The Chicken and the Egg: Causal Ordering of Goals and Self-Concept and its Effect on Academic Achievement

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Many studies have examined relations between goal orientations and academic achievement, and relations between academic self-concept and academic achievement. A limited number of studies, however, have attempted to examine relations between *both* goal orientations and self-concept and their combined effects on academic achievement. Even fewer studies have specifically examined the nature of causal relations between goals, self-concept and their combined effects on achievement. For this reason, more research investigating causal relationship between goals, self-concept and academic achievement is clearly warranted (Skaalvik, 1997).

The present research seeks to directly address the issue of causal relations between goals, self-concept and achievement. In order to situate this research in a theoretical context we first investigate findings from the literature concerning the casual ordering of these variables.

Goal Orientations

Goal theory (Ames, 1992; Cury, Biddle, Sarrazin, Famose, 1997; Dowson & McInerney, 2003) focuses on the different goals or purposes students perceive for their learning, rather than on the actual level of their motivation as measured by their ongoing interest or involvement in learning (Middleton & Midgley, 1997). These goals provide a framework within which individuals interpret, experience, and react to various achievement situations (Bouffard, Vezeau & Bordeleau, 1998; Elliott & Sheldon, 1998).

Various goals have been extensively and recently investigated in the literature (see, for example, Barker, Dowson, & McInerney, 2000; Butler, 1999; Dowson & McInerney, 2001, 2003; Middleton & Midgley, 1997; Nicholls & Utesch, 1998). A full review of these goals is not possible here. Very briefly, however, these goals include the following that we focus on in the present study:

(a) mastery goals, where academic achievement situations are perceived as a means of promoting *competence within* students,
(b) performance goals, where academic achievement situations are perceived as a means of promoting *competition between* students, and
(c) social goals, where academic achievement situations are perceived as a means of promoting *cooperation between* students.

Self-Concept

In very general terms, self-concept may be defined as the cumulation of an individual's self perceptions (Wigfield & Karpathian, 1991), particularly those perceptions relating to relative ability (Byrne & Shavelson, 1986). These perceptions are derived from experiences with the social environment as information is supplied by significant others in the home, school and community (Cole, Maxwell, Martin, Peeke, Seroczynski, Tram, Hoffman, Ruiz, Jacquez, & Maschman, 2001; Hau, Kong, & Marsh, 2000). Self-perceptions are said to drive behaviour,

which in turn further influences the way we perceive ourselves (Byrne & Shavelson, 1986; Dai, 2001; Shavelson, Hubner, & Stanon, 1976).

Historically, research described self-concept as a general or global construct that was not differentiated across physical, social, academic and other domains (Marsh & Shavelson, 1985). However, recent research has demonstrated that self-concept is multidimensionally constructed and hierarchically ordered (Byrne & Shavelson, 1986; Harter, 1985; Marsh, 1993; Marsh & Holmes, 1990).

Of particular interest to the present study is that students' overall academic self-concept may be effectively and validly differentiated into their English and Mathematics self-concepts (Hau, et al., 2000; Marsh, 1993). Moreover, as might be expected, students' maths and English self-concepts are typically positively associated with their maths and English achievement respectively. Conversely, students' maths and English self-concepts are typically negatively associated with their English and maths achievement respectively (Marsh, Walker, & Debus, 1991). In other words, self-concept appears to be domain specific with respect to achievement.

Causal Ordering 1: Goals, Self-Concept and Achievement

Mastery Goals, Self-Concept and Achievement

In general, direct evidence for the causal ordering of goals (of any kind), self-concept (in any domain) and achievement is limited. This is also true of mastery goals in particular. As one example of such evidence, however, Ames (1990) conducted a study in which mastery goals were fostered amongst primary school children. After one year, students demonstrated stronger preferences for challenging tasks, greater propensities to apply effective cognitive strategies, enhanced intrinsic motivations, and higher self-concepts of ability. Skaalvik and Rankin (1996a) also identified indirect and direct effects of persistence and engagement in classroom tasks (i.e. mastery-type behaviours) on achievement. Interestingly, the indirect effect was meditated through self-concept of ability.

Somewhat more indirectly, students approaching tasks with a mastery goal have been shown to deploy 'deep' cognitive processing strategies such as linking new material with previous knowledge and attempting to understand complex tasks (Anderman & Maehr, 1994). As a result, mastery orientated students may be more likely to succeed in academic situations. It is reasonable to speculate in these circumstances that mastery oriented students may feel successful as students and hence hold positive self-concepts.

Performance Goals, Self-Concept and Achievement

As with mastery goals, direct evidence for the causal ordering of performance goals, self-concept, and achievement is limited. However, some studies have investigated links between these constructs. Meece and Miller (1996), for example, measured a significant decline in ability competence for students who became less learning (i.e. more performance) and more work avoidant orientated. In contrast, Roeser, Midgley & Urdan (1996) found that performance goals were positively correlated with academic self-efficacy and grade point average. This later finding is consistent with an understanding that performance goals are not always 'bad', or are at least are not bad for all students all of the time (Dowson & McInerney, 2003; Urdan, 1997).

In contrast to the findings regarding mastery goals, students approaching tasks with a performance goal typically deploy maladaptive patterns of cognition such as engaging in 'surface' level strategies and immediately requesting assistance from the teacher in the face of difficult tasks (Dowson, 2003; Elliot & Dweck, 1988; Barker, et al., 2002; Solomon, 1996; Martin & Debus, 1998). These patterns of cognition may predispose performance oriented students to academic difficultly and failure. It is reasonable to speculate, therefore, that performance-oriented students may develop more fragile academic self-concepts (compare Bouffard, 2000; Bouffard-Bouchard & Pinard, 1988; Harter, 1992).

Causal Ordering 2: Self-Concept, Motivation and Academic Achievement

Positive self-perceptions of ability have been shown to relate systematically to measures of intrinsic motivation (Meece, Blumenfeld & Hoyle, 1988; Gottfried, 1990; Skaalvik & Rankin, 1996a). For example, Mac Iver, Stipek, & Daniels (1991) proposed a causal relationship between self-perceived abilities and intrinsic motivation, and demonstrated that self-perceptions of ability predicted directional changes of intrinsic motivation. It has also been convincingly demonstrated that students with positive self-perceptions persevere when confronted with challenging tasks and eventually succeed (Berry & West, 1993; Bouffard, 2000; Bouffard-Bouchard & Pinard, 1988; Harter, 1992). As both intrinsic motivation and perseverance are central features of a mastery goal orientation, it may be argued that positive self-perceptions cause mastery goals.

Additionally, high self-concepts (as opposed to more generalised self-perceptions) of ability may be a favourable precondition for the initiation and persistence of effort in learning and achievement situations (Helmke, 1989, 1991, 1992). As perseverance in the face of challenge or difficulty is also a key feature of a mastery goal, this again suggests that positive self-concept may causally precede the development of mastery goals.

On the other hand, students with low self-concepts may avoid 'dangerous' learning situations that could further threaten their self-concept (Baumeister, Tice, & Hutton, 1989; Thompson, 1994). Thus, it has also been convincingly demonstrated that students with negative self-perceptions tend to give up, or engage in avoidance or self-handicapping strategies, when confronted with challenging tasks (Ames, 1992; Dweck & Leggett, 1988). As such features are central to a performance goal, it may be argued that negative self-concepts may causally precede the development of performance goals.

Non-Causality, Social Goals and Measurement

Contradictory evidence in the literature concerning the causal ordering of goals, self-concept and ability suggest that there may be no clear-cut ordering of these variables i.e. self-concept and gaols may be reciprocally or recursively related. Such a relationship would explain both sets of orderings evidenced in the literature. For this reason, we propose that reciprocal relationships ought at least be explored in a study investigating the causal ordering (or not) of goals and self-concept.

Whatever the direction (if any) of causality, we are aware of no studies that have investigated relations between social goals, self-concept and achievement. This is perhaps not surprising given that social goals are only a relatively recent topic of investigation in the literature (Dowson & McInerney, 2003, 2001). Despite this, we think it is at lest plausible that, if other goals are influenced by, or influence, self-concept that social goals may do the same. In

particular, it may be that the pursuit of social goals (e.g. desiring to achieve in order to help or please others) may enhance students' conceptions of themselves because, for example, they may get praise for helping or pleasing others. This enhanced sense-of-self may directly contribute to improvements students academic self-concept.

Finally, studies of causality in any domain imply the need for accurate measurement instruments. Despite this, in the present context, few studies have demonstrated through factor or related analyses that the self-concept and motivation items may form separate, if related, scales (Skaalvik, 1997; Skaalvik & Rankin, 1996a; Tanzer, 1996). For this reason it is highly desirable that instruments measuring both self-concept and motivation constructs be developed and validated. The present study directly addresses this need.

Purpose

The purpose of the present research was to explore causal relations between students' goals, self-concept and achievement. This was achieved by testing a series of Structural Equation Models with three waves of longitudinal data. Specifically, three sets of models were tested. The first set of models tested the hypothesis that goals are casually predominant over self-concept in affecting achievement (Models M1 and M2 in Figure 1A). The second set of models tested the hypothesis that self-concept is causally predominant over goals in affecting achievement (Models M3 and M4 in Figure 1A). The third set of models tested the hypothesis that neither goals nor self-concept are casually predominant in affecting achievement (Models M5 to M8 in Figure 1B). The extent to which these sets of models fit the data in the present study was used as a measure of the extent to which each of the hypotheses was confirmed or otherwise.

Method

Participants

Participants in the study were 2 132 secondary school students. One-thousand, one-hundred and nine (1109) or 52% of these students were female, and 1023 or 48% were males. The mean age of all students was 13.10 years. The students were in Years 7 to 9 in eleven (11) high schools broadly representative of school settings in New South Wales, Australia. Six (6) of these schools were located in the Sydney metropolitan area. The remainder of these schools were located in regional areas in NSW.

Measures

Students' Academic self-concept was measured using items drawn from the Self-Description Questionnaire II (SDQ II) (Marsh, 1992), the psychometric properties of which are well established in the literature (Byrne, 1996; Plucker & Stocking, 2001; Yeung, Chui, & Lau, 1999). Specifically, five items measuring English self-concept (eg. "I am good at English"), and five items measuring maths self-concept (eg. "I am good at maths") were adopted from the SDQ II for use in the present study. Students responded to these on a five-point likert-type scale ranging from "strongly disagree" to "strongly agree".

Students' motivational goals were measured using a recently developed instrument, the General Achievement Goal Orientation Scale (GAGOS). This instrument was developed by McInerney (1997) and has demonstrated consistently good psychometric properties in several recent studies (see Barker, McInerney, & Dowson, 2003, for one example). Specifically, the GAGOS measures achievement motivation in three goal areas. These are General Mastery

(eg. "I am most motivated when I see my work improving"), General Performance (eg. "I am most motivated when I am doing better than others"), and General Social (eg. "I am most motivated when I work with others"). The GAGOS comprises four items measuring General Mastery, four items measuring General Performance, and five items measuring General Social orientation. Students responded to the GAGOS items on a five-point likert scale ranging from "strongly disagree" to "strongly agree".

Students' academic achievement was measured by their English and Mathematics ranks. These ranks were derived from students' achievement scores and only took into account academic performance criteria (e.g. end of semester examinations) measured after the second administration of survey. Students' ranks were standardised within and between schools.

The survey data were collected over two waves approximately 10 month apart (Times 1 and 2 in Figures 1A and 1B) order to be able to model longitudinal relations between the variables. The achievement data was collected approximately 2 months after the second administration of the survey.

Data Analysis: Overview of Longitudinal Structural Equation Modelling

A full description of Longitudinal Structural Equation Modelling (LSEM) is not possible here, and the reader may consult many excellent reviews (Byrne, 1998; Kaplan, 2000) on the subject. Briefly, however, in LSEM models researchers postulate *a priori* relations between observed and latent (unobserved) variables based on present theory and past research. The validity of these hypothesised (*a priori*) LSEM models when fitted to actual data is then statistically analysed.

The goodness-of-fit of LSEM models is largely determined by how closely a matrix of implied (model generated) variances and covariances matches the matrix of empirical (data generated) sample variances and covariances (Kelloway, 1998). In addition it is critical that values obtained for each parameter in a LSEM model should be permissible e.g. there should be no impossible values such as negative factor loadings or variances.

A traditional measure of a model's overall fit is the Chi-square/degrees of freedom test statistic. This test computes a value for the ratio of the Chi-square statistic for a given model to the degrees of freedom associated with that model (see Dowson and McInerney, in press; Kelloway, 1998; Mueller, 1996). Problematic for the Chi-square statistic, however, is its sensitivity to sample size (Loehlin, 1998). With very large samples, for example, it is possible to obtain a highly significant Chi-square/df ratio even with substantially 'good' models.

Given the difficulties with the Chi-square test, a number of alternative fit indices have been proposed. These include the Goodness-of-Fit Index (GFI), the Adjusted Goodness-of-Fit Index (AGFI), the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) (Kelloway, 1998; Loehlin, 1998).

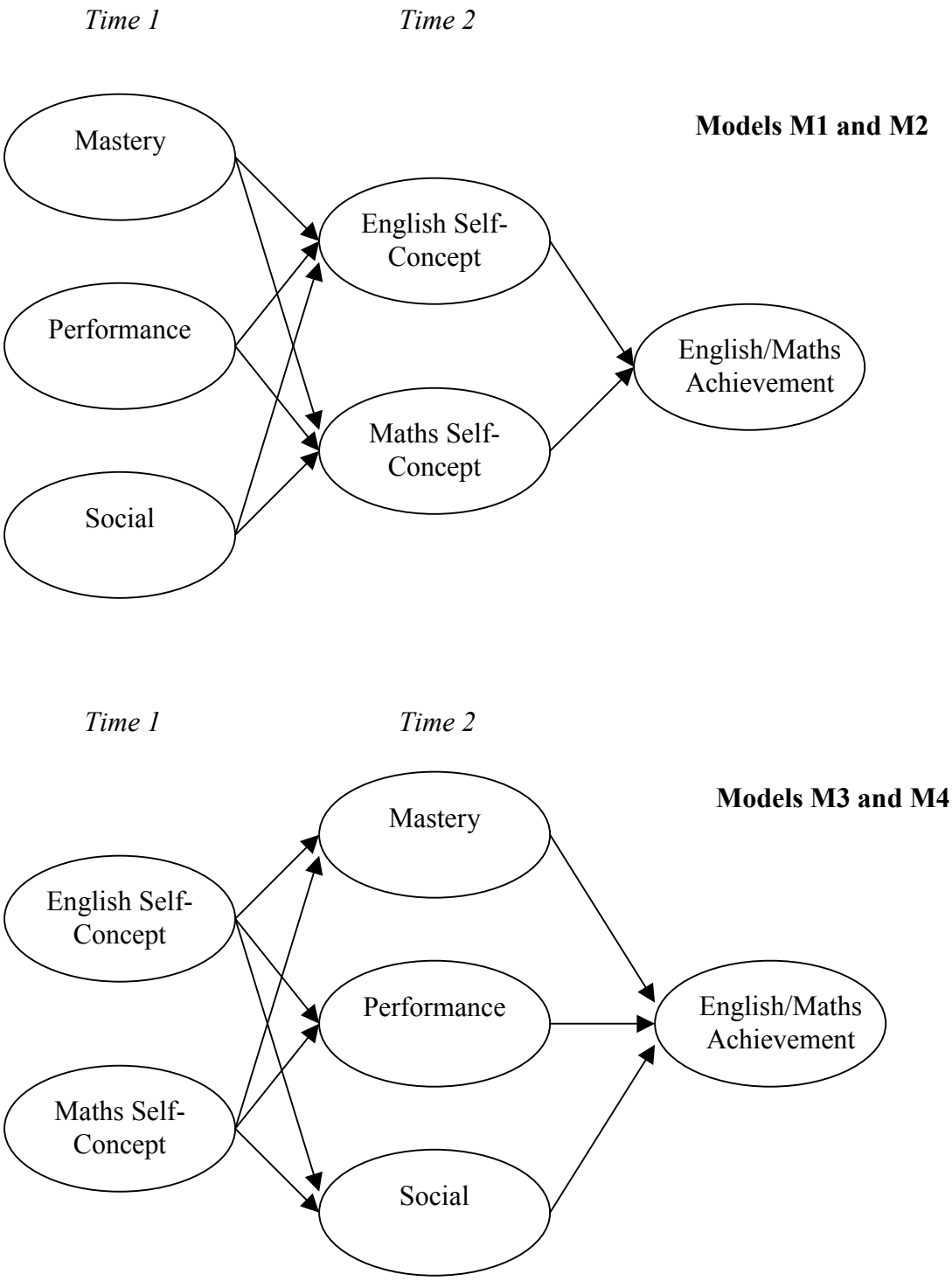
The relative merit of these indices is hotly debated in the literature (Diamantopoulos & Siguaw, 2000; Marsh & Balla, 1992, 1994). However, a broad consensus exists that, if these indices are to be used, several of them should be used alongside each other in evaluating model fit (Diamantopoulos & Siguaw, 2000; Mueller, 1996). In this way, discrepancies in the performance of one or two indices may be balanced by comparison with others. Ideally, values for the GFI, AGFI, TLI and CFI should be as close to 1.00 as possible i.e. greater than

0.95, although values greater than 0.90 indicate acceptable fit (Diamantopoulos & Siguaw, 2000; Marsh, Balla, & Hau, 1996). Conversely, values for the RMSEA should ideally be less that 0.05, although values between 0.05 and 0.08 indicate reasonable fit (Byrne, 1998).

Descriptions of Models Tested

In order to test the potential causal ordering of goals and self-concept with respect to achievement, we initially tested eight structural equation models (Models M1 to M8 in Figures 1A and 1B). The first four of these models tested causal linkages between goals, self-concept and achievement in English and mathematics (Figure 1A). The second set of four models tested non-causal links between goals, self-concept and achievement in English and mathematics (Figure 1B). The overall aim of this testing program was to whether causal or non-causal models, and in which domain(s) (i.e. English and/or mathematics), best explained the data in the present study.

***Figure 1A*. Schematic outline of causal models linking goals, self-concept and achievement.**



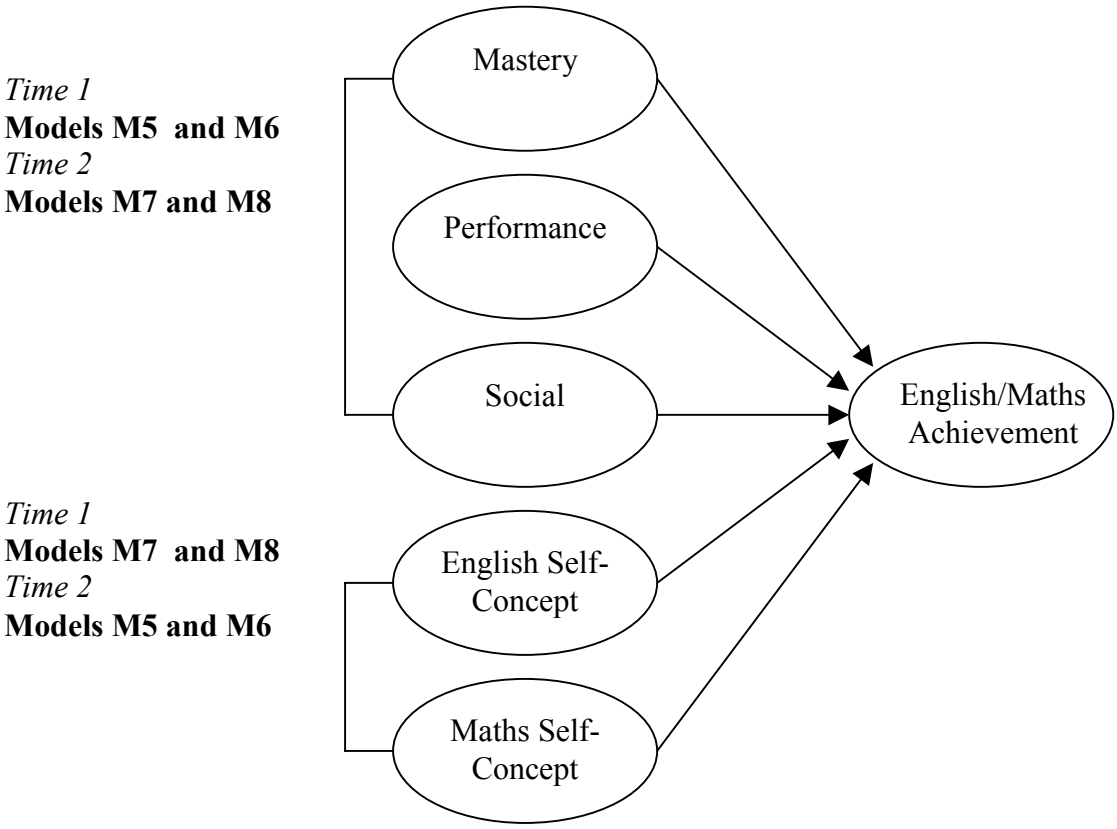


Figure 1B. **Schematic outline of non-causal models linking goals, self-concept and achievement.**

Nested models

When a model is identical to a 'parent' model, with the exception of certain parameter restrictions, the model is said to be nested under the parent model. Nested models will always fit the data less well than parent models because they place additional (error laden) restrictions on the data. However, when nested models fit the data almost as well as parent models they are typically preferred because they are more parsimonious than the parent model. A formal test of fitting the data "almost as well" is the Chi-square difference test. This test compares the difference in Chi-squares ($\Delta\chi^2$) between the parent and the nested model with the attendant difference in degrees of freedom (Δdf) between the two models. If this difference is not significant against a Chi-square distribution then the nested model may be considered to be superior to the parent model – at least in terms of its parameter estimates.

We tested four nested models in this research (M1a, M1b, M2a, and M2b i.e. nested versions of Models 1 and 2). These models are described in the Results, and were tested as a result of examining the parameter estimates in the parent models.

Results

Model Fit

Overall results for the goodness-of-fit of the initial eight tested models are presented in Table 1.

***Table 1*: Model Fit Statistics**

Model	χ^2	df	χ^2/df	GFI	AGFI	TLI	CFI	RMS	Model Description
Causal Models									
M1	649.39	126	5.15	0.93	0.91	0.92	0.93	0.07	Goals T1 to Self T2 (English)
M2	750.52	126	5.95	0.92	0.89	0.92	0.93	0.07	Goals T1 to Self T2 (Maths)
M3	1465.24	129	11.36	0.86	0.81	0.76	0.79	0.10	Self T1 to Goals T2 (English)
M4	1163.21	129	9.02	0.89	0.85	0.80	0.83	0.09	Self T1 to Goals T2 (Maths)
Non-Causal Models									
M5	928.01	132	7.03	0.91	0.88	0.88	0.90	0.08	Goals T1 and Self T2 (English)
M6	985.94	132	7.47	0.90	0.87	0.89	0.91	0.08	Goals T1 and Self T2 (Maths)
M7	1607.52	132	12.18	0.85	0.80	0.74	0.78	0.11	Self T1 and Goals T2 (English)
M8	1201.74	132	9.10	0.88	0.85	0.80	0.82	0.09	Self T1 and Goals T2 (English)

Note: Self = Self-concept; T1 = Time 1, T2 = Time 2
GFI = Goodness-of-fit; AGFI = Adjusted Goodness-of-fit; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMS. = Root Mean Square Error Approximation.

Table 1 indicates that Models M1 and M2 (the *causal* models linking Goals at Time 1 to Self-Concept at Time 2 to English and Maths Achievement) fit the data quite well. All indices for these models indicated good or, in the case of the RMSEA for M1 and M2, and the AGFI for M2, reasonable fit for both models. Table 1 also indicates that Models M5 and M6 (the *non-causal* models linking Goals at Time 1 and Self-Concept at Time 2 to English and Mathematics Achievement) fit the data reasonably well, but not as well as Models M1 and

M2. In contrast, both the causal (M3 and M4) and non-causal (M7 and M8) versions of Self-Concept at Time 1 leading to Goals at Time 2 leading to English and Mathematics Achievement, showed poor fit with the data. None of the fit indices for these models reached criterion values for 'good' fit, and many were well below accepted values for even 'reasonable' fit.

Taken together, these findings suggest that, whether casually or non-causally related, models with Goals at Time 1 and Self-Concept at Time 2 leading to Achievement fit the data clearly better than both causal and non-casual models with Self-Concept at Time 1 and Goals at Time 2 leading to Achievement. Moreover, this pattern applies whether English or Maths Self-Concept and English or Maths Achievement are included in the models. Thus, the pattern of results favouring a Goals-Self-Concept ordering does not appear to be domain specific.

Finally, despite the above, the causal models (M1 and M2) for Goals leading to Self-Concept leading to Achievement appear to fit the data better than their non-causal (M5 and M6) counterparts. This suggests that a causal ordering of Goals and Self-Concept leading to Achievement best explains latent variable relations in the present data.

Direct and Indirect Effects

Having established that Models M1 and M2 represent the best overall fit for the data of the models tested in this research, the specific values of the parameters of these models may be investigated further. Of particular interest is the pattern of direct and indirect effects between latent variables in the models. These effects are reported in Tables 2 (English) and 3 (Maths).

***Table 2*: Direct, Indirect and Total Effects of Goals and Self-Concept on English Achievement**

	English Self-Concept			**English Achievement**		
	Coefficient	**SE**	**T-value**	**Coefficient**	**SE**	**T-value**
Mastery						
Direct	**0.35**	0.04	8.18	**0.16**	0.04	3.81
Indirect	**-**	-	-	**0.11**	0.02	6.40
Total	**0.35**	0.04	8.18	**0.27**	0.04	6.50
Performance						
Direct	**-0.09**	0.05	-2.09	**-0.17**	0.04	-3.10
Indirect	-	-	-	**-0.03**	0.01	-2.07
Total	**-0.09**	0.05	-2.09	**-0.20**	0.04	-4.49
Social						
Direct	-0.06	0.04	-1.68	**-0.09**	0.04	-2.28
Indirect	-	-	-	-0.02	0.01	-1.65
Total	-0.06	0.04	-1.68	**-0.11**	0.04	-2.90
English SC						
Total	-	-	-	**0.31**	0.03	9.40

Note: All effect sizes are based on a fully Standardised Solution.
Boldfaced figures represent significant paths at, at least, the 0.05 level.
Absolute value of total direct effects of goals on English achievement = 0.42
Absolute value of total indirect effects of goals on English achievement = 0.16

***Table 3*: Direct, Indirect and Total Effects of Goals and Self-Concept on Maths Achievement**

	Math Self-Concept			**Maths Achievement**		
	Coefficient	**SE**	**T-value**	**Coefficient**	**SE**	**T-value**
Mastery						
Direct	**0.09**	0.04	2.05	**0.08**	0.04	2.15
Indirect	-	-	-	**0.03**	0.02	2.03
Total	**0.09**	0.04	2.05	**0.12**	0.04	2.78
Performance						
Direct	**0.10**	0.05	2.15	**-0.10**	0.04	2.45
Indirect	-	-	-	**0.04**	0.02	2.10
Total	**0.10**	0.05	2.15	-0.07	0.04	-1.52
Social						
Direct	-0.02	0.04	-0.56	**-0.09**	0.04	-2.66
Indirect	-	-	-	-0.01	0.01	-0.56
Total	-0.02	0.04	-0.56	**-0.10**	0.04	-2.70
Maths SC						
Total	-	-	-	**0.36**	0.03	11.44

Note: All effect sizes are based on a fully Standardised Solution.
Boldfaced figures represent significant paths at, at least, the 0.05 level.
Absolute value of total direct effects of goals on Maths achievement = 0.27
Absolute value of total indirect effects of goals on Maths achievement = 0.08

Tables 2 and 3 display some interesting patterns. First, in both cases (English and maths) mastery goals positively affect self-concept. Second, performance goals negatively affect English self-concept, but positively affect maths self-concept. Third, in both cases social goals have no statistically significant effect on self-concept (although it is interesting to note that in both cases the coefficient for these effects is negative).

Fourth, in both cases, mastery goals have a positive direct impact on achievement, and a positive indirect effect on achievement through self-concept. This suggests that mastery goals and self-concept may work together to positively influence students' achievement in different domains. Fifth, in both cases performance goals significantly and negatively affected students' achievement (directly), and the total effect of performance goals on achievement was negative (although not significant in the case of maths achievement). However, for maths achievement the indirect effect of performance through maths self-concept was positive, while the reverse was true for English. This suggests that maths self-concept may override (to some extent) the negative effect of a performance goal in maths. This is not the case, however, with respect to English self-concept and achievement.

Sixth, in both cases, social goals have a significant and negative effect on achievement. Moreover, in both cases this effect is almost entirely comprised of the *direct* negative effect

social goals have on achievement, suggesting that self-concept and social goals do not interact significantly to influence achievement. Seventh, in both cases, self-concept has a very strong positive effect on achievement. In fact, in both cases, the direct effects for self-concept on achievement are the highest of any in the models.

Eighth, in terms of overall direct and indirect effects, the total direct effects of Goals on English achievement (0.42) are much more substantial than they are for Maths (0.27). This suggests that, in terms of their effects on achievement, goals may be domain specific. This perspective is supported by the fact that the direction of effects between goals and achievement differs between achievement domains. Finally, the squared multiple correlation for achievement (i.e. the amount of variance in achievement accounted for by the models as a whole) was significant, and of a similar magnitude in both cases (0.163 for English 0.146 for Maths).

Additional Models

It is clear from both Tables 2 and 3 that the absolute value of the indirect effects of goals through self-concept on achievement is much less substantial than the direct effects of either goals of self-concept on achievement. This suggests that, although the causal ordering of goals to self-concept to achievement fits best as an overall model, the indirect effects implied in this model are not particularly substantial.

For this reason we estimated four further models. These models were nested versions of M1 and M2 (the goals to self-concept to achievement models). Models M1a and M2a tested goals to English and maths achievement with out self-concept as a mediating variable. Models M1b and M2b tested self-concept to English and maths achievement without goals as precursor variables. Results of these models are presented in Table 4.

***Table 4*: Model Fit Statistics: Nested Models**

Model	χ^2	df	χ^2/df	GFI	AGFI	TLI	CFI	RMS	Model Description
M1	649.39	126	5.15	0.93	0.91	0.92	0.93	0.07	Goals T1 to Self T2 (English)
M1a	808.90	130	6.22	0.92	0.89	0.89	0.91	0.07	Goals T1 to English Achievement (No Self)
M1b	751.26	132	5.69	0.92	0.90	0.91	0.92	0.07	English SC T2 to English Achieve (No Goals)
M2	750.52	126	5.96	0.92	0.89	0.92	0.93	0.07	Goals T1 to Self T2 (Maths)
M2a	884.70	130	6.81	0.91	0.90	0.90	0.92	0.08	Goals T1 to Maths Achievement (No Self)
M2b	790.97	132	5.99	0.92	0.89	0.92	0.93	0.07	Maths SC T2 to Maths Achieve (No Goals)

Note: 'SC' and 'self' = self-concept; T1 = Time 1; T2 = Time 2
GFI = Goodness-of-fit; AGFI = Adjusted Goodness-of-fit; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; RMS. = Root Mean Square Error Approximation.

The Chi-square difference ($\Delta\chi^2$) test for the difference between Models 1 and 1a (159.51 with 4df), and Models 1 and 1b (101.87 with 4df), were both significant ($p < .001$). This indicates that both Models 1a and 1b fit the data significantly worse that Model 1. A similar pattern exists for the differences between Model 2 and 2a (134.18 with 4df) and Models 2 and 2b (40.45 with 6df), which were both significantly different ($p < .001$). These differences indicate that Model 2 is a better fit for the data than Models 2a and 2b.

In terms of the variance in achievement accounted for by each model, the goals only models accounted for a trivial amount of variance (5% for English and 1% for maths achievement respectively). The self-concept models in contrast accounted for 12% of achievement in both models. This is not much less than the full models (16% for English and 15% for maths respectively). These and the other results of the study are discussed below.

Discussion

Some interesting findings emerge from the present research. First, tested against six non-nested competing models, the initial set of models (M1 and M2) appears to fit the present data best. This, in turn, indicates that the general causal ordering of goals to self-concept to

achievement (in both English and maths) represents the best ordering for the present data. This is an important finding because the ordering of goals and self-concept, with respect to achievement is an issue of substantial theoretical and practical relevance (Skaalvik, 1997). This is not least the case because both goals and self-concept have been shown to have substantial effects on achievement – yet their *interacting* effects on achievement has not been well explored.

Despite this, the indirect effects in the models with the goals-self-concept-achievement causal ordering are relatively weak in comparison with the direct effects in these models. This left open the question as to whether models with only goals or only self-concept (the nested models in Table 4) may form nearly-as-adequate models. When this question was tested, however, the results using the Chi-square difference test indicated that all four nested models fit the data significantly less well that the original models.

We also note that Models 1 and 2 'explain' more variance in achievement that any of the competing nested models – although the self-concept –achievement models (Models 1b and 2b) do provide a parsimonious and not-much-less explanatory model of achievement. Despite this, we make the judgement that, on the basis of model fit comparison with the ten competing non-nested and nested models, and on the basis of explained variance, Models 1 and 2 still provide the best representation of the present data.

If this judgement is accepted, then the direct and indirect effects in these models may be discussed further. First, mastery goals and self-concept have significant and positive effects on English and maths achievement. Also, the indirect effects of mastery through self-concept are positive and significant for achievement in both domains. This suggests that mastery goals and self-concept are good 'partners' with respect to achievement in different domains.

In contrast, performance and social goals have unambiguously negative effects on achievement. (This finding on social goals is notable in the context of the current debate concerning whether or not social goals are good for achievement.) However, the indirect effects of these goals through self-concept appear to indicate that self-concept may, to some extent, 'iron out' the negative effects of these goals on achievement. Thus, self-concept may be conceived of as a protective factor in terms of achievement (i.e. it may counter-balance the negative effects of performance and social goals on achievement), as well as contributing substantially and directly to achievement itself.

The finding above has important implications given the fact that the deleterious effects of, particularly, performance goals on achievement are widely noted, and supported by this study. Despite this, many schools and classes may be 'forced' to emphasise these goals through compulsory examinations, testing, competitive assignments, etc. However, even in such circumstances, positive self-concept may support student achievement by counter-acting the negative effects of performance goals. All the above may be repeated for social goals, with the caveat that social goals have not been shown to be unambiguously bad for achievement – although this was the case in the present study.

Conclusion

The present research has demonstrated that:

(a) a preferred causal ordering for goals, self-concept, and achievement can be established with at least one data set from amongst a systematically constructed series of non-nested and nested competing models, and

(b) taken alone, the direct and indirect effects in the preferred models are not inconsistent with previous research. However, the pattern of these effects highlights new, interactive, relationships (i.e. self-concept balancing the negative effects of performance and social goals) between goals and self-concept with respect to achievement.

Given its links to previous research and its new findings, we suggest that the present research may provide a basis from which further investigations of the relationship between goals, self-concept and achievement may be fruitfully pursued.

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