

A Reciprocal Effects Model of the Causal Ordering of Academic Self-Concept and Achievement

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The rationale for this presentation is a theoretical model indicating that people who perceive themselves to be more effective, more confident, and more able accomplish more than people with less positive self-perceptions (I believe, therefore I am). Support for this prediction is strongest in academic self-concept research where a substantial body of research in support of the reciprocal effects model now exists. Prior academic self-concept has a positive effect on subsequent achievement beyond what can be explained in terms of prior academic achievement. Subsequent academic self-concept is also affected by prior achievement beyond what can be explained in terms of prior academic self-concept. In this presentation we review existing research and present new results evaluating the generality of these results in developmental research with young children and cross-cultural research.

Do changes in academic self-concept lead to changes in subsequent academic achievement? The causal ordering of academic self-concept and academic achievement is, perhaps, the most vexing question in academic self-concept research. This critical question has important theoretical and practical implications, and has been the focus of considerable research.

Byrne (1984) emphasized that much of the interest in the self-concept/achievement relation stems from the belief that academic self-concept has motivational properties such that changes in academic self-concept will lead to changes in subsequent academic achievement. Calsyn and Kenny (1977) contrasted self-enhancement and skill development models of the self-concept/achievement relation. According to the self-enhancement model, self-concept is a primary determinant of academic achievement. Support for this model would provide a strong justification for self-concept enhancement interventions explicit or implicit in many educational programs. In contrast, the skill development model implies that academic self-concept emerges principally as a consequence of academic achievement. According to this model, the best way to enhance academic self-concept is to develop stronger academic skills.

Due largely to limitations in statistical techniques to test these models in the 1980s, researchers argued for “either-or” conclusions. In a review and critique of this research, Marsh (1990a, 1990b, 1993; also see Marsh, Byrne & Yeung, 1999) argued that much of this research was methodologically unsound and inconsistent with the academic self-concept theory. He emphasised that it was widely accepted that prior academic achievement was one determinant of academic self-concept. Hence, the critical question is whether there also exists a causal link from prior academic self-concept to subsequent achievement. The statistical significance and size of this path is of critical importance, whether or not it was larger than the path from prior academic achievement to subsequent academic self-concept. Marsh (1990a; Marsh, Byrne & Yeung, 1999) further argued that a more realistic compromise between the self-enhancement and skill-development models was a “reciprocal effects model” in which, prior self-concept affects subsequent achievement and prior achievement affects subsequent self-concept. Marsh’s reciprocal effects model has major implications for the importance placed on academic self-concept as a means of facilitating other desirable outcomes, as well as being an important outcome variable.

Because self-concept and academic achievement are not readily amenable to experimental manipulations, most research relies on longitudinal panel data in which both self-concept and achievement are measured on at least two occasions (i.e., a 2-wave, 2-variable design). With hindsight and 15 years' experience, Marsh, et al (1999) offered commentary on potential problems and how they can be avoided in future research; demonstrated new, more defensible models of these data; emphasised more generally the role of researcher as substantive data detective; and updated Byrne's (1984) standards of an "ideal" study and directions for future research. Ideally, studies will: (a) measure academic self-concept and academic achievement (school performance, standardized test scores, or preferably both) at least twice (i.e., a 2-wave study) and preferably more frequently; (b) infer all latent constructs on the basis of multiple indicators; (c) consider a sufficiently large and diverse sample to justify the use of CFA and the generality of the findings, and; (d) fit the data to a variety of CFA models that incorporate measurement error and test for likely residual covariation among measured variables. In Figure 1 I offer a prototype for a causal ordering study.

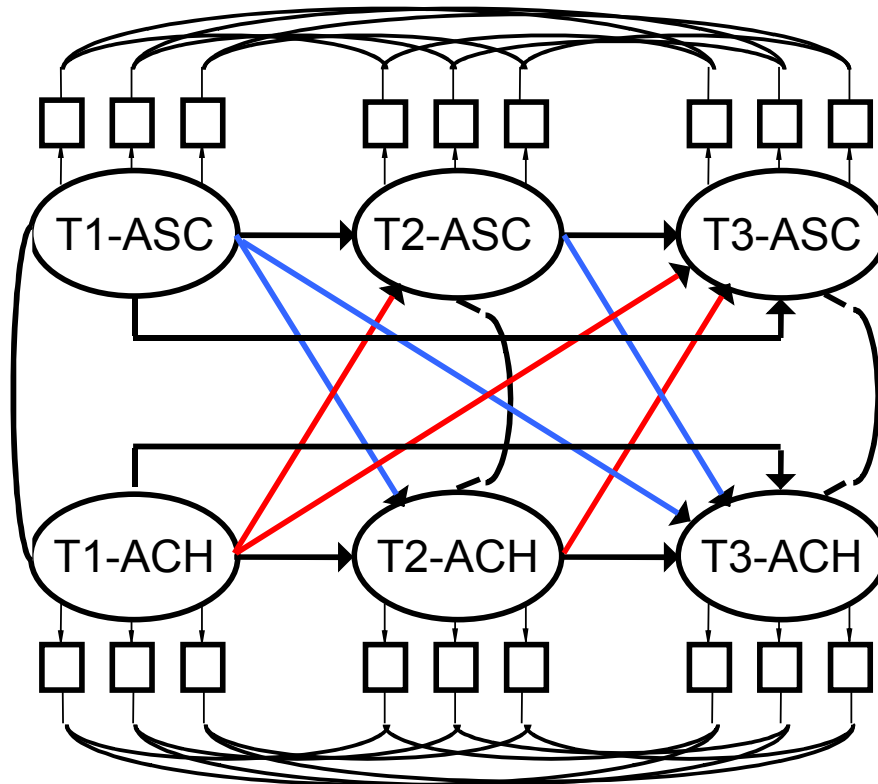
Despite Byrne's guidelines and the growing popularity of the SEM techniques, Marsh (1990a) was able to find only three studies meeting Byrne's criteria (Byrne, 1986; Newman, 1984; Shavelson & Bolus, 1982). Despite some methodological inconsistency in the results of these studies, Marsh suggested that they seemed to be consistent with his earlier suggestion that the effect of prior academic self-concept on subsequent achievement is likely to be greater when achievement is based on school grades. Marsh (1990a) tested the causal ordering of academic self-concept and academic achievement with four waves of data (last 3 years of high school and 1 year after graduation) based on standardized test scores, school grades, and academic self-concept. He found support for reciprocal effects in which the largest paths were from prior academic self-concept to subsequent school grades.

Marsh and Yeung (1997a; also Byrne, 1996 updated previous reviews to include new research, but found only nine relevant longitudinal causal modeling studies and again judged none to be fully adequate. They concluded, however, that this research provided reasonably consistent support for a reciprocal effects model. Apparent exceptions were the Shavelson and Bolus (1982) study that reported only significant paths from self-concept to achievement, Newman (1984) who reported only significant paths from achievement to self-concept (but Marsh, 1988, reported some evidence for self-concept effects in his reanalysis of the data), and Byrne (1986) who found no cross-paths at all. Marsh (1990a) suggested that paths from self-concept to achievement might be stronger for school based performance measures compared to standardized achievement measures, but Helmke and van Aken (1995) did not support this suggestion. Skaalvik and Hagtvet (1990) suggested that paths from self-concept to achievement might be stronger for studies based on older students and there was some support for this proposal. Marsh and Yeung (1997a) examined the relations among academic self-concept, school grades, and teacher ratings of achievement collected in English, math, and science in each of three years. Although the paths leading from prior achievement to subsequent academic self-concept tended to be somewhat larger and more systematic than paths leading from prior self-concept to subsequent achievement, there was clear support for both sets of paths. This study was important to a multidimensional self-concept perspective because, with the exception of the classic Shavelson and Bolus (1982) study, this was the only study that the authors were able to identify that considered more than one academic content domain.

Marsh, Byrne and Yeung (1999; Byrne, 1996; Marsh & Yeung, 1997a) reviewed previous research and concluded that there was consistent support for a reciprocal effects model,

whereby changes in academic self-concept impact on achievement and vice versa. They also emphasized, however, that SEM models were not the only appropriate analytical approach for inferring change and causal ordering. Thus, for example, the variety of approaches outlined in the Collins and Horn (1991) monograph, recent developments in latent growth modeling, and multi-level analyses (Raudenbush & Bryk, 2002) that evaluate change at both the level of the individual students and the class are potentially relevant. Also, consistent with our focus on convergence between multiple methods, this area of research seems ideal for good qualitative/quantitative blended studies in order to better examine the underlying processes whereby academic self-concept contributes to growth in achievement.

Fig 1. Causal Ordering ASC/ACH Models
self-enhancement (+ blue paths: ASC → ACH); skill-development (+ red paths: ACH → ASC); reciprocal effects (+ blue & red)



Classic Causal Ordering Study

Marsh (1990a) tested the causal ordering of academic self-concept and academic achievement with data from the large, nationally representative (of the US) Youth in Transition study. He considered data from Times 1 (early 10th grade), 2 (late 11th grade), 3 (late 12th grade), and 4 (one year after normal high school graduation). Three latent constructs were considered: academic ability (T1 only) inferred on the basis of four standardized test scores, academic self-concept (T1, T2, and T4) inferred from responses to 2 (T4) or 3 (T1 and T2) self-rating items, and school grades (T1, T2, T3). Analyses were conducted on responses from the 1,456 students who had complete data at T1, T2, and T3. The initial a priori model (Figure 2) was based primarily on the temporal ordering of the data collection (i.e., T1 variables precede T2 variables). At T1, there were three constructs: academic ability, school grades, and academic self-concept. Academic ability was posited to precede school grades because students were asked to report their grades from the previous year. Similarly, at T2, school grades preceded academic self-concept. At T3 and at T4, only one construct was considered and no casual ordering was necessary.

Of particular importance are the effects of latent constructs in one wave on latent constructs in subsequent waves. Parameter estimates for the final model showed that at T2, academic self-concept is influenced by academic ability and T1 academic self-concept, but not T1 grades. At T2 school grades are influenced both by T1 academic self-concept and by T1 school grades. Similarly, school grades at T3 are influenced significantly both by T2 academic self-concept and by T2 grades. Academic self-concept at T4 was influenced significantly by academic self-concept at T2 (there was no T3 academic self-concept measure) but not by T3 school grades.

Particularly since the results were replicated across two different intervals, the findings provide strong support for the effect of prior self-concept on subsequent school grades. The Marsh (1990a) study is important because it was one of the first studies -- along with, perhaps, Shavelson and Bolus (1982) -- to provide defensible evidence for the effect of prior academic self-concept on subsequent academic achievement and because it was apparently methodologically stronger than previous research.

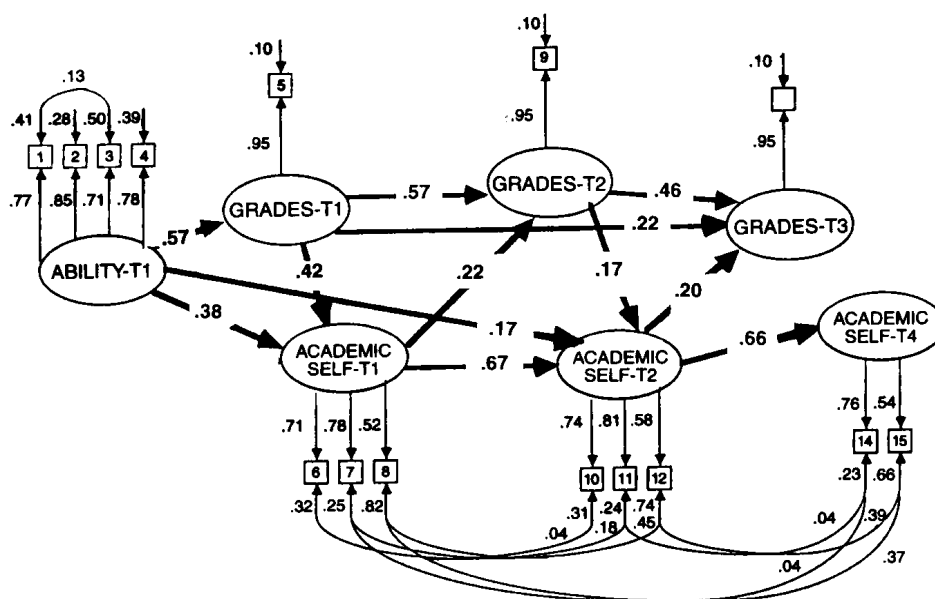


Figure 2

A structural equation model of the longitudinal panel design relating academic achievement and academic self-concept on multiple occasions: the standardized effects of prior ability, school grades, and academic self-concept on subsequent school grades and academic self-concept. The boxes represent measured variables used to infer each latent construct (the ovals). The straight lines (in bold) connecting the different latent constructs represent path coefficients. Nonsignificant path coefficients are excluded for purposes of clarity. The curved lines represent correlated residuals between measured variables. (From Marsh, 1990.

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Academic Self-Concept and Academic Achievement: Developmental Perspectives on Their Causal Ordering

There is support for reciprocal effects models of relations between academic self-concept and achievement (Marsh, Byrne and Yeung, 1999). However, this relation has not been examined fully from a developmental perspective, especially with younger children. Wigfield and Karpathian (1991:255) argued that: "Once ability perceptions are more firmly established the relation likely becomes reciprocal: Students with high perceptions of ability would approach new tasks with confidence, and success on those tasks is likely to bolster their confidence in their ability." Skaalvik and Hagtvet (1990) found support for a reciprocal effects model for older students (sixth and seventh grades) but a skill-development model for younger students (third and fourth grades; see also Muijs, 1997 for similar results). Whereas, Skaalvik (1997) also reported support for a skill-development model during elementary school years and reciprocal influences during the high school years, Skaalvik and Valas (1999) did not provide support for this developmental perspective. In summary, previous research has suggested stronger support for a skill-development model during the early elementary school years, whereas support for a reciprocal effects model became stronger in later school years.

In order to test the developmental pattern in the causal ordering of these constructs, Marsh et al. (1999) recommended the use of multicohort-multioccasion designs (e.g., Marsh, Craven & Debus, 1998) that combined the advantages of cross-sectional (multiple age cohorts) and longitudinal (multiple occasions) research within the same study. The purpose of the present investigation (Guay, Marsh & Boivin, in press) was to evaluate developmental hypotheses about the causal ordering of academic self-concept and academic achievement among elementary school children through the use of a multicohort-multioccasion design.

This study (Guay, Marsh & Boivin, in press) tested theoretical and developmental models of the causal ordering between academic self-concept and academic achievement in a multicohort-multioccasion design (i.e., three age cohorts, each with three measurement waves). Participants (202 girls, 183 boys) were students in grades 2, 3, and 4 from 10 elementary schools. Based on previous developmental research, we formulated four developmental hypotheses: 1) academic self-concept measurement error would decrease as children grow older; 2) as children grow older, the stability of self-concept across time would increase; 3) as children grow older, the relation between academic achievement and academic self-concept would be stronger; 4) during the early to middle elementary school years, academic achievement would predominate over academic self-concept, whereas this relation would become reciprocal in late elementary school years or early adolescence (see Figure 3). However, it is important to emphasize, that there was little or no empirical support for hypothesis 4 and that the generality of support for the reciprocal effects model reported by Marsh et al. (1999) suggested that support for the reciprocal effects model might not vary with age (although they emphasized that there was limited methodologically sound research with young children to draw firm conclusions).

Results from correlational and CFA analyses showed that, as children grow older, their academic self-concept responses became more reliable (hypothesis 1), more stable (hypothesis 2), and more strongly correlated with academic achievement (hypothesis 3). Furthermore, support for these age-related differences were evident for both multicohort (cross-sectional) and multioccasion (longitudinal) comparisons in our multicohort-multioccasion design. However, results from invariance analyses provided a different picture. That is, these formal tests indicated that the developmental effects observed within and between cohorts were not sufficiently strong to be statistically significant. However, the low number of participants involved in the three cohorts (Ns of 125, 147, and 113) may explain the absence of significant effects. Taken together, these results provided strong support for hypothesis 1 but only weak (or no) support for hypotheses 2 and 3.

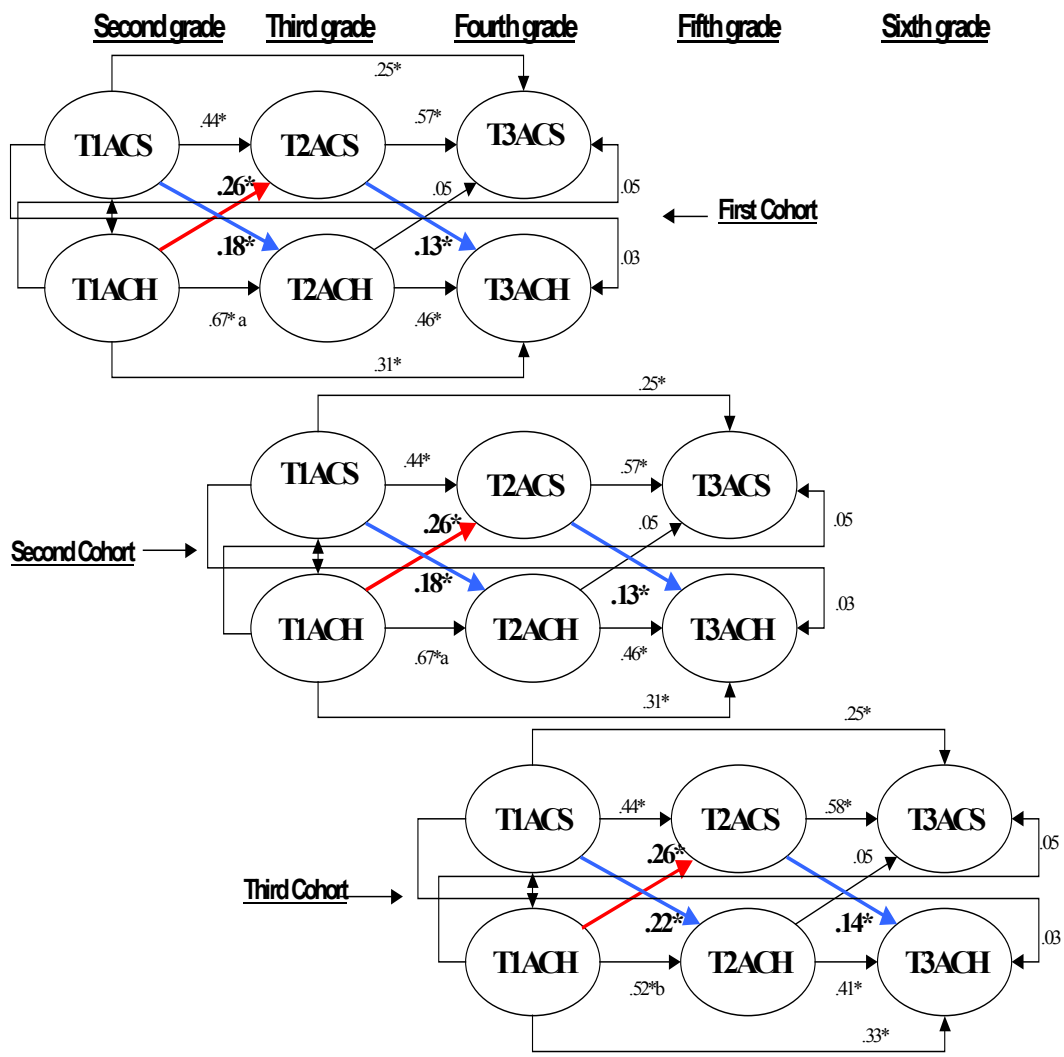
Although previous research (e.g., Skaalvik and Hagtvet, 1990; Skaalvik, 1997) suggested evidence in favor of the skill development model (ACH → ASC) for young children and support for the self-enhancement model (ASC → ACH) or the reciprocal effects model for older children, there was little support for this developmental pattern for the children considered in the present investigation. The results of this study provided strong support for a reciprocal effects model for all three-age cohorts. Indeed, support for self-enhancement model was stronger than support for a skill development model for all three waves. Strong support for the generalisability of this pattern of results was evident for the tests of invariance since the pattern of these results did not differ significantly across the three cohorts. In contrast to hypothesis 4, the results of the present investigation supported the contention by Marsh et al. (1999) that support for the reciprocal effects model has good generalizability. Because the present investigation is, perhaps, the methodologically strongest study of the causal ordering of academic self-concept differences for young children, it provides

important new support for the reciprocal effects model. In particular, it substantially extends the Marsh et al. conclusion about the generalizability of the reciprocal effects model.

It is important to emphasize that the present results have important practical implications. The fact that the reciprocal effect model was supported for very young children (i.e., Grade 2) provided support for early interventions based on academic self-concept and achievement and not only on achievement, as suggested by the results of a number of previous studies (e.g., Chapman & Tunmer, 1997; Helmke and van Haken, 1995; Skaalvik and Hagtvet, 1990; Skaalvik, 1997; Skaalvik and Valas; 1999). Specifically, results of previous developmental studies suggest that, for young children, skills-development effects predominate. According to these results, teachers should primarily improve students' academic achievement without necessarily fostering students' self-beliefs in their academic capabilities. However, the present results suggest that with young children, teachers should strive to improve simultaneously both academic self-concept and achievement in order to produce positive changes in both these constructs.

In conclusion, we began by arguing that the critical question in self-concept research is whether or not there exists a causal link from prior academic self-concept to subsequent achievement. Although there is increasing evidence in support of this effect for older students in middle and high schools, there is a very limited body of strong research and no consistent pattern of results for young students in the early primary school years. This is indeed unfortunate as many researchers and practitioners alike argue, this is a critical time for young children to develop positive self-concepts of themselves as students (e.g., Chapman & Tunmer, 1997; Marsh & Craven, 1997). In contrast to all previous research, we offer a methodologically strong study that provides clear support for this link, is consistent across comparisons based on different age cohorts of young students and different waves within each cohort. In summary, the results of our study provide stronger support for the generality over preadolescent ages of this important link between prior self-concept and subsequent achievement.

Fig. 3 Developmental Perspectives on Causal Ordering ASC/ACH Models
self-enhancement (+ blue paths: ASC→ACH); skill-development (+ red paths: ACH→ASC); reciprocal effects (+ blue & red)



Multilevel Causal Ordering of Academic Self-Concept and Achievement For Hong Kong Students

Much of the causal ordering research is based on studies from the US, Australia and Canada. Hence, it is important to evaluate the cross-cultural generalizability of support for the reciprocal effects model – particularly in non-Western countries. In the present investigation, the authors (Marsh, Hau & Kong, in press) ask: **How well do predictions from the reciprocal effects model work in a Chinese high school setting?**

Previous research suggests that Chinese students differ from Western students in ways that may be relevant to how they construct their self-concepts. Thus, for example, Chinese culture is low on the cultural value of individualism and high on collectivism (e.g., Bond, 1996; Hofstede, 1991; also see Markus & Kitayama, 1991; Triandis, 1989). Furthermore, Hong

Kong students attributed their examination results more to effort than to ability and concentrated more on their own improvement over time than on comparisons with other students as determinants of perceived academic achievement (Hau & Salili, 1991, 1996). Given these cultural differences, it is reasonable to ask whether Western models of the relations between academic self-concept and achievement also differ for these Chinese students. Whereas the authors did not specifically hypothesize that there were cultural differences in these relations, Marsh et al. (1999) emphasized the need to evaluate the limits of the generalizability of the reciprocal effects model across students from different cultures. The present investigation offers a unique opportunity to evaluate the generalizability of theoretical models and empirical findings based on Western settings in a Chinese setting.

The Marsh, Hau and Kong (in press) investigation was a six-year longitudinal study based on a large representative sample of Hong Kong high school students (7802 students, 56 high schools). Data included important pretest (T0) measures of achievement, as well as academic achievement and self-concept measures collected during the five years of high school (T1-T5). This study was also apparently the first to evaluate causal ordering models with multilevel modeling approach recommended by Marsh, Byrne and Yeung (1999). As noted earlier, this procedure allows researchers to evaluate the extent to which relations at the individual student level vary from school-to-school. In the present investigation, the authors used multilevel modeling to determine whether support for the reciprocal effects model was consistent across different high schools or whether the pattern of relations varied systematically from one school to the next.

Causal Ordering of Academic Self-Concept and Academic Achievement

Model 1 was a variance components model that was intended to evaluate the extent of variation at the school level and at the individual student level for achievement and academic self-concept scores. At T1, T2 and T3, approximately half of the variation in achievement scores was explained by the school level and half was explained by differences at the individual student level. Hence, there were substantial differences between schools in (school-average) achievement scores. In contrast to the achievement scores, most of the variance in academic self-concept outcomes was at the individual student level; these varied from .876 to .933). There was little variation in self-concept responses at the school level.

Insert Table 2 About Here

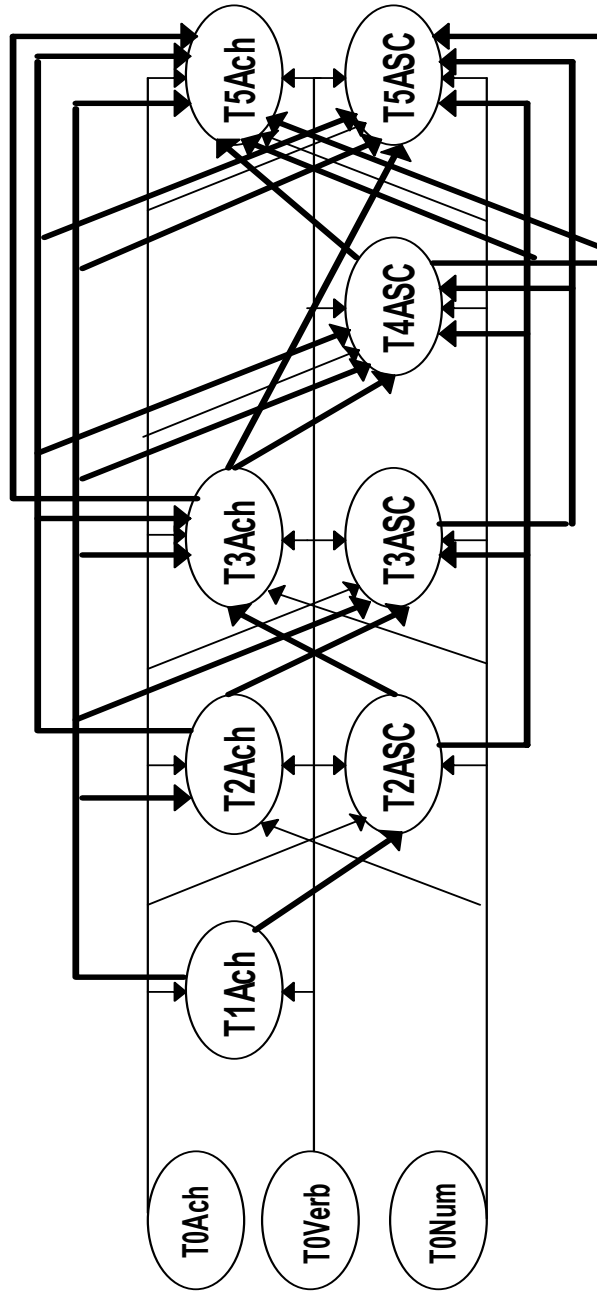
In Model 2, the pretest achievement scores were added to Model 1. Variance components for academic achievement at both the individual student and particularly the school level were reduced substantially by controlling for these pretest measures. Thus, school level variance



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components for achievement varied from .137 to .189, whereas those for individual students varied from .343 to .382. Hence, the majority of the between-school variation in achievement and much of the between-student variation could be explained in terms of pre-existing differences that were measured prior to the start of high school. In contrast to the achievement outcomes, the effects of the pretest achievement scores on the subsequent academic self-concept scores were much smaller, although the inclusion of the pretest achievement scores did reduce somewhat the sizes of the individual student variance components.

Fig. 4 Multilevel Causal Ordering of Academic Self-concept and Achievement For Hong Kong Students



In Model 3, a full path model (see Figure x) was fit to each achievement and self-concept outcome in order to evaluate support for the reciprocal effects model. We began by evaluating the effects of prior academic achievement on self-concept. Self-concept was first collected at T2 (T2ASC). The paths leading to T2ASC from T1Ach (.197) and from T0Ach (.097) were significant. These results clearly indicated that achievement and self-concept were correlated. However, they need to be interpreted cautiously because there was no control for prior measures of self-concept. For T3ASC, the largest effect was T2ASC (.644), indicating that academic self-concept was stable over time. However, the effects of T2Ach (.078) and T1Ach (.053) on T3ASC were still highly significant even after controlling for the substantial effects of T2ASC. For T4ASC, the effect of T3Ach was not statistically significant but the small effects of T2Ach (.046) and T0Ach (.057) were statistically significant. For T5ASC, none of the effects of T1Ach, T2Ach, and T3Ach was statistically significant, although the small effects of T0Ach (.025) and T0Verb (.046) were significant.

In summary, there were significant effects of prior academic achievement on subsequent academic self-concept, even after controlling for the effects of prior self-concept. Hence, the results supported the hypothesis that prior academic achievement has positive effects on subsequent academic self-concept after controlling for the effect of prior academic self-concept.

Next, we evaluated the effects of prior academic self-concept on subsequent academic achievement after controlling for prior achievement (i.e., change in achievements). Because self-concept was first collected at T2, the first tests of this prediction were the significant effects of T2ASC on T3Ach (.078) after controlling for the substantial effects of T0Ach, T1Ach, and T2Ach. For T5Ach, the effect of T4ASC (.117) was larger and even the small positive effect of T3ASC (.037) was statistically significant. It is important to emphasize that these effects of prior self-concept on subsequent achievement were in addition to the substantial combined effects of T0, T1, T2, and T3 achievement scores. Hence, the results provide clear support for the hypothesis that prior academic self-concept affects subsequent achievement beyond the effects of prior academic achievement.

In summary, as hypothesized, the results provided strong support for a reciprocal effects model. Specifically, there were significant effects of prior achievement on subsequent measures of self-concept after controlling for prior self-concept and of prior academic self-concept on subsequent achievement after controlling the effects of prior achievement. However, the effects of prior academic self-concept on subsequent achievement were stronger than the effects of prior achievement on subsequent academic self-concept (although stronger comparisons would have been possible if both academic self-concept and achievement scores had been available every year of the study). These results demonstrated that academic self-concept and achievement are mutually reinforcing constructs, providing strong support for the cross-cultural generalizability of the reciprocal effects model that heretofore has been based primarily on research in Western countries.

The main purpose of the Marsh, Hau and Kong (in press) study was to evaluate the cross-cultural generalizability of support for the reciprocal effects model. Based on this model, they hypothesized that prior academic self-concept would affect subsequent achievement and that prior achievement would affect subsequent academic self-concept. Despite the identification of some cultural differences that might influence the way Hong Kong students formed their self-concept there was good support for the reciprocal effects model. The results of this research also demonstrated that support for the reciprocal effects model generalized well across the sample of 56 high schools considered in the large study and, more specifically, across English- and Chinese-language high schools in this Chinese (Hong Kong) setting.

These results imply that academic self-concept and achievement are mutually reinforcing constructs in Hong Kong as well in Western countries. Because the Hong Kong culture differs from the Western countries that have been the basis of the previous research reviewed earlier, these results provided important new support for the cross-cultural generalizability of the reciprocal effects model. Although it may be premature to claim that the predicted pattern of results is universal, the results of our research clearly extended the cross-cultural generalizability of support for the reciprocal effects model.

Summary

The results of causal modeling studies provide a clear affirmative answer to the question “Do changes in academic self-concept lead to changes in subsequent academic achievement?” **This research is critically important in that it has established that increases in academic self-concept lead to increases in subsequent academic achievement and other desirable educational outcomes. Hence, not only is self-concept an important outcome variable in itself, it also plays a central role in mediating the effects of other desirable educational outcomes. These findings have significant implications for international educational policy and practice.**

It is important to emphasize that the direction of causality between academic self-concept and achievement has very important practical implications for educators. If the direction of causality was from academic self-concept to achievement (the self-enhancement model), then teachers might be justified in placing more effort into enhancing students’ self-concepts rather than fostering achievement. On the other hand, if the direction of causality was from achievement to self-concept (the skill development model), then teachers should focus primarily on improving academic skills as the best way to improve self-concept. In contrast to both these apparently overly simplistic (either-or) models, the reciprocal effects model implies that academic self-concept and academic achievement are reciprocally related and mutually reinforcing. Improved academic self-concepts will lead to better achievement AND improved achievement will lead to better academic self-concepts. For example, if teachers enhance students’ academic self-concepts without improving achievement, then the gains in self-concept are likely to be short-lived. However, if teachers improve students’ academic achievement without also fostering students’ self-beliefs in their academic capabilities, then the achievement gains are also unlikely to be long lasting. If teachers focus on either one of these constructs to the exclusion of the other, then both are likely to suffer. Hence, according to the reciprocal effects model, teachers should strive to improve simultaneously both academic self-concept and achievement.

There now exists good support for the reciprocal effects model. However, there is also a need to pursue further research into processes that mediate the positive effects of prior academic self-concept on subsequent academic achievement. Implicit in our discussion is the untested assumption that the effect of prior self-concept on subsequent achievement was mediated by student characteristics such as increased conscientious effort, persistence in the face of difficulties, enhanced intrinsic motivation, academic choice, and coursework selection (see Marsh et al., 1999). Thus, for example, Marsh and Yeung (1997a; 1997b) found that coursework selection partially mediated the effects of prior academic self-concept in a specific school subject on subsequent achievement in the same subject (e.g., high math self-concept led to taking more advanced math courses which led to higher levels of math achievement). Clearly, there is a need for more research exploring the psychological processes that mediate the effects of prior academic self-concept on subsequent achievement.

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