findings are consistent with the contrast effect found in BFLPE studies in that the yellow circle appeared to be smaller in relation to the other yellow circles that were larger even though the yellow circle was the same size as the green circle to which it was compared. Translating this finding into the BFLPE, consider a school in which the school-average ability in mathematics was above-average whereas the school-average ability in English was below-average. Students from that school who were average in both mathematics and English would be predicted to have an below-average math self-concepts and above-average English self-concepts. That is, school-average mathematics skills will have a negative influence on just math self-concept whereas school-average English skills will have a negative influence on just English self-concepts. An important purpose of the present investigation is to determine whether or not separate BFLPEs can be established in English and mathematics.

## The Present Investigation

The general purpose of the present investigation is to determine how different frames of reference affect the formation of math and English self-concepts. More specifically, the study brings together research on the I/E model and the BFLPE into a single theoretical and empirical framework. Predictions based on the interface of I/E model and the BFLPE are tested that have not been previously considered. The HSB data base used to test these predictions is uniquely appropriate because of its size (14,825 students from 1015 high schools) and national representativeness, and because of the quality of particularly the academic achievement measures. These data were analyzed with covariance structural models using LISREL that provides important advantages over more conventional approaches to analyzing path models.

Insert Table 1 About Here

In the major analyses 18 measured variables (see Table 1) were used to infer six constructs. Two mathematics tests were used to infer individual math achievement and three English tests were used to infer individual English achievement. The corresponding five school-average scores on these achievement tests were used to infer school-average math achievement and school-average English achievement. Responses to 4 self-report items were used to infer math self-concept and responses to 4 parallel items were used to infer English self-concept. Based on the original internal/external model, three major predictions were generated:

1. Math and English self-concepts are nearly uncorrelated or at least substantially less correlated than math and English achievements;

2. Individual math achievement has a strong positive effect on math self-concept but a weaker, negative effect on English self-concept.

3. Individual English achievement has a strong, positive direct effect on English self-concept but a weaker, negative direct effect on math self-concept.

To these predictions from the internal/external model that have been supported in previous research are added two previously untested predictions. These are based on the assumption that separate school contexts exist for mathematics and English skills, and the extension of the BFLPE to account for this content specificity as described above:

4. School-average math achievement will have a negative effect on math self-concept but not on English self-concept;

5. School-average English achievement will have a negative effect on

English self-concept but not on math self-concept.

## Methods

### Sample and Data

Subjects are the 14,825 respondents selected for the second follow-up of the sophomore cohort of the HSB study. A detailed description of these data is available in the data file user's manual produced by the National Center for Educational Statistics (NCES, 1986). The sophomore cohort initially involved a two-stage probability sample of 1,015 high schools and approximately 36 sophomores within each of these high schools. The second follow-up consisted of a probability sample of 14,825 of the original sample. Included on the commercially available data file for the second follow-up study are variables collected in 1980 when respondents were high school sophomores, in 1982 when most respondents were high school seniors, and in 1984 two years after the normal time of high school graduation. All variables used here come from the 1980 survey when the respondents were sophomores (the self-concept measures emphasized here were only administered during the sophomore year). These responses were weighted so as to take into account the disproportionate sampling of specified subgroups in the HSB design (NCES, 1986, Table 3.5-1). Because of the cluster sampling in the HSB study, standard errors based on the assumption of simple random sampling substantially underestimate the sampling variability in summary statistics and distort tests of statistical significance. In order to compensate for this bias, the weight for each student was divided by the estimated design effect of 2.40 (NCES, 1986, Table 3.6-5), reducing the nominal sample size from 14,825 to 14,825/2.40 = 6177.

Whereas analyses were conducted for only responses by the 14,825 students included in the second follow-up, school-average values for the five achievement tests (see Table 1) were based on responses by the approximately 30,000 students who completed the tests during their sophomore year in high school. Thus, the school-average responses were based on approximately 30 students per school instead of approximately 15 students per school included in the follow-up study. These school-average tests scores were merged with the second follow-up data so that all students from the same school were assigned the same school-average values. A correlation matrix was constructed from the 18 variables using pair-wise deletion for missing data. After weighting, the number of nonmissing values for the 18 variables varied from 6177 to 4848, and an N of 5,000 was used for purposes of statistical significance testing.

<u>Statistical Analyses -- the Application of Structural Equation Modelling.</u>

Weaknesses of the traditional use of multiple regression for estimating path coefficients are well known (e.g., Joreskog & Sorbom, 1981; Long, 1983a, 1983b; McDonald, 1985; Pedhazur, 1982) and are not reviewed here in detail. Perhaps the most serious weakness is the assumption that the single score typically used to infer each construct is measured without error. Particularly when multiple indicators of the inferred constructs are available, structural equation modelling provides important advantages. Although parameters for the entire model are estimated simultaneously, the model can be logically separated into measurement and structural models.

The measurement model contains estimates of the relations between each latent construct and its multiple indicators (i.e., factor loadings) and error/uniquenesses associated with each measured variable. Unlike classical measurement approaches, the error/uniquenesses are not required to be independent. This advantage is important for studies such as the present one in which the assumption of uncorrelated error/uniquenesses is problematic. In particular, because the same achievement tests were used to infer individual and school-average achievement scores, the uniquenesses representing the individual and school-average scores on the same test are likely to be correlated. Also, because the wording of the four math self-concept items is parallel to the wording of the four English self-concept items (see Table 1), the uniquenesses associated with each pair of items having the same wording are likely to be correlated. Whereas these a priori hypotheses about the measurement model are plausible, the comparison of alternative models provides empirical tests of these assumptions. More importantly, if these assumptions are supported, then conventional approaches to testing the path models would be inappropriate and the implications of these violations would be difficult to evaluate. The structural model contains estimates of causal relations between the latent constructs (i.e., path coefficients) that are corrected for measurement error. In the present investigation 18 measured variables (defined in Table 1 and represented by squares in Figure 1) were used to define 6 constructs (represented by circles in Figure 1).

An important, unresolved issue in structural equation modelling is the assessment of goodness of fit -- particularly when sample size is very large as in the present investigation. On the basis of theory, the logic of the data, and, perhaps, previous analyses, the researcher typically posits a set of alternative models designed to explain relations among the measured variables. To the extent that the hypothesized model is able to fit the observed data, there is support for the model. The problem of goodness of fit is how to decide whether the predicted and observed results are sufficiently alike to warrant support for a model. Whereas $X^2$ values can be used to test whether these differences are statistically significant, there is a growing recognition of the inappropriateness of the classical hypothesis testing approach. Because restricted models are only designed to approximate reality, all such models are a priori false and will be shown to be false if tested with a sufficiently large sample size (Cudeck & Browne, 1983; Marsh, Balla & McDonald, in press; Marsh, McDonald & Balla, 1987; McDonald, 1985). Model selection must be based on a subjective combination of substantive issues, inspection of parameter v .ues, goodness of fit, model parsimony, and a comparison of the performances of competing models. A variety of fit indices have been derived to aid in this process such as the the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973) and the Bentler-Bonett Index (BBI; Bentler & Bonett, 1980) that are considered here. In studies of these and other . .ces Marsh, Balla and McDonald (1988) and Marsh, McDonald, and Balla (1988) found that the TLI was the only frequently used index that was relatively independent of sample size and imposed an apparently appropriate penalty function for the inclusion of additional variables to control for capitalizing on chance. For this reason the TLI is emphasized in the present investigation.

An often neglected issue in structural equation models is justifying the choice of particular variables to define theoretical constructs. This problem may be particularly relevant for research conducted on large nationally representative data bases that were not specifically designed for purposes of a particular study. The use of covariance structure analysis provides important tests relevant to this issue in that it specifically tests the structure hypothesized to unlie the constructs of interest. Still, it does not provide the verbal labels used to name the constructs. Whereas there is 'ittle ambiguity in the appropriateness of using standardized achievement test scores to infer academic achievement constructs, one might question whether the academic self-concept items actually reflect self-concept rather than some other construct. Ethington and Wolfle (1986), for example, used the term mathematics <u>attitudes</u> in referring to a construct defined by the four mathematics items. Others might prefer the term academic anxiety or a more ambiguous term such as academic affect. It is important to note, however, that empirical results to be described for the math and English items used here (Figure 1a) are like those from other research (Marsh, 1986; Marsh, Byrne, & Shavelson, 1988) that has tested the I/E model with a variety of self-concept instruments that were specifically developed to measure math and verbal self-concepts. In this respect, it is probably reasonable to refer to the constructs as math and verbal self-concepts.

One additional complication with the math and and English self-concept item is that they are dichotomously scored. Non-interval, dichotomous data may be inappropriate for factor analysis, and related violations of multivariate normality assumptions may make dubious the maximum likelihood test statistics and associated probability levels. Muthen and Kaplan (1985) describe alternative approaches to the analysis of such data. They also, however, noted important practical limitations in these approaches and so evaluated the robustness of the traditional methods used here in a simulation study. They found that it was not the dichotomous nature of variables that produced problems with the traditional approach, but rather the skew and kurtosis of the measured variables. Fortunately, they also found that maximum likelihood estimators and associated chi-square statistics were quite robust when skews and kurtoses were moderate as is the present investigation.

## Results

### The Original Internal/External Model

In an initial set of analyses (Models 1.0 - 1.3) predictions based on just the original Internal/External model are tested without the addition of the school-average test scores. These models (see Figure 1A) posit a particular pattern of relations among four latent constructs -- math achievement, English achievement, math self-concept, English self-concept -- and the measured variables associated with each construct. The primary substantive interest is in the path coefficients relating these latent constructs (see earlier predictions), but it is first necessary to determine whether the model is able to adequately fit the data.

Insert Table 2 and Figure 1 About Here

The ability of Model 1.1 with no correlated uniquenesses to fit the data is only modest (Table 2). As noted earlier, it was predicted that uniquenesses associated with each pair of self-concept items that have the same wording (e.g., I dread mathematics class and I dread English class) would be correlated. Inspection of the modification indices provided by LISREL (Joreskog & Sorbom, 1981) also suggested that it was necessary to add these four correlated uniquenesses to the Model 1.1. The inclusion of these 4 correlated uniquenesses substantially improved the goodness of fit (Model 1.2 in Table 2). Inspection of the remaining modification indices for Model 1.2 suggested that two additional correlated uniqueness were needed. The first was between the two positively worded math self-concept items (see Bachman & O'Malley, 1986, for a discussion of correlated uniquenesses among positively worded and among negatively worded items representing the same self-concept scale). The second was between two of the three indicators (the vocabulary and reading tests) associated with the English achievement. The inclusion of these two additional correlated uniquenesses resulted in a small but statistically significant (due to the extremely large sample size) improvement in fit (see Model 1.3 in Table 2).

All parameter estimates for Models 1.3 are presented Figure 1A and the most important parameters estimates for Models 1.1 - 1.3 are summarized in Table 2. Whereas the substantive discussion of the results emphasizes Model 1.3, Models 1.1, 1.2 and 1.3 all result in substantively similar conclusions. Even though the addition of correlated uniquenesses had a large impact on goodness of fit, the parameter estimates from all three models support predictions 1-3 described earlier.

Prediction 1 posits math and English self-concept to be relatively uncorrelated. The nonsignificant covariation between the residual variances (-.025 in Model 1.3) is the relation between math and English self-concept after controlling for math and English achievements. The actual correlation between math and English self-concept without partialling variance attributable to other variables (-.024) is also close to zero. The inclusion of correlated errors between math and English self-concept items does affect the size of this correlation. However, in Model 1.1 the covariation between the residual variances (.042 -- see Table 2) and the corresponding correlation between the unpartialled factors (.050) are also close to zero. In contrast to this near-zero correlation between the math and English self-concepts, the correlation between individual math and English achievements (r=.88) is substantial. In summary, the results of these analyses demonstrate that math and English self-concept scores in the present investigation are nearly uncorrelated and much more content-specific than the corresponding achievement constructs.

Predictions 2 and 3 refer to relations between the achievement and self-concept constructs. Not surprisingly, though consistent with the predictions, better math skills are associated with substantially higher levels of math self-concept and better English skills are associated with substantially higher levels of English self-concept. What is more surprising, though still consistent with the predictions, is that better math skills are associated with lower English self-concepts and better English skills are associated with lower math self-concepts. This contrasting set of relations provides strong support for the discriminant validity of the English and math self-concepts.

The results of this first set of models are not new, but provide a strong replication of previous studies of the I/E model (Marsh, 1986; Marsh, Byrne & Shavelson, 1988). The present investigation does, however, have two important advantages over these previous studies. First, the present investigation was based on a large, nationally representative sample that demonstrates the generality of the findings. Second, the present investigation used sophisticated covariance structural models instead of path models derived from conventional multiple regressions.

The Content Specificity of the BFLPE.

In the next set of analyses, the five school-average test scores were added to the variables considered in Models 1.1 to 1.3 (see Figure 1B). As in Model 1.1 considered earlier, Model 2.1 posited no correlated uniquenesses but provided only a modest fit (Table 2). For this analysis a total of 9 correlated uniquenesses were hypothesized a priori (see earlier discussion). The set of 4 correlated uniquenesses relating self-concept items with the same wording and the set of 5 correlated uniquenesses relating individual and school-average achievement scores based on the same test substantially improved the fit in Models 2.2 and 2.3 respectively. The two additional correlated uniquenesses added to Model 1.2 in earlier analyses also provided a modest improvement in fit in Model 2.4 (Table 2). As in the earlier analyses, the inclusion of correlated uniqueness substantially improves the fit, but the parameter estimates for each of the models (Table 2) supports predictions 4 and 5 described earlier. Also, predictions 1-3 based on the original internal/external model that were supported in earlier analyses continue to be supported after the inclusion of school-average variables.

The important new predictions for Model 2.4 concern the relations between the school-average math and English Achievements and the corresponding self-concept measures. Consistent with prediction 4, school-average mathematics test scores negatively affects math self-concepts but not English self-concepts. Consistent with prediction 5, school-average English test scores negatively affect English self-concepts but not math self-concepts. These findings provide clear support for the content specificity of the BFLPE to math and English constructs.

Several other features cf Model 2.4 deserve further mention. First, not only are all the predictions based on the original internal/external model and its extension satisfied, but there is a striking symmetry in the size of the substantively important parameter estimates for the math and English constructs (Figure 1B). This symmetry supports the generality of the hypothesized processes. Second, though not specifically predicted a priori, school-average mathematics has a weak positive effect on English self-concept (e.g., if I am in a school in which other students are mathematical geniuses, my academic self-concept will suffer but my English self-concept may be a bit higher) and school-average English has a weak positive effect on math self-concept. These effects are consistent with the general observation that a variable which effects either one of the academic self-concepts has the opposite effect on the other academic self-concept. This pattern of counter-balancing effects apparently reflects the internal comparison process described as part of the internal/external model. Third, the school-average scores for math and English achievement are very highly correlated. The .72 in Figure 1B reflects the residual covariation after partialling out effects due to individual math and English achievements. The actual correlation between these two constructs without partialling out any other effects is .95. This extremely high correlation means that the school contexts of math and of English achievements are very similar. Because the school contexts in relation to these two subjects are so similar, the amount of variance in the self-concept measures that can be explained by these differences is limited. Whereas this similarity in the two contexts accurately reflects the natural state of affairs, it is theoretically relevant to note that if these contexts were not so similar -- due to non-random selection processes or to systematic interventions -- then the content specificity of the BFLPE would probably be much more dramatic.

Other, Unreported Analyses.

One additional, unreported set of models was fitted to the entire set of 18 measured variables. These models were similar to models 2.1 - 2.4 except that each pair of math and English constructs (e.g., math and

English self-concepts) was collapsed into a single global academic construct. For example, a single global academic achievement construct was associated with all five academic test scores and posited to affect school-average global achievement and global academic self-concept. Even after including all the correlated uniquenesses considered previously, the fit of this model was very poor. Furthermore, the global academic self-concept variable tended to be a bipolar construct in which the math and English items loaded in the opposite direction. The inclusion of additional correlated uniquenesses among the math indicators of each construct and among the English indicators of each construct substantially improved the fit, but resulted in a seriously ill-defined model. In particular, the residual variance estimate for the global academic self-concept construct was significantly less than zero and the global academic self-concept construct was nearly unrelated to the other two constructs. This pattern of results suggests that when variances attributable to the math self-concept indicators and attributable to the English self-concept indicators are partialled out of the global academic self-concept construct through the inclusion of correlated uniquenesses there is little or no variance left in the construct. This observation is consistent with the zero correlation between math and English self-concepts observed in earlier analyses. Because of these problems this set of models was not pursued further, but the ill-defined results provide further support for the inappropriateness of a single global measure of academic self-concept.

## Summary and Implications

Historically researchers considered global measures of self-concept, but a large body of research has suggested that more specific components of self-concept are more useful for understanding specific outcome measures. One of these more specific components has been academic self-concept. The results presented here, however, suggest that general academic measures of self-concept should be replaced with math and English measures of self-concept. Because math and English self-concepts seem to be nearly uncorrelated, it may be unjustified to subsume these two measures into a more general measure of academic self-concept. If the role of self-concept research in academic settings is to better predict academic behaviors and accomplishments, to provide outcome measures for academic interventions, and to relate academic self-concept to other constructs, then math and English self-concepts may be more useful than a general academic self-concept. From this perspective it is recommended that future research should examine math and English self-concept measures in relation to important theoretical issues in self-concept research.

The internal/external model was developed to explain the dramatic lack of correlation between math and English self-concepts and their corresponding relations to math and English achievement. The present findings because of the size and the representativeness of the sample, and because of the sophistication of the covariance structure models, provide important support for the generality of earlier findings. The findings are also important in that they demonstrate that math and English self-concepts are influenced by different processes than those that influence achievement. In this respect, there is empirical and theoretical support for earlier suggestions that academic self-concepts and differ from corresponding academic achievements because the two constructs are evaluated in relation to different frames of reference. It is also possible that frame of reference effects that influence self-concepts will subsequently influence achievement-related behaviors (e.g., course selection and subsequent achievement) through their influence on academic self-concept (Marsh, 1987).

A growing body of research in support of the BFLPE suggests that students who attend selective, high-ability schools will suffer lower academic self-concepts than if they attended low- or medium-ability schools. Marsh (1987; Marsh & Parker, 1984) posited this to be an example of frame of reference effects studied widely in social psychology and psychophysics and proposed a model based on this previous research. In combining the BFLPE and the internal/external models for purposes of the present investigation, it was proposed that if school-average contexts differ systematically in terms of math and English achievements, then these differences should be reflected in differential effects on math and English self-concepts. Whereas math and English contexts, as inferred from school-average tests scores, were highly correlated, they were sufficiently distinct to provide strong support for the predicted content specificity of the BFLPE. Support for this content specificity provides particularly compelling support for the theoretical bases for both the BFLPE and internal/external models. The findings also demonstrate that self-concept responses are remarkably sensitive to even small differences in frame of reference contexts.

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**Table 1**

**Description of the 18 Variables (HSB variable labels in parentheses) used to define each of the 6 constructs (see Figure 1)**

| | |
|---|---|
| Individual Math Achievement Test Scores | |
| 1 | (YBMTH1FS) Sophomore Math Part 1 Formula Score |
| 2 | (YBMTH2FS) Sophomore Math Part 2 Formula Score |
| Individual English Achievement Test Scores | |
| 3 | (YBVOCBFS) Sophomore Vocabulary Formula Score |
| 4 | (YBREADFS) Sophomore Reading Formula Score |
| 5 | (YBWRITFS) Sophomore Writing Formula Score |
| School-average Math Achievement Test Scores | |
| 6 | School-average of Math Part 1 |
| 7 | School-average of Math Part 2 |
| School-average English Achievement Test Scores | |
| 8 | School-average of Vocabulary |
| 9 | School-average of Reading |
| 10 | School-average of Writing |
| Math Self-concept Items | |
| 11 | (YB035E) I am usually at ease in mathematics class 12 |
| 12 | (YB035F) Doing mathematics assignments makes me feel tense |
| 13 | (YB035G) Mathematics class does not scare me |
| 14 | (YB035H) I dread mathematics class |
| English Self-concept Items | |
| 15 | (YB035A) I am usually at ease in English class |
| 16 | (YB035B) Doing English assignments makes me feel tense |
| 17 | (YB035C) English class does not scare me |
| 18 | (YB035D) I dread English class |

Note. The variables are numbered 1 to 18 and these numbers correspond to the 18 measured variables shown in Figure 1. The variable label names used to identify each of these variables on the HSB data file (see NCES, 1986) are also presented (in parentheses).

Table 2

Goodness of Fit Indices For Alternative Models and Important Parameter Estimates

| | Goodness Of Fit Indices[a] | | | | | Important Parameters Relating[b]: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Model | $X^2$ | df | RMSR | TLI | BBI | IMA MSC | IMA ESC | IEA ESC | IEA MSC | SMA MSC | SMA ESC | SEA ESC | SEA MSC | MSC ESC |
| Models of the Original Internal/External Model (see Fig. 1a) | | | | | | | | | | | | | | |
| 1.0 | 23,380 | 78 | .267 | 0 | 0 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1.1 | 1,300 | 59 | .038 | .930 | .944 | 53 | -22 | 51 | -34 | -- | -- | -- | -- | 04 |
| 1.2 | 333 | 55 | .026 | .983 | .986 | 53 | -22 | 51 | -33 | -- | -- | -- | -- | -04 |
| 1.3 | 188 | 53 | .024 | .992 | .992 | 61 | -33 | 42 | -41 | -- | -- | -- | -- | -02 |
| Models Adding School-Average Test Scores (see Fig. 1b) | | | | | | | | | | | | | | |
| 2.0 | 59,012 | 153 | .318 | 0 | 0 | -- | -- | -- | -- | -- | -- | - | -- | -- |
| 2.1 | 2,571 | 120 | .032 | .947 | .956 | 65 | -31 | 64 | -43 | -37 | 29 | -38 | 33 | 05 |
| 2.2 | 1,604 | 116 | .025 | .967 | .973 | 65 | -31 | 65 | -43 | -38 | 30 | -40 | 33 | 03 |
| 2.3 | 516 | 111 | .024 | .991 | .991 | 57 | -22 | 56 | -35 | -17 | 06 | -14 | 12 | -04 |
| 2.4 | 516 | 109 | .023 | .994 | .994 | 66 | -35 | 69 | -43 | -22 | 13 | -22 | 17 | -02 |

Note. Models 1.0 and 2.0 are null models. Models 1.1 and 2.1 posit no correlated uniquenesses. Models 1.2 and 2.2 posit 4 (a priori) correlated uniquenesses relating pairs of self-concept items that have the same wording. Model 1.3 posits 2 additional (a posteriori) correlated uniquenesses. Model 2.3 adds 5 (a priori) correlated uniquenesses to Model 2.2 that relate individual and school-average scores based on the same test. Model 2.4 posits an additional 2 correlated uniquenesses (those included in Model 1.3). For each model, goodness-of-fit indicators are presented on the left-hand side of the table and substantively important parameter estimates are presented on the right-hand side of the table. Parameters not estimated in a particular model are indicated as "--".

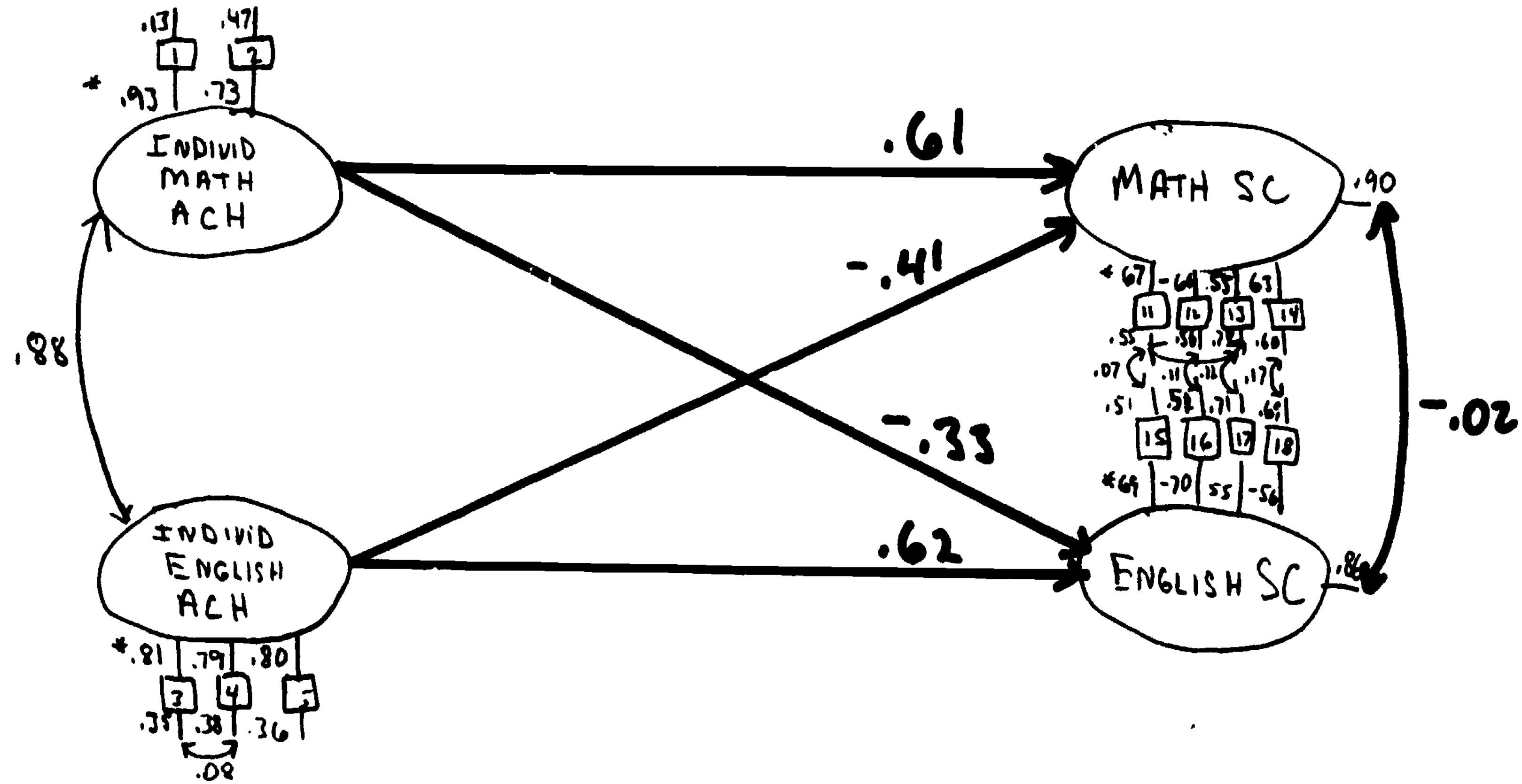
[a] BBI = Bentler-Bonett Index; TLI = Tucker-Lewis Index; RMSR = Root Mean Square Residual (based on a correlation metric). [b] IMA = Individual Math Achievement; IEA = Individual English Achievement; SMA = School-average Math Achievement; SEA = School-average English achievement; MSC = Math Self-concept; ESC = English Self-concept. A "--" indicates that a parameter was not estimated in a particular model. All parameter estimates are presented in standardized form to facilitate interpretations and all but the residual covariation between MSC and ESC are direct path coefficients (see Figure 1).

FIGURE CAPTIONS

Figure 1. The structural parameter estimates for Models 1.3 (A) and 2.4 (B). Model 1.3 relates individual math and English achievements to math and English self-concepts. School-average math and English achievements are added to Model 2.4. The theoretically most important linkages are presented in boldface and the corresponding coefficients based on other models are presented in Table 2. [The numbered boxes refer to the measured variables (see Table 1) and the latent constructs are indicated by circles. All the constructs have at least two indicators (i.e., the circles are associated with two or more boxes) and correlated uniquenesses are posited for some indicators. Path coefficients (the single-headed arrows going from left to right) represent relations between latent constructs.]

NOTE: Please note that the hand-drawn figure is only intended for purposes of review and that professional, camera-ready artwork will be supplied in the event that the manuscript is accepted for publication.

A



INDIVID MATH ACH
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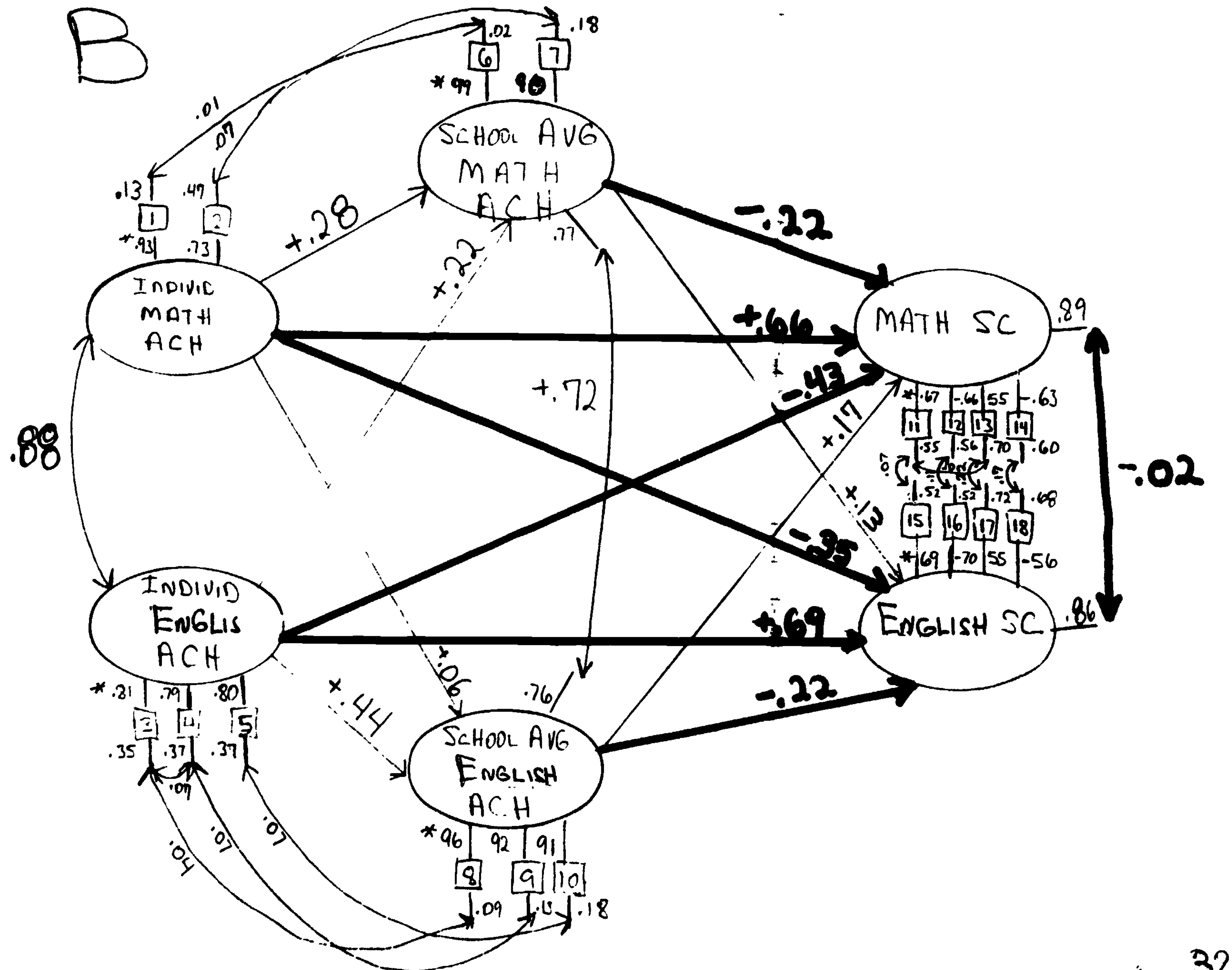


* Fixed at 1.0 in unstandardized metric

APPENDIX 1

## CORRELATIONS AND SUMMARY STATISTICS FOR THE 18 MEASURED VARIABLES

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | .678 | .667 | .668 | .657 | .440 | .396 | .387 | .395 | .374 | -.186 | .166 | -.070 | .166 | -.143 | .157 | -.067 | .132 |
| 2 | .678 | 1.000 | .695 | .523 | .504 | .360 | .384 | .309 | .313 | .296 | -.159 | .123 | -.058 | .149 | -.101 | .110 | -.066 | .093 |
| 3 | .667 | .695 | 1.000 | .713 | .629 | .413 | .374 | .474 | .425 | .399 | -.079 | .052 | .001 | .058 | -.172 | .182 | -.102 | .158 |
| 4 | .668 | .523 | .713 | 1.000 | .643 | .335 | .303 | .338 | .386 | .329 | -.106 | .083 | -.021 | .089 | -.183 | .202 | -.105 | .165 |
| 5 | .657 | .504 | .629 | .643 | 1.000 | .353 | .318 | .369 | .359 | .414 | -.103 | .069 | .016 | .084 | -.198 | .206 | -.086 | .162 |
| 6 | .440 | .360 | .413 | .335 | .353 | 1.000 | .895 | .882 | .854 | .856 | -.056 | .037 | .006 | .029 | -.056 | .069 | -.005 | .034 |
| 7 | .396 | .384 | .374 | .303 | .318 | .895 | 1.000 | .801 | .822 | .777 | -.059 | .039 | .002 | .032 | -.047 | .057 | .006 | .032 |
| 8 | .387 | .309 | .474 | .338 | .369 | .882 | .801 | 1.000 | .891 | .837 | -.065 | .030 | .001 | .019 | -.056 | .069 | -.014 | .038 |
| 9 | .395 | .313 | .425 | .386 | .359 | .854 | .822 | .891 | 1.000 | .862 | -.044 | .035 | .010 | .030 | -.066 | .060 | -.006 | .043 |
| 10 | .374 | .296 | .399 | .329 | .414 | .856 | .777 | .837 | .862 | 1.000 | -.035 | .030 | .018 | .017 | -.036 | .071 | .006 | .029 |
| 11 | -.186 | -.159 | -.079 | -.106 | -.103 | -.056 | -.059 | -.065 | -.044 | -.035 | 1.000 | -.435 | .473 | -.425 | .066 | -.024 | -.031 | .004 |
| 12 | .166 | .123 | .052 | .083 | .069 | .037 | .039 | .030 | .035 | .030 | -.435 | 1.000 | -.386 | .424 | .026 | .123 | .006 | -.002 |
| 13 | -.070 | -.058 | .001 | -.021 | .016 | .006 | .002 | .001 | .010 | .018 | .473 | -.386 | 1.000 | -.319 | -.035 | .020 | .161 | .072 |
| 14 | .166 | .149 | .058 | .089 | .084 | .029 | .032 | .019 | .030 | .017 | -.425 | .424 | -.319 | 1.000 | .027 | .124 | .059 | .157 |
| 15 | -.143 | -.101 | -.172 | -.183 | -.198 | -.056 | -.047 | -.056 | -.066 | -.036 | .066 | .026 | -.035 | .027 | 1.000 | -.475 | .375 | -.401 |
| 16 | .157 | .110 | .182 | .202 | .206 | .069 | .057 | .069 | .060 | .071 | -.024 | .123 | .020 | .124 | -.475 | 1.000 | -.306 | .395 |
| 17 | -.067 | -.066 | -.102 | -.105 | -.086 | -.005 | .006 | -.014 | -.006 | .006 | -.031 | .006 | .161 | .059 | .375 | -.306 | 1.000 | -.259 |
| 18 | .132 | .093 | .158 | .165 | .162 | .034 | .032 | .038 | .043 | .029 | .004 | -.002 | .072 | .157 | -.401 | .395 | -.259 | 1.000 |
| MEAN | 10.157 | 2.560 | 8.672 | 6.827 | 8.605 | 10.063 | 2.523 | 6.630 | 6.773 | 8.216 | 1.364 | 1.690 | 1.325 | 1.652 | 1.240 | 1.717 | 1.279 | 1.647 |
| SD | 7.686 | 2.732 | 5.302 | 4.758 | 5.100 | 3.668 | 1.138 | 2.646 | 1.947 | 2.353 | .466 | .463 | .466 | .452 | .425 | .451 | .469 | .459 |
| SKEW | 0.156 | 0.406 | 0.011 | 0.314 | -.259 | -.029 | 0.616 | -.106 | -.026 | -.565 | 0.854 | -.623 | 0.768 | -.841 | 1.243 | -.552 | 1.967 | -.660 |

NOTE: VARIABLES LABELS AND DESCRIPTIONS OF VARIABLES 1-18 APPEAR IN TABLE 1

APPENDIX 1

CORRELATIONS AND SUMMARY STATISTICS FOR THE 18 MEASURED VARIABLES

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.000 | .678 | .647 | .668 | .657 | .440 | .394 | .387 | .395 | .374 | -.184 | .146 | -.070 | .166 | -.143 | .157 | -.067 | .132 |
| 2 | .678 | 1.000 | .495 | .523 | .504 | .340 | .384 | .309 | .313 | .296 | -.159 | .123 | -.058 | .149 | -.101 | .110 | -.046 | .093 |
| 3 | .647 | .495 | 1.000 | .713 | .629 | .413 | .374 | .474 | .425 | .399 | -.079 | .052 | .001 | .058 | -.172 | .182 | -.102 | .158 |
| 4 | .668 | .523 | .713 | 1.000 | .643 | .335 | .303 | .338 | .386 | .329 | -.104 | .083 | -.021 | .089 | -.183 | .202 | -.105 | .165 |
| 5 | .657 | .504 | .629 | .643 | 1.000 | .353 | .318 | .349 | .359 | .414 | -.103 | .069 | .014 | .084 | -.198 | .204 | -.086 | .162 |
| 6 | .440 | .340 | .413 | .335 | .353 | 1.000 | .895 | .882 | .894 | .856 | -.056 | .037 | .006 | .029 | -.054 | .059 | -.005 | .034 |
| 7 | .394 | .384 | .374 | .303 | .318 | .895 | 1.000 | .801 | .822 | .777 | -.059 | .039 | .002 | .032 | -.047 | .057 | .006 | .032 |
| 8 | .387 | .309 | .474 | .338 | .349 | .882 | .801 | 1.000 | .891 | .837 | -.045 | .030 | .001 | .019 | -.056 | .069 | -.014 | .038 |
| 9 | .395 | .313 | .425 | .386 | .359 | .894 | .822 | .891 | 1.000 | .862 | -.044 | .035 | .010 | .030 | -.064 | .080 | -.016 | .043 |
| 10 | .374 | .296 | .399 | .329 | .414 | .856 | .777 | .837 | .862 | 1.000 | -.035 | .030 | .010 | .017 | -.036 | .071 | .006 | .029 |
| 11 | -.184 | -.159 | -.079 | -.104 | -.103 | -.056 | -.059 | -.045 | -.044 | -.035 | 1.000 | -.435 | .472 | -.425 | .068 | -.124 | -.001 | .004 |
| 12 | .146 | .123 | .052 | .083 | .069 | .037 | .039 | .030 | .035 | .030 | -.435 | 1.000 | -.366 | .424 | .021 | .123 | .005 | -.002 |
| 13 | -.070 | -.058 | .001 | -.021 | .014 | .006 | .002 | .001 | .010 | .010 | .472 | -.366 | 1.000 | -.315 | -.039 | .020 | .111 | .072 |
| 14 | .166 | .149 | .058 | .089 | .084 | .029 | .032 | .019 | .030 | .017 | -.425 | .424 | -.315 | 1.000 | .127 | .024 | .254 | .157 |
| 15 | -.143 | -.101 | -.172 | -.183 | -.198 | -.054 | -.047 | -.056 | -.064 | -.036 | .068 | .021 | -.039 | .127 | 1.000 | -.471 | .375 | -.401 |
| 16 | .157 | .110 | .182 | .202 | .204 | .059 | .057 | .069 | .080 | .071 | -.124 | .123 | .020 | .024 | -.475 | 1.000 | -.300 | .395 |
| 17 | -.067 | -.046 | -.102 | -.105 | -.086 | -.005 | .006 | -.014 | -.006 | .006 | -.001 | .005 | .111 | .254 | .375 | -.300 | 1.000 | -.259 |
| 18 | .132 | .093 | .158 | .165 | .162 | .034 | .032 | .038 | .043 | .029 | .004 | -.002 | .072 | .157 | -.401 | .395 | -.259 | 1.000 |
| MEAN | 10.157 | 2.540 | 8.672 | 6.827 | 8.405 | 10.053 | 2.523 | 1.640 | 6.773 | [illegible] | 1.364 | [illegible] | [illegible] | [illegible] | [illegible] | .717 | 1.275 | 1.697 |
| SD | 7.684 | 2.732 | 5.302 | 4.756 | 5.100 | 3.068 | 1.138 | 2.640 | 1.947 | 2.103 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | .449 | .459 |
| SKEW | 0.154 | 0.406 | 0.011 | 0.314 | -.259 | -.029 | 0.415 | -.114 | -.025 | -.545 | 0.354 | -.823 | [illegible] | [illegible] | [illegible] | [illegible] | 0.967 | -.860 |

NOTE: VARIABLES LABELS AND DESCRIPTIONS OF VARIABLES 1-18 APPEAR IN TABLE 1