Subject Specific Components of Academic Self Concept and Self Efficacy: A Response to Skaalvik and Rankin (in press).

Herbert W. Marsh, University of Western Sydney, Macarthur

Richard Walker and Raymond Debus, University of Sydney

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Running Head: Academic Self Concept and Self Efficacy

Requests for further information about this study should be sent to Herbert W. Marsh, University of Western Sydney, Macarthur, PO Box 555, Campbelltown, NSW 2560 Australia. We would like to thank Einar Skaalvik for providing us with a pre-publication copy of his article that prompted the present investigation.

ABSTRACT

The Internal/External (I/E) frame of reference model posits academic self-concept in a particular subject is based in part on how achievement in that subject is perceived to compare with achievements in other school subjects. The model predicts that math and verbal self-concepts are substantially less correlated than the corresponding achievements, and has been supported in Australian, Canadian, and US studies. Skaalvik and Rankin (in press) reported, however, that math and verbal self-concepts were as highly correlated as verbal and math achievements for Norwegian students, suggesting to them that there may be cultural differences. Their self-concept measure, however, was actually a self-efficacy measure and their results may reflect differences between self-concept and self-efficacy. This interpretation was supported in the present investigation which found support for the I/E model for self-concept responses but not for self-efficacy responses. The results were interpreted in relation to the role of frames of reference used in forming self-concept and self-efficacy responses.

The purpose of the the present investigation is to compare and contrast some key features in measures of academic self-concept and academic self-efficacy. The research was stimulated in part by Skaalvik and Rankin (in press) who were unable to replicate results from self-concept research using instruments that resemble traditional self-efficacy

measures more than self-concept measures. Critical emphases are the content specificity of academic self-concept and self-efficacy, and the role of frames of reference.

A Multidimensional Self-concept

There is growing recognition for the need to consider multiple dimensions of self-concept in addition to -- or instead of -- a single, global indicator of self-concept. Particularly in educational research there is clear evidence for the separation of academic self-concept from nonacademic and general self-concept (Byrne, 1984; Marsh, Byrne & Shavelson, 1988; Marsh & Shavelson, 1985). Marsh, Byrne and Shavelson, for example, found that the academic scales from three different instruments had a substantial and logical pattern of relations with academic achievement indicators whereas three general measures of self-concept were unrelated to the achievement indicators. They also found, however, that there was a very strong content specificity in the pattern of relations; mathematics achievement was substantially more strongly related to math self-concept and verbal achievement was substantially more correlated with verbal self-concept. Furthermore, math self-concept was nearly uncorrelated with verbal self-concepts for all three instruments even though math and verbal achievements were substantially correlated.

Verbal and mathematics achievements typically are correlated .5 to .8 and so it might be reasonable to expect that verbal and math self-concepts should also be correlated substantially. This expectation was incorporated into the original Shavelson, Hubner, and Stanton (1976) model of self-concept in which academic self-concepts in particular subject areas were hypothesized to form a general academic self-concept. In contrast to initial expectations, math and verbal self-concepts have been found to be nearly uncorrelated in numerous studies with various Self Description Questionnaire (SDQ) instruments and other self-concept instruments (Marsh, 1986; Marsh, Byrne & Shavelson, 1988). These results led to a revision of the Shavelson et al. model (Marsh, in press-c; Marsh & Shavelson, 1985; Shavelson & Marsh, 1986; Marsh, Byrne & Shavelson, 1988) in which two higher-order facets of academic self-concept -- math/academic and verbal/academic -- were posited instead of just one.

Marsh (1986) proposed the I/E model to explain the extreme content specificity of academic self-concepts. According to the model, verbal and math self-concepts are formed in relation to both external and internal comparisons, or frames of reference, that can be characterized as:

1) External Comparisons -- According to this process, students compare their self-perceptions of their own math and verbal skills with the perceived skills of other students within their frame of reference and use this external relativistic impression as one basis for their self-concept in each of the two areas.

2) Internal Comparisons -- According to this process, students compare their self-perceived math skills with their self-perceived verbal skills

and use this internal, relativistic impression as a second basis for arriving at their self-concept in each of the two areas.
In order to clarify how these two processes operate, consider students who accurately perceive themselves to be below average in both math and verbal skills, but who are better at math than at other academic subjects. Their math skills are below average relative to other students (an external comparison) but higher than average relative to their own skills in other academic areas (an internal comparison). Depending upon how these two components are weighted, these students may have average or even above-average self-concepts in mathematics despite their poor math skills.

The operation of an external comparison process reflects well-established social comparison processes. For example, Marsh (1987; 1990; in press-b; Marsh & Parker, 1984) reported that equally able students have lower academic self-concepts when they attend schools where the average ability of others students is higher -- the big-fish-little-pond effect. Since verbal and math achievements are correlated substantially, this external comparison process should lead to a positive correlation between verbal and math self-concepts. However, the internal process should lead to a negative correlation between verbal and math self-concepts, since math and verbal skills are compared with each other and it is the difference between the two that contributes to a higher self-concept in one area or the other. The external process predicts a positive correlation between verbal and math self-concepts whereas the internal process predicts a negative correlation. Hence, the joint operation of both processes, depending upon the relative strength of each, will lead to the near-zero correlation between verbal and math self-concept that has been observed in empirical research. The I/E model does not require that the verbal/math correlation is zero, but only that it is substantially less than the typically large correlation between verbal and math achievement levels. To the extent that the correlation between math and verbal self-concept is similar to the correlation between math and verbal achievement, the internal comparison process is apparently not working. Thus, for example, Marsh (1986) concluded that the internal comparison process is much weaker for self-concept responses inferred by significant others than for self-report self-concept responses.

The I/E model is tested with path models (like those discussed later in Figure 1; also see Marsh, 1986; Marsh, Byrne & Shavelson, 1988) in which academic achievement is hypothesized to be one causal determinant of academic self-concept. This does not, however, argue against a more dynamic model in which subsequent levels of academic achievement and self-concept are each determined by prior levels of achievement and self-concept (see Marsh, in press-a; in press-b). The I/E model predicts that math achievement will positively affect math self-concept and that verbal achievement will positively affect verbal self-concept. The key predictions, however, are the negative direct effects of mathematics

achievement on verbal self-concept, and of verbal achievement on math self-concept. For example, a high math self-concept will be more likely when math skills are good (the external comparison) and when math skills are better than verbal skills (the internal comparison). Thus, once math skills are controlled, it is the difference between math and verbal skills which is predictive of math self-concept; high verbal skills detract from a high math self-concept. There is considerable support for the generality of these predictions based across different ages (preadolescent, adolescent and late-adolescent/young adult), across respondents in educational and non-educational settings, across different instruments, and across students from different Western countries (Canada, Australia, and the US; see Marsh, 1986; Marsh, 1990; Marsh, Byrne & Shavelson, 1988).

A Comparison of Self-Concept and Self-Efficacy

Perceived self-efficacy is defined as the self-perceptions of one's skills and capabilities to execute courses of action required to deal with prospective situations (Bandura, 1986; Schunk, 1987; 1989). It is based on inferential processes involving prior performance, vicarious experience, verbal persuasion, and emotional arousal. Self-efficacy is hypothesized to promote appropriate task choice, motivation, sustained effort and persistence in the face of difficulty, and subsequent successful performance; these in turn reinforce self-efficacy. Self-beliefs of efficacy are seen as operating to enhance or impair performance through cognitive, affective, or motivational mediating processes that contribute to the prediction of future behavior. In this vein Bandura emphasizes that self-efficacy judgments are "not simply inert predictors of future behavior" in that people with efficacious self-beliefs "make things happen" (1989, p. 731). Thus, self-efficacy mediates the effects of environmental factors and prior behavior on subsequent behavior.

Self-efficacy is measured by asking subjects to judge their capability of succeeding at specific target tasks within the domain or subdomain being tested. Students may, for example, be asked to judge their capability in solving a series of division problems which they are shown briefly or to assess their likely level of remembering in a series of memory task situations. More sensitive efficacy measures seek to assess respondents' beliefs in their capabilities to fulfill task demands at various gradations of difficulty within the domain rather than to assess personal efficacy at a single level of task difficulty (Bandura, 1989). In part, self-efficacy ratings are validated by correlating the ratings with actual performance and testing whether they contribute to the prediction of subsequent performance beyond what can be explained by prior performance.

Bandura (1986) has been particularly critical of global measures such as those used in earlier self-concept research. According to Bandura this overemphasis on global measures impairs the ability to understand and predict behavior in particular situations and does not take into account

the complexity and variation of self-efficacy perceptions. Whereas self-efficacy and self-concept researchers agree in recognizing the inadequacy of such global measures and focus on more domain-specific measures, there remains a clear difference in the level of specificity typically assessed in each approach. Measures such as the SDQ (Marsh, 1988) are based on scales representing a compromise between domain specific behaviors and generality, reflecting a level of specificity near the middle of the Shavelson et al (1976) hierarchy. Many of the SDQ scales, however, could be viewed as higher-order constructs and inferred from a set of even more narrowly-defined scales corresponding to the specific behaviors that are at the base of the Shavelson et al hierarchy. Measures of perceived self-efficacy derived from response to specific tasks in particular subdomains, resulting in assessments at this more specific level which "permits a microanalysis of the degree of congruence between self-percepts of efficacy and action at the level of individual tasks" (Bandura, 1986, p. 422). This distinction between self-concept and self-efficacy measures, however, is not inherent in that self-concept could be assessed at a lower level in the Shavelson et al. hierarchy.

The major emphasis in self-efficacy research has been a focus on individual domains or subdomains and not the relations between self-efficacies in different domains. Thus, self-efficacy researchers normally present items from a single domain and even when more than one domain is considered, it is typical (e.g., Skaalvik & Rankin, in press) to present the items relevant to each domain separately. In contrast, self-concept researchers are more likely to consider self-concepts in a wide variety of domains and the pattern of relations between self-concepts in different domains. Consistent with this emphasis, items from different domains are typically interspersed with each other on multidimensional self-concept instruments. The intermixing of items from different domains may encourage the comparison of competencies across domains in the form suggested in the internal comparison process posited in the I/E model. With its typical separation of items from each domain, self-efficacy measures are unlikely to instigate such an internal comparison process. This format difference, however, is not inherent in that self-efficacy items from different domains could be interspersed on a single instrument and self-concepts items from each domain could be tested separately.

Both self-efficacy and self-concept responses are posited to reflect more than just an objective assessment of existing achievement levels. Bandura (1989), for example, noted a tendency for self-efficacy judgments to

overestimate actual capabilities, suggesting that "optimistic self-appraisals that are not unduly disparate from what is possible can be advantageous" (p. 732). In this sense, self-efficacy and self-concept measures -- even after partialling out the effects of prior achievement -- are likely to contribute to the prediction of subsequent behaviors that are dependent on active choice, motivation, and sustained effort.

Self-efficacy and self-concept responses, however, are likely to differ in the influence of social comparison and frame of reference effects like those posited in the I/E model. Frame of reference effects are directly implicated in self-concept measures as students use the performances of other classmates (external comparison processes) and their own performances in other domains (internal comparison processes) to establish frames of reference for evaluating their own performances. Bandura (1986), for example, noted that self-esteem -- but not self-efficacy -- is partly determined by "how well one's behavior matches personal standards of worthiness" (p. 410). In self-efficacy judgments the focus of assessment is on the individual's capabilities in relation to the specific criterion items presented and so the influence of frame of reference effects is minimized. Schunk (1985) noted that students may make some use of the performance of others to evaluate their own likelihood of success. Even this limited influence of an external comparison process, however, is only likely when the task is novel or ambiguous so that students are unable to use their previous experience with similar tasks. In summary, self-concept responses are likely to be more influenced by frame of reference effects -- particularly the internal comparison process -- and this distinction appears to be inherent in the way self-concept and self-efficacy responses are measured. Support for this claim, based in part on evidence recently presented by Skaalvik and Rankin (in press), is examined in the present investigation.

The Skaalvik and Rankin (in press) Study

Skaalvik and Rankin (in press) evaluated the I/E model using data from 231 Norwegian 6th grade students. They considered verbal and mathematics achievement (scores on objective tests) and what they called math and verbal self-concepts (but also referred to as self-concepts on a cognitive level and expectations for success). Their self-concept scores were obtained by asking students to judge their ability to successfully answer each of 20 math items and each of 30 verbal items on the same tests used to infer math and verbal achievement -- a standard operationalization of self-efficacy. Based on their research, they found little or no support for the I/E model suggesting to them that there may be substantial cultural differences and, perhaps, that academic self-concept is more complex than previously assumed.

In particular, they noted that the correlation between math and verbal self-concept (.67) was slightly higher than the correlation between the corresponding achievement measures (.63), thus "contradicting the findings by Marsh (1986) and Marsh, Byrne, and Shavelson (1988)" (p. xxx). Skaalvik and Rankin argued for the distinction between evaluative self-concepts measured by instruments like the SDQ and what they referred to as cognitive self-concepts, noting the need for further research that directly compares both types of measures. Whereas we agree with the need to pursue this distinction, we find it more useful to consider Skaalvik and Rankin's key variables as measures of self-efficacy rather than self-concept.

Prompted in part by Skaalvik and Rankin (in press), the purposes of the present investigation are to consider relations between math and verbal achievements, math and verbal self-concepts, and math and verbal self-efficacy. These relations are evaluated in relation to predictions based on the I/E model and to distinctions between self-concept and self-efficacy discussed earlier. Consistent with earlier discussion emphasizing that self-concept responses are more influenced by frame of reference effects than self-efficacy responses, we predicted that:

1) math and verbal self-concept measures are substantially less positively correlated than math and verbal self-efficacy measures;

2) support for the internal comparison component of the I/E model, predicting the negative effect of math achievement on verbal self-concept and of verbal achievement on math self-concept, is stronger for self-concept responses than self-efficacy responses.

Methods

Sample and Procedures. The sample consisted of responses by 426 students fifth grade students (50% male) from 8 Catholic schools in metropolitan Sydney Australia. The measures were administered by one of the authors (RW) to intact classes of no more than 34 students. The measures were administered to all students in attendance at the time of administration. The data were collected as part of a larger study, serving as base-line data used to select students for a subsequent intervention and to evaluate the effects of an intervention.

Instruments. The math and verbal self-concept measures were based on responses to the SDQI instrument (Marsh, 1988; Marsh, in press-b). For each scale, students responded to 8 positively worded items using a 5-point response scale (1=False,...,5=True). Internal consistency estimates of reliability for each scale were .90 (math) and .88 (verbal). The math and verbal self-efficacy scales were obtained by asking students to indicate whether they could correctly answer each item on a mathematics test and on a verbal test similar to subsequently administered tests of each construct.

The math and verbal self-efficacy scales were presented on separate days. For both self-efficacy measures the items varied in level of difficulty and were presented in ascending order of difficulty. For each scale, students responded to 10 test items using a 10-point response scale (0%, 10%, 20% ... 100%) to indicate the likelihood of being able to correctly solve the problem. Internal consistency estimates of reliability for each scale were 0.90 (math) and .86 (verbal).

Verbal achievement was inferred from responses to three objective tests; the Primary Reading Survey test (ACER, 1971) consisting of 39 multiple-choice items based on 7 passages; the Paragraph Understanding Test (New South Wales Department of Education, 1982) consisting of 34 multiple-choice items based on 34 short paragraphs, and the GAP (McLeod, 1977) test of reading comprehension consisting of 34 cloze items in which students supply a missing word. The internal consistency estimates of reliability for these three verbal comprehension tests were .90, .78, and .87 respectively. Mathematics achievement was inferred from responses to two objective tests; the PEP Word Problems test (Australian Council of Educational Research, 1977) consisting of 38 multiple-choice items assessing a wide variety of mathematical skills and a second test similar in format to the first that consisted of 23 multiple-choice items involving only the four basic arithmetic operations. The internal consistency estimates of reliability for the these two mathematics tests were .74 and .65 respectively.

Statistical Analysis. Confirmatory factor analyses and path analyses were conducted with LISREL (Joreskog & Sorbom, 1988; also see Byrne, 1989). As in other SDQ research (e.g., Marsh, 1988; Marsh & Hocevar, 1985) analyses were conducted on item-pair scores (or parcels) in which the first two items in each scale are averaged to form the first item pair, the next two items are used to form the second pair, and so forth. Thus the 16 SDQI items were reduced to 8 item pairs, 4 to infer math self-concept and 4 to infer verbal self-concept. Similarly, the 20 self-efficacy items were reduced to 10 item pairs, 5 to infer math self-efficacy and 5 to infer verbal self-efficacy. Math achievement was inferred from scores on two math tests and verbal achievement was inferred from scores on three verbal tests.

An important unresolved issue in CFA is how to determine whether the goodness of fit of a priori models is adequate. The general approach is to evaluate the parameter estimates to determine whether they are consistent with predictions and to evaluate goodness of fit for alternative models. Researchers have developed a variety of goodness of fit indicators to aid in this process and the Tucker-Lewis Index (TLI) appears to be one of the most useful of the widely used indices (Marsh, Balla & McDonald, 1988; Marsh & Balla, 1990; McDonald & Marsh, 1990). Although there are no clearly established rules as to what constitutes a "good" fit, a widely applied

guideline for relative indices like the TLI is .90 (e.g., Bentler & Bonnet, 1980; Byrne, 1989). An index of .90 can be roughly interpreted as being able to explain 90% of the covariation among the measured variables.

Results and Discussion

In model 1A (Figure 1), the I/E model was evaluated with self-concept responses. The model is well defined in that the solution converged to a proper solution, all factors are well defined, and the goodness of fit is good (TLI = .97). The correlations among the latent constructs (not shown)1 indicate that math and verbal achievements are substantially more positively correlated (.78) than the corresponding self-concept scores (.19). The pattern of path coefficients in Figure 1a is consistent with the I/E model; the effect of verbal achievement is positive on verbal self-concept (.61) but negative on math self-concept (-.33), the effect of math achievement is positive on math self-concept (.63) but negative on verbal self-concept (-.58).

In the second model (Figure 1b), the I/E model was evaluated with self-efficacy measures as in the Skaalvik and Rankin (in press) study. The model is well defined in that the solution converged to a proper solution, all factors are well defined, and the goodness of fit is adequate (TLI = .84). The correlations among the latent constructs (not shown) indicate that math and verbal achievements are substantially correlated (.78) as are the corresponding self-efficacy scores (.64). The pattern of path coefficients in Figure 1b is not consistent with the I/E model; the effect of verbal achievement is positive on verbal self-efficacy (.27) but nonsignificant for math self-efficacy (-.02), the effect of math achievement is positive on math self-efficacy (.43) but not significant for verbal self-efficacy (.07). This lack of support for the I/E model based on self-efficacy responses is generally consistent with the Skaalvik and Rankin (in press) results and earlier predictions for self-efficacy responses.

Although not the focus of this presentation, additional models were evaluated that included both self-concept and self-efficacy measures. Partialling the effects of self-efficacy from self-concept responses, however, had little effect on support for the I/E model shown in Figure 1A. Similarly, partialling the effects of self-concept from self-efficacy responses had little effect on the pattern of results shown in Figure 1B. Because the

inclusion of self-concept and self-efficacy in the same model had almost no effect on the major results, these models are not considered further.

Results of this study replicate previous studies of the I/E model based on self-concept responses and support predictions about the differences between self-concept and self-efficacy responses. This investigation suggests that the Skaalvik and Rankin (in press) failure to support the I/E model occurred because they based their study on self-efficacy measures instead of self-concept responses that are the basis of the I/E model. The results also support earlier contentions that self-efficacy measures reflect performance expectancies on a particular task whereas as self-concept responses are more influenced by frame of reference effects like those posited in the I/E model. In particular, the internal comparison process (that students evaluate performance in one academic subject in relation to performances in other subjects) does not appear to operate for self-efficacy responses.

In the form that the measures are typically presented, the inherent differences between self-efficacy and self-concept measures are confounded with differences in format. Here, math and verbal self-efficacy items were presented as separate scales whereas math and verbal self-concept items were intermixed and presented together. Intermixing items from different domains may enhance the internal comparison process for self-concept responses, though we suspect that intermixing self-efficacy items would not induce a substantial internal comparison process. Further clarification, however, requires research in which both self-concept and self-efficacy items are presented as separate scales and in an intermixed format. Of greater theoretical importance, there is need to test whether the frames of reference that are reflected in self-concept responses are an unnecessary complication or are useful in predicting future behaviors.

In the study of self-efficacy responses, little emphasis has been placed on the criteria, standards, or frames of reference that subjects use to evaluate their performances. Such standards may be supplied by the researcher, implicit in the task, or based on previous performance, but they must exist. Even if frames of reference have little influence on the self-perceived likelihood of successfully answering a particular problem, these frames of reference are likely to play an important role in evaluating whether the performance expectations represent a worthy or successful performance. The self-perceived worthiness of performance expectations in relation to personal and external standards may be central to self-efficacy's ability to motivate and sustain performance. We suspect that the influences of frames of reference like those posited in the I/E model that

are substantially attenuated in self-efficacy responses may be important in predicting subsequent academic behaviors that are the focus of self-efficacy
theory. In order to clarify this suggestion, consider two students who are equally able at mathematics but who differ substantially in terms of their verbal skills. These students are likely to have similar math self-efficacies (as operationalized here), and so the self-efficacy responses will not predict differences in subsequent math behaviors for these two students. According to the I/E model, however, the student with poorer verbal skills will have a better math self-concept that will affect favorably subsequent math behaviors such as task choice, sustained effort, persistence in the face of difficulty, coursework selection, and future math
performance. This prediction is based on the supposition that it is not the self-efficacy responses per se that affect subsequent behavior, but rather students' cognitive, affective or motivational mediating processes that the performance expectancies instigate. Self-concept responses apparently reflect both performance expectancies and evaluations of these expectancies.

Footnotes

1 -- Relations between verbal and math achievements and verbal and math self-constructs in Models 1A and 1B are covariances which depend on the variances of the latent constructs. Also, in the path model, the effects of the achievements are partialled from relations between the verbal and math self-constructs. Because the actual correlations among the various constructs are more easily interpreted and also relevant to the present investigation, these are presented as part of the discussion of the results.

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