

Students' Goals, Academic Self-concept and Academic Achievement: Testing
Competing Models of Causation

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Studies reporting correlations between goals and self-concept are informative and heuristic, but their findings are based on a single wave of data, hence the underlying mechanisms responsible for the results remain unexplained. To address this void, this study tested competing structural equation models utilising longitudinal data from 535 high school students in Grades 7, 8, and 9 in the first wave of the study, to extrapolate the causal relations among self-concept, goal orientations, and academic achievement. The results reveal that self-concept is causally predominant over students' goals and academic achievement. Implications of these findings are discussed in terms of their impact on future theory, research, and practice.

Substantial research has been conducted on (a) the relations between self-concept and academic achievement and (b) the relations between goal orientations (mastery goals and performance goals) and academic achievement (Gottfried, Fleming, & Gottfried 2001; Marsh & Craven, 2005). Few studies have attempted to relate goal theory to academic self-concept and academic achievement, and even fewer studies have assessed the causal ordering of these variables on academic achievement. Direct evidence of causal ordering of goals (of any kind), self-concept (in any domain) and achievement is almost absent. However, based on the few correlational studies available and findings from experimental studies, it is feasible to form hypotheses for how these variables may be causally related. The central aim of this paper is to investigate the relationships between students' domain-specific self-concepts and goal orientations and examine how these two sets of motivational variables interrelate to affect academic achievement. Thus, this research paper hypothesises three competing models of causality:

1. goal orientations affect academic self-concepts which affect subsequent academic achievement,
2. academic self-concepts affect goal orientations which affect subsequent academic achievement and,
3. goal orientations, academic self-concepts and academic achievement affect each other such that they are reciprocally related over time.

Causal Ordering 1: Goals, self-concept, and academic achievement

Correlations between self-concept and goal orientations provide important information about their relationship but do not provide evidence for how they are causally related. A rationale for how goals could potentially be causally predominant over academic self-concept in affecting academic achievement is considered below.

Mastery goals, self-concept, and academic achievement

Ames (1990) conducted a study in which a goal theory perspective was fostered by teachers at a primary school. A vast number of strategies representative of a mastery goal were adopted by classroom teachers. After one year of implementing the advised strategies, students demonstrated enhanced preference for challenging tasks, applied

more effective cognitive strategies, were more intrinsically motivated and had higher self-concepts of ability. Results from Ames' study demonstrate that a classroom setting that fosters a mastery goal orientation can induce a positive self-concept.

Similar findings to Ames were evident in the experimental study conducted by Schunk (1996). In that study, fourth grade students learning six mathematics fractional skills were conditioned to either a mastery goal orientation or a performance goal orientation. Before each of the six lessons, the teacher varied the instructions such that the mastery condition were informed to try and *learn* how to solve the fraction problems, while the performance condition were informed to try and *solve* the fraction problems. After six days of conditioning, the students were asked to judge their ability to solve mathematics fraction problems. Students conditioned to the mastery goal orientation reported higher self-efficacy and correctly solved more problems than did the students conditioned to the performance goal orientation. These results assume that the goal pursued by a student affects important educational outcomes including students' self-efficacy and performance attainment.

Performance goals, self-concept, and academic achievement

Performance oriented individuals attribute poor performance to lack of ability, and since perceptions are formed through attitudes, feelings, and knowledge about skills (Byrne, 1984), these individuals' self-concepts more readily fluctuate. It is reasonable to hypothesise, therefore, that these students have vulnerable self-concepts. Students with negative self-perceptions give up when confronted with challenging tasks and are more likely to fail (Assor & Connell, 1992; Bandura, 1986; Berry & West, 1993; Boggiano, Main, & Katz., 1988; Bouffard, 2000; Bouffard-Bouchard & Pinard, 1988; Entwistle, Alexander, Pallas, & Cadigan., 1987; Harter, 1990, 1992). Research on low self-concept has been demonstrated to affect academic achievement adversely.

In a review of achievement motivation research, Harackiewicz, Barron, and Elliot (1998) reported performance goals were adaptive in terms of cognitive engagement, self-regulation, learning strategies and performance (see also Harackiewicz, Barron, Carter, Lehto & Elliot, 1997; Midgley & Urdan, 1995; Roeser Midgley, & Urdan, 1996; Skaalvik 1997a, 1997b). Harackiewicz et al. (1998) highlighted that the extent to which performance goals are adaptive or maladaptive is largely dependent upon the educational setting. For instance, Harackiewicz and colleagues demonstrated that competitive settings for those high in achievement

orientation can beneficially affect performance goal oriented individuals through their motivation and performance (Elliot & Harackiewicz, 1994; Epstein & Harackiewicz, 1992). Although a performance goal can be adaptive, a performance oriented individual grounds success and failure essentially in terms of ability (see Middleton & Midgley, 1997). Therefore, if a performance goal oriented individual regularly outperforms their peers, then they are likely to compare and evaluate themselves positively and this can lead to the development of a positive self-concept.

Social goals, self-concept, and academic achievement

Of the limited research relating to social goals, it has been shown that students' preference for working with peers can heighten motivation, which supports and extends learning (Eccles, Wigfield, & Schiefele., 1998; Zusho & Pintrich, 2001). Perhaps working with friends and facilitating others provides positive exchanges for students pursuing a social goal. Students may receive recognition of their assistance from their teachers as well as from their peers. These positive interactions and experiences could contribute to the formation of a positive self-concept. On the other hand, facilitating others may elicit unhealthy comparisons between peers and induce negative exchanges. Furthermore, the preoccupation with facilitating others may detract from the importance of attaining competence and understanding for themselves, leading to the decline of their own self-concept. It is therefore hypothesised that the pursuit of a social goal causes changes to self-concept, and these changes could be either negative or positive. The direction of change to one's self-concept will depend on the quality of the interactions as well as the recognition received.

In consideration of the above discussion, it is hypothesised that students' goal orientations influence self-concepts in academic domains such as English and mathematics; these in turn predict students' academic achievement in the respective domain. Figure 1 depicts this causal relationship. According to the domain-specificity of self-concept, specific subject domains (e.g., mathematics self-concept) correlate most strongly with academic achievement from the same subject domain (e.g., mathematics achievement; Byrne & Worth-Gavin, 1996). This paper also proposes that student goal orientations affect students' mathematics and English self-concepts, which in turn predict their achievement in corresponding subject domains.

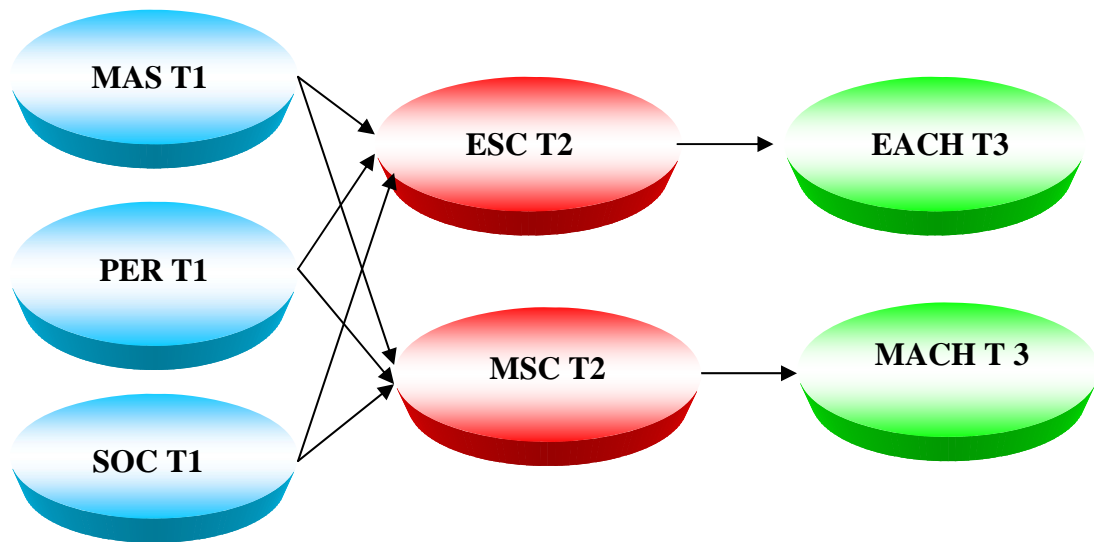


Figure 1. Goal orientations causally predominant. MAS = Mastery goal, PER = Performance goal, SOC = Social goals, ESC = English self-concept, MSC = Mathematics self-concept, EACH = English achievement, MACH = Mathematics achievement, T1 = Time 1, T2 = Time, T3 = Time 3.

Causal Ordering 2: Self-concept, goals, and academic achievement

In contrast to the above proposed causal ordering of goals and self-concept and their effect on academic achievement, the following section proposes a rationale for the causal predominance of self-concept over goals.

Self-concept, mastery goals, and academic achievement

A general consensus in contemporary motivational research is that low self-perceptions of ability have dire consequences for motivation, such that these beliefs detrimentally influence task engagement, effort expenditure, and persistence in the face of difficulty (Graham & Weiner, 1996; Skaalvik, 1997c). For instance, Skaalvik Valas, and Sletta. (1994) demonstrated that perceptions of self predicted students' goal orientation.

It appears that a mastery pattern of behaviour is driven by a strong sense of self (Seifert, 2004). Therefore, it is reasonable to hypothesise that students with a high self-concept will orient themselves towards a mastery goal. For instance, a positive mathematics self-concept has been shown to relate to students' perseverance when confronted with challenging tasks (Berry & West, 1993; Bouffard, 2000).

Self-concept, performance goals, and academic achievement

Skaalvik et al. (1994) demonstrated that perceptions of self predicted students' goal orientation. For instance, an individual with a high self-concept may focus on outperforming others, which would predict a positive path between self-concept and performance approach goals. Supporting this prediction is the research that has found positive correlations between academic self-concepts and performance approach goals (see for example Nicholls, 1989). Hence, a performance pattern of behaviour can also be driven by a positive sense of self.

Self-concept, social goals, and academic achievement

It is hypothesised that social goals emerge principally as a consequence of academic self-concept. According to this model, developing a strong self-concept will affect subsequent social goal pursuits. A proportion of the literature on social goals highlights the benefits of working with peers, especially for adolescents since they are more inclined to prefer working and assisting their peers to complete tasks (Ellis, Marsh, & Craven, 2005). If students evaluate themselves positively, and are encouraged to develop enhanced self-concepts, then it is likely that these students will feel more confident in their ability, and will be more likely to pursue a social goal because they feel confident in helping their peers.

In accordance with the literature, it is hypothesised that students' mathematics and English self-concepts influence goal orientations which, in turn, predict student academic achievement. Figure 2 depicts this causal flow.

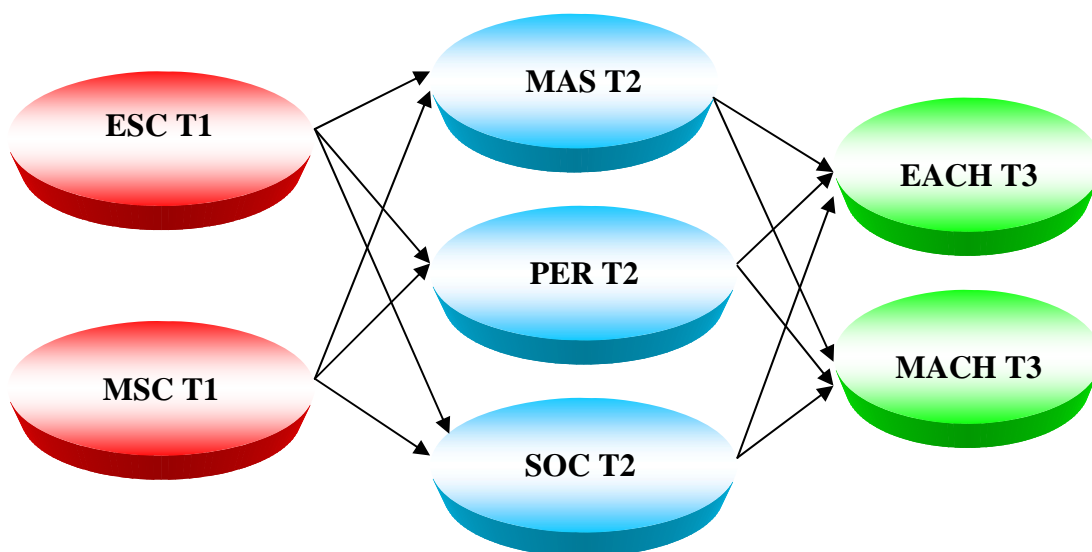


Figure 2. Domain-specific self-concepts causally predominant. MAS = Mastery goal, PER = Performance goal, SOC = Social goals, ESC = English self-concept, MSC = Mathematics self-concept, EACH = English achievement, MACH = Mathematics achievement, T1 = Time 1, T2 = Time, T3 = Time 3.

Causal Ordering 3: Reciprocal Causality

Reciprocal relationship between goals, self-concept, and academic achievement

The final rationale for the potential causal flow of goals and self-concept is the reciprocal-effects model. This alternative model is perhaps a compromise between the two earlier proposed models since it provides evidence supporting both competing causal flows discussed in the above two sections. The section below proposes a rationale for the reciprocal-effects model.

Self-concept researchers distinguish the self-concept-motivation relationship implicitly and explicitly. For example, the widely used SDQ instrument has mathematics and verbal self-concept scales which integrate measures of self-perceived ability and motivational/emotional items (Skaalvik, 1997c). A few studies have demonstrated through factor analysis that the self-concept and motivation items form separate scales, yet remain strongly correlated (Barker, Dowson, & McInerney, 2006; Skaalvik & Rankin, 1996; Tanzer, 1996). Perhaps goals influence self-concept over time but self-concept also influences goal pursuits over time.

Contradictory evidence in the literature dealing with the causal ordering of goals, self-concept, and achievement suggests that there may be no clear-cut causal ordering of these variables; that is, self-concept and goals may be reciprocally or non-recursively related. Such a relationship would potentially account for evidence for both sets of ordering in the literature. For this reason, it is proposed that a reciprocal relationship between goals and academic self-concept ought to be investigated as an alternative to the two causal orderings proposed above. Figure 3 assumes students' domain-specific self-concepts affect subsequent academic achievement and that this is mediated through the goal orientations, and that students' goal orientations affect subsequent academic achievement and this is mediated through domain-specific self-concepts.

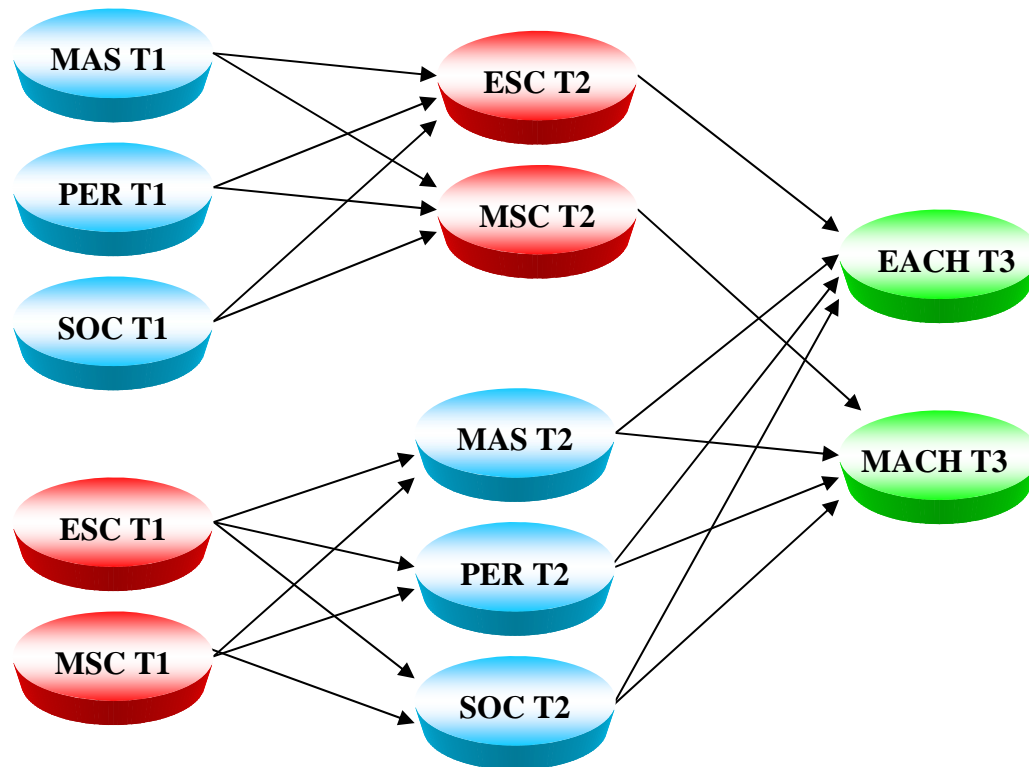


Figure 3. Reciprocal-effects model of goals and self-concept affecting subsequent academic achievement. MAS = Mastery goal, PER = Performance goal, SOC = Social goals, ESC = English self-concept, MSC = Mathematics self-concept, EACH = English achievement, MACH = Mathematics achievement, T1 = Time 1, T2 = Time, T3 = Time 3.

Methodological Guidelines

Critiques and reviews of causal ordering studies involving academic self-concept have led to advances in both analyses and methodological approaches such that a clear set of guidelines has been formulated (Guay, Marsh, & Boivin., 2003). Due to these advances, earlier research has become obsolete and precludes conclusive findings on causal relations between self-concept and achievement. To avoid future methodological pitfalls, Marsh, Byrne, and Yeung (1999) recommend four distinct phases of analyses and related ten guidelines for an *ideal* study that supersedes earlier methodologies. Specifically, longitudinal causal ordering should proceed according to the following four phases:

- Phase 1: involves basic confirmatory factor analyses for each wave of data, to resolve measurement issues.

- Phase 2: entails testing more complicated CFAs which involves simultaneously examining relations of all variables across all data waves. The purpose of this large CFA is to examine relationships among the variables across the various time waves but also to address remaining measurement issues.
- Phase 3: entails testing a full-forward model which specifies correlations among factors within parallel waves, in addition to all paths from all constructs in each wave to all constructs in subsequent waves freely estimated.
- Phase 4: entails testing a full-forward model and exploring alternative SEM models. The role of a researcher, according to Marsh et al. (1999), is to investigate alternative leads and offer defensible explanations for these.

Marsh et al. (1999) are aware of no studies that fulfil all the guidelines, and pragmatically suggest that fulfillment may never be attained. The present study applies the recommended phases and guidelines by Marsh et al (1999). It also applies the most recent prototype model prescribed by Marsh and Craven (2006) for evaluating causal relations. In order to assess the full-forward model proposed in Marsh et al.'s (1999) fourth phase, Marsh and Craven (2006) describe a prototype causal ordering model procedure (Figure 4) to facilitate researchers in their evaluation and judgements of causal ordering. This procedure is explained below.

Common to the self-enhancement, skill-development and reciprocal effects models is that all three predict that the path of each T1 variable on the parallel T2 and T3 variables is substantially positive (solid gray horizontal paths in Figure 4). Discrimination among the three models occurs with the cross-paths relating prior achievement to subsequent self-concept and vice versa.

The skill-development model can be identified by three paths from prior achievement to subsequent academic self-concept (three paths represented by dashed black lines in Figure 4) which are all positive. Identifiably, the path from T1 achievement to T2 academic self-concept and the path from T2 achievement to T3 academic self-concept are both predicted to be significantly positive. Since the effects of T1 achievement to T3 academic self-concept are likely to be ameliorated due to the mediated effect through T2 constructs, the path from T1 achievement to T3 academic self-concept is considered less important.

The self-enhancement model can be identified by three paths from prior academic self-concept to subsequent achievement (three paths represented by solid black lines in Figure 4), all of which are positive. Identifiably, the path from T1 academic self-concept to T2 achievement and the path from T2 academic self-concept to T3 achievement are predicted to be significantly positive. Since the effects of T1 academic self-concept to T3 achievement are likely to be ameliorated due to the mediated effect through T2 constructs, the path from T1 academic self-concept to T3 achievement is considered less important.

The reciprocal effects model can be identified by including the positive paths from both the skill-development model and self-enhancement model. In sum, paths leading from prior achievement to subsequent academic self-concept (skill-development) and prior academic self-concept to subsequent achievement (self-enhancement) will all be positive. The ameliorating effects from the other two models also apply to the reciprocal effects model, since the effects of T1 constructs on T3 constructs are mediated through the T2 constructs.

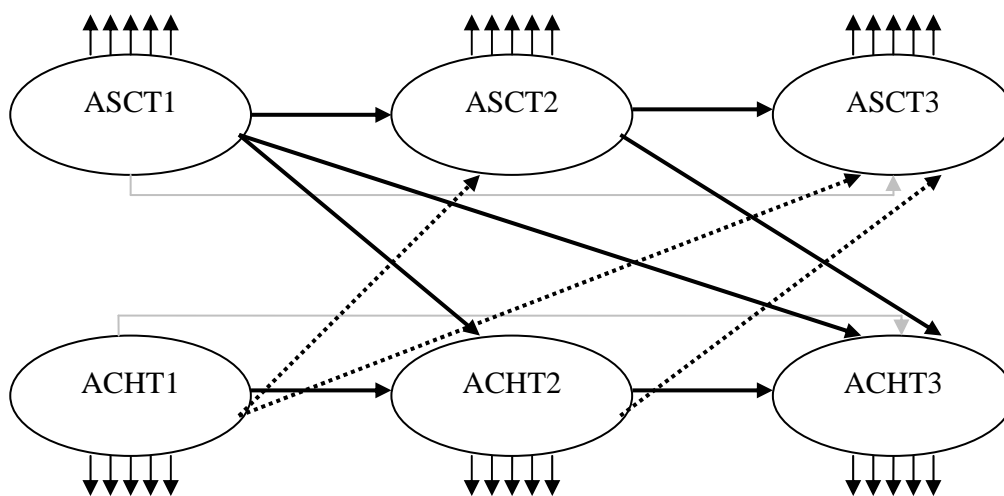


Figure 4. Marsh and Craven's causal ordering prototype model for evaluating the full-forward model. ASC = Academic self-concept, ACH = Academic achievement, T1 = Time 1, T2 = Time 2, T3 = Time 3.

Although the procedure described above applies to causal relations between academic self-concept and academic achievement, parallel procedures were applied when examining paths in the full-forward model from the present study. Specifically,

these procedures were applied when evaluating the full-forward model, which includes goals, domain-specific self-concepts, and academic achievement.

METHOD

Participants

Participants in the study were 535 secondary school students in Years 7, 8 and 9 in the first year of data collection and Years 8, 9 and 10 in the second year and Years 9, 10 and 11 in the final year. Participants were from nine high schools broadly representative of school settings in New South Wales, Australia. Table 1 presents the composition of the sample.

Table 1

Sample Composition

	2002 T1	2003 T2	2004 T3
Focus Sample			
Year 7	195 (36%)		
Year 8	179 (34%)	195 (36%)	
Year 9	161 (30%)	179 (34%)	195 (36%)
Year 10		161 (30%)	179 (34%)
Year 11			161 (30%)
Number	535	535	535
Ration male/female	59/41	59/41	59/41
Age–mean	13.0	14.3	15.1
Age–std dev	1.0	1.0	0.9

Measures

Based on the SDQ II, Marsh (1990) developed the Academic Self-Description Survey II. The ASDQ II examines academic self-concepts in specific domains. The full ASDQ II comprises 136 items however in this study, only the English and mathematics domains were assessed. Five items measured English self-concept (eg. “I am good at English.”) and 5 items measured math self-concept (eg. “I am good at maths.”). These items, their numerical identifiers, and their alpha estimates of reliability at both Time 1, Time 2 and Time 3, are recorded in Appendix 1. Students responded to the items in Appendix 1 on a five-point likert scale ranging from “strongly disagree” to “strongly agree”.

The nature of students' motivation was evaluated using the General Achievement Goal Orientation Scale (GAGOS) developed by McInerney (1997). Although a recent instrument, the GAGOS has demonstrated sound psychometric properties (see for example Barker, McInerney, & Dowson, 2002; Barker, Dowson & McInerney, 2004; Barker, Dowson & McInerney, 2005). This validation process can not be underestimated as DeShone and Gallespie (2005) highlight in their expansive review of goal theory research, the large proportion of studies that use self-developed measures especially designed for their particular research study are almost always unvalidated. Specifically, the GAGOS comprises five items measuring general mastery, eight items measuring general performance, five items measuring general social, five items measuring global motivation and three items measuring valuing motivation. These items, their numerical identifiers, and their alpha estimates of reliability at both Time 1, Time 2 and Time 3 are recorded in Appendix 2. As with items from the ASDQ II, students responded to the items in Appendix 2 on a five-point likert scale ranging from "strongly disagree" to "strongly agree".

Achievement data provided included school ranks for English and mathematics. Like the GAGOS and ASDQ II, achievement data was collected at three time points, with each data collection point taking place one academic year apart. Students were assigned ranks based on performance in class tests and exams. Ranks ranged from 1 through 5, with 5 representing top performers and 1 representing the poorest performers. Too few schools provided achievement scores in English and mathematics to permit analyses using multiple measures of academic achievement.

Procedure

The items listed in Appendix 1 and 2 were combined, and randomly ordered among 114 items from various other instruments forming a single survey instrument. A standardised explanation of the purpose of the survey was provided for participants before each administration. The survey was read aloud to the students to (a) ensure that most participants completed the survey within the time allotted (b) overcome reading and language difficulties of some students (c) ensure consistency with the procedure from school to school and (d) assist students with learning difficulties. At each session there were at least two research assistants present to assist the students completing the surveys. School teachers were not involved in the administration of the survey. Researchers collected the surveys from all students before they left the

room. The same questionnaire and procedure was followed for all three waves of data collection. The first wave of data was collected in November 2002, and the second wave in November 2003 and the final wave in November 2004.

Analyses

Confirmatory Factor Analyses (CFAs: e.g., Hau, Kong & Marsh, 2000; Kaplan, 2000) using LISREL 8.54 and Reliability Analyses using SPSS (Pedhazur & Pedazur-Schmelkin, 1991) were used to determine the psychometric properties of the combined GAGOS and ASDQ II scales at Time 1, Time 2 and Time 3. Data were analysed using LISREL 8.54 (Jöreskog & Sörbom, 1989; 2003). Models were estimated using Maximum Likelihood estimation (MLE). Based on recommended methodological guidelines analyses proceeded in four phases (see for example Marsh et al., 1999). Phase 1 entailed testing single wave a priori CFA models with the purpose of identifying measurement problems and resolving them accordingly.

Phase 1 single CFAs. The first-order models were tested across three waves of data using a structured approach to determining the properties of the combined scales. These models were:

- (a) Model 1 - Time 1 (M1T1): the hypothesised (five factor) model for the full set of 28 items at Time 1.
- (b) Model 2 - Time 1 (M2T1): the hypothesised (five factor) model with the refined set of 23 items at Time 1.
- (c) Model 2 - Time 2 (M2T2): the hypothesised (five factor) model with the refined set of 23 items at Time 2.
- (d) Model 2 - Time 3 (M3T3): the hypothesised (five factor) model with the refined set of 23 items at Time 3.

Phase 2 complicated CFAs. Two models examined relations of all five factors across all data waves with the second model varying from the first as it included the achievement data.

- (e) Model 3 (M3): the hypothesised five factor three wave (5V3W) model.
- (f) Model 4 (M4): the hypothesised seven factor three wave (7V3W) model (which included English and mathematics ranks).

Phase 3 full-forward SEM model. A full-forward model tested all possible paths by correlating factors within the same wave, as well as paths from all constructs in each wave to all constructs in subsequent waves.

- (g) Model 5 (M5): the hypothesised full-forward model with all parameters estimated.

Phase 4 alternative SEM models. Two nested models under the full-forward model were tested.

- (h) Model 6 (M6): The constrained full-forward model with paths from goals T1, self-concept T2, and ranks T3.
- (i) Model 7 (M7): The constrained full-forward model with paths from, self-concept T1, goals T2, and ranks T3.

Strict Confirmability. Although CFAs are labelled “Confirmatory”, typically CFA researchers do not test one model alone (a strictly confirmatory approach), but often make post-hoc adjustments to models in order to make models fit sample data better. Thus, many CFA studies are really quasi-confirmatory, or even outright exploratory (Byrne, 1998). In the present study we followed this quasi-confirmatory approach for the first wave of data. However, for the second and third waves of data we followed a strictly confirmatory approach. This strictly confirmatory approach is a feature of the present study, and represents a strong test of the factorial structure of the instrument.

Evaluating Model Fit. The indices used to assess the fit of models in this study were the Chi-square/degrees of freedom ratio, the Goodness of Fit Index (GFI), the Tucker Lewis Index (TLI), the parsimony Relative Non-centrality Index (PRNI) and the Root Mean Square Error of Approximation (RMSEA) (Byrne 1998). (Kelloway, 1998, p.27) describes the GFI as “a ratio of the sum of the squared discrepancies [between the sample variance/covariance matrix and the model-implied variance-covariance matrix] to the observed variances”. Values above 0.9 indicate good fit to the data for the GFI (Loehlin, 1998).

The TLI and the PRNI both compare a null model with a hypothesised model. In a null model all variables are typically specified to be uncorrelated, that is, no relationship between the variables is specified (Kelloway, 1998). Null models serve as a valuable baseline for comparing alternative models which imply specified covariances between the observed variables (Byrne, 1998). The TLI and PRNI should ideally be greater than 0.95, although values greater than 0.90 indicate acceptable fit (Marsh, Balla, & Hau, 1996). In the present study, these indices were computed using formulae given in Marsh et al. (1996).

The RMSEA takes into account an error of approximation in the implied population covariance matrix, thus relaxing the stringent requirement in the Chi-square/degrees of freedom statistic that the model holds exactly in the population. The RMSEA should ideally be less than 0.05. However, values between 0.05 and 0.08 indicate reasonable fit (Byrne, 1998; Diamantopoulos & Siguaw, 2000).

Testing Nested Models. Where CFA (and other types of) models are ‘nested’ i.e. one model (the ‘child’ model) contains a sub-set of variables in another model (the ‘parent’ model), a Chi-square difference test ($\Delta\chi^2$) between the two models may be computed (see Marsh, Dowson, Pietsch, & Walker, in press). This test is conducted by subtracting the Chi-square and associated degrees of freedom for the child model from the Chi-square and associated degrees of freedom for the parent model. The remaining Chi-square value (compared against the remaining degrees of freedom) acts as measure of how much better the child model fits to the parent model. Where this difference is significant, the child model can be said to fit the data better than the parent model. The $\Delta\chi^2$ test can be used to test models at the same level (e.g. nested first-order models), or models at different levels (e.g. first-order models with nested higher-order models).

RESULTS

The results presented relate to the four phases of analyses recommended by Marsh et al. (1999). Since the central aim of this paper is to disentangling the causal ordering of goals and domain-specific self-concepts, phases 1 and 2 are briefly discussed because they relate to measurement issues, whereas phases 3 and 4 directly test hypotheses bearing on the issue of causal predominance and are therefore elaborated upon in this section and subsequent discussion of the results.

Phase 1

The first phase entails testing a number of simple single wave a priori CFA models with the purpose of identifying measurement problems and resolving them accordingly. Model 1a T1 (M1aT1) tested the hypothesis of 28 items loading on 5-factors. Results in Table 2 indicate that this model fits the data marginally well. Having removed five poorly fitting items, a CFA was performed on the 23-item, 5

subscale model. The resulting model (M2aT1) yielded a chi square of 538.08 ($df = 220$), a TLI of .96, a CFI of .96 and RMSEA of .05. These fit indices demonstrate that the combined GAGOS-ASDQII provided a good fit to the data for the sample. The refined model (M2aT1) was then tested with the Time 2 and Time 3 data. Models M2aT2 and M2aT3 provided a good fit to the data. Table 2 presents the fit statistics for M2aT2 and M2aT3.

Phase 2

Phase 2 tested two complicated CFA models. The first model, Model 3 (M3) simultaneously tested five first-order variables (mastery goals, performance goals, social goals, English self-concept and mathematics self-concept) across three waves. The second model, Model 4 (M4), simultaneously tested seven first-order variables (the same five variables above with the addition of English and mathematics achievement) across all three waves. Table 2 presents the fit statistics for these two models. Results demonstrate that both M3 and M4 provide an excellent fit to the data, with all fit indices exceeding criterion values. M4 provides a good basis for pursuing SEM models.

Correlations among the seven factors across three waves are presented in Table 3. Most notable are the stability correlations which are the test-retest correlations for the seven latent constructs across three waves of data. As expected, variables collected on multiple occasions were highly and positively correlated with each other; for example, the correlation between performance goals at T1 and T2 is .62 and at T2 and T3 is .51. This pattern of results between parallel variables collected on multiple occasions was replicated for mastery goals, social goals, English self-concept, mathematics self-concept, English ranks, and mathematics ranks (boldfaced correlations). A similar pattern of correlations that emerged in the earlier first-order CFAs, were evident in the results for Model 4.

Table .3

Correlations Among 7V3W a Priori Model (M4)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 MAST1	-																				
2 PERT1	44***	-																			
3 SOCT1	22***	36***	-																		
4 ESCT1	40***	21***	03	-																	
5 MSCT1	17**	22***	14**	19***	-																
6 EACHT1	07	-05	-19**	16**	00	-															
7 MACHT1	-03	-07	-15**	02	36***	51***	-														
8 MAST2	41***	32***	13**	23***	22***	-01	-01	-													
9 PERT2	17**	62***	18*	08	15**	-08	-10	43***	-												
10 SOCT2	00	15*	44**	-06	01	-15**	-11	19**	39***	-											
11 ESCT2	30***	01	-07	56***	07	17**	-04	25***	07	00	-										
12 MSCT2	03	08*	07	05	63*	-03	28***	21**	20***	05	17***	-									
13 EACHT2	19**	-19***	-18**	12*	07	54***	44***	20***	-11*	-11	36***	08	-								
14 MACHT2	03	-04	-10	00	24***	39**	59***	10	-07	-15*	00	34***	54***	-							
15 MAST3	31***	24***	10	09	13*	-03	-01	44**	31***	12*	11*	20***	08*	04	-						
16 PERT3	13*	37***	07	-01	14**	-01	-04	30**	51**	10	03	15***	00	-06	52***	-					
17 SOCT13	03	16**	37***	-05	07	-07	-05	12*	19**	42***	-08	03	-11*	-13*	17**	30***	-				
18 ESCT3	19***	07	-02	45***	07	21***	-03	15**	06	00	55***	06	22***	01	20***	12*	-04	-			
19 MSCT3	07	08*	11**	-03	39***	-07**	12*	03	14**	09	-01	48***	-01	15**	17**	26***	00	20***	-		
20 EACHT3	17**	-03	-18**	20***	08	43***	35***	21***	-03	-11	28***	10	52***	44***	09*	-05	-18***	36***	-03*	-	
21 MACHT3	10*	-07	-13	-02	14***	38***	51***	13**	-08	-13	03	12***	40***	54***	-02	-02	-17**	02	13***	58***	-

Note. Decimals omitted. Coefficients are significant at * $p < .05$. ** $p < .01$. *** $p < .001$.

Phase 3

Phase 3 involved testing the full-forward model (Model 5). Model 5 (M5) assumes that the latent constructs are reciprocally related and therefore the model's specifications comprised correlations among observed variables within parallel waves, in addition to all paths from all latent variables in each wave, to all latent variables in subsequent waves. This complex model converged to a proper solution. M5 was well defined because the factor loadings were substantial and the fit statistics were very good. Table 2 presents the overall goodness-of-fit indices. Table 4 presents the factor loadings, Table 5 presents factor correlations, and Table 6 presents the path coefficients and total effects.

The largest effect for each T1 and T2 as well as T2 and T3 outcome was the parallel variable from the preceding wave. For instance, Table 6 presents the total effects for mastery goals at T1 to T2, T2 to T3, and T1 to T3 were highly significant and positive (.28, .36, and .28 respectively). However, the crucial effects in relation to the a priori reciprocal effects model are the effects of goal orientations on subsequent domain-specific self-concepts and the effects of domain-specific self-concept on subsequent goal orientations. Due to the large number of nonsignificant crosslagged effects, only tentative judgements at best concerning the causal ordering of these variables is possible. The full-forward model was useful for exploring how each of the variables related across three waves of data and will be used as a baseline comparison for the competing models of causation.

Phase 4

Phase 4 tested the two competing models which are nested under the full-forward model. Model 6 tested the predominance of goals and Model 7 tested the predominance of self-concept. Overall results of these two models and the full-forward model are presented in Table 2. In order to compare the full-forward model with the two competing nested models, it is necessary to conduct a chi square difference test. If the chi square difference test reveals a significant difference between the full-forward model and a nested model, then the conclusion drawn is that the full-forward model provides a significantly better fit to the data. It is common for the model with additional parameters (full-forward model) to fit the data better than nested models. This was the case for the full-forward model with the first nested Model (Model 5), which hypothesised the causal flow of goals T1, domain-specific

self-concept T2, and achievement T3. Table 7 presents the results of the chi square difference tests. Interestingly, the second nested Model (Model 7) with the causal ordering of domain-specific self-concept T1, goals T2, and achievement T3 provided a nonsignificant difference chi square test and therefore the full-forward model does not necessarily explain the data best. This nested model with domain-specific self-concept T1, goals T2, and achievement T3 was assessed for the relative strength of relationships to make judgements about causality.

Most of the patterns of relationships apparent in M5 were replicated in M7. This is because the full-forward model represents all possible paths and M7 is nested under the full-forward model. The patterns of effect and strength of relationships for M7 were almost identical to M5's. Given that: (a) the form of effects and strength of these effects are near equivalent between M5 and M7, (b) the chi square difference test reveals that M5 does not explain the data any better than M7, and (c) M7 is more parsimonious than M5, it is proposed that M7 provides the best explanation for the causal ordering of domain-specific self-concept, goals, and academic achievement. Model 7, which specifies domain-specific self-concept as causally predominant over goals and academic achievement, provides the best explanation of the data.

Table 2

Model Fit Statistics

Model	χ^2	df	χ^2/df	TLI	CFI	RMSEA	Model Description
Phase 1							
M1T1	1199.64	340	3.5	.92	.93	.69	Hypothesised model T1 (28 items)
M2T1	538.08	220	2.5	.96	.96	.05	Refined model T1 (23-items)
M2T2	527.06	220	2.4	.95	.96	.05	Refined model T2
M2T3	585.67	220	2.7	.99	.96	.06	Refined model T3
Phase 2							
M3	3791.20	2104	1.8	.97	.96	.04	5V3W with correlated uniquenesses
M4	3489.92	2423	1.4	.97	.98	.03	7V3W model with Correlated uniquenesses
Phase 3							
M5	3573.48	2427	1.5	.97	.97	.03	Full-forward model
Phase 4							
M6	3603.90	2445	1.5	.97	.97	.03	Goals T1, Self T2 and Ranks T3
M7	3601.82	2445	1.5	.97	.97	.03	Self T1, Goals T2 and Ranks T3

Note. N.a. = not available. TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error Approximation. A null model is a model that specifies no relationship between the variables composing the model. The null model is used as a baseline to compare the hypothesised model (a model in which the relationship between variables has been specified) in the TLI.

TLI = $\left[\frac{\text{Chi-square/degrees of freedom (null model)}}{\text{Chi-square/degrees of freedom (hypothesised model)}} \right]$

$\frac{\text{Chi-square/degrees of freedom} - 1}{\text{Chi-square/degrees of freedom} - 1}$ (null model)

RMSEA = Square Root $\left[\frac{\text{Chi-square} - \text{degrees of freedom}}{(n - 1) \text{ degrees of freedom}} \right]$

Table 4
Factor Loadings for the Full-Forward Model

	Time 1							Time 2							Time 3							
	M	P	S	ES	MS	EA	MA	M	P	S	ES	MS	EA	MA	M	P	S	ES	MS	EA	MA	
FL																						
MAS																						
27	52***							53***							53***							
32	49***							53***							45***							
42	53***							58***							59***							
50	46***							48***							56***							
PER																						
72		72***						70***										63***				
78		62***						71***										77***				
90		74***						64***										70***				
95		81***						73***										78***				
98		61***						64***										57***				
SOC																						
35				68***							59***							80***				
55				87***							86***							89***				
67				75***							85***							84***				
101				40***							39***							30***				
ESC																						
1				76***							83***							87***				
2				74***							76***							83***				
3				69***							69***							83***				
4				71***							79***							82***				
5				.72***							.73***							86***				
MSC																						
1					91***							92***							88***			
2					93***							94***							87***			
3					89***							86***							85***			
4					87***							89***							88***			
5					87***							88***							86***			
EACH						1.00							1.00								1.00	
MACH							1.00							1.00								1.00

Note. Decimals omitted. Coefficients are significant at * $p < .05$. ** $p < .01$. *** $p < .001$. FL = Factor loading, MAS = Mastery goal items, PER = Performance goal items, SOC = Social goal items, ESC = English self-concept items, MSC = Mathematics self-concept items, EACH = English achievement, MACH = Mathematics achievement.

Table 5

Factor Correlations for the Full-forward Model

	Time 1							Time 2							Time 3							
	MAS	PER	SOC	ESC	MSC	EA	MA	MAS	PER	SOC	ESC	MSC	EA	MA	MAS	PER	SOC	ESC	MSC	EA	MA	
FC																						
MAST1	1.00																					
PERT1	31***	1.00																				
SOCT1	21***	24***	1.00																			
ESCT1	19**	10*	05	1.00																		
MSCT1	11**	13**	08*	15***	1.00																	
EACHT1	10	08	03	12*	00	1.00																
MACHT1	02	05	-07	11**	17***	19**	1.00															
MAST2								1.00														
PERT2								26***	1.00													
SOCT2								14**	31***	1.00												
ESCT2								16***	05	03	1.00											
MSCT2								12**	11**	-02	19***	1.00										
EACHT2								06	-11*	-04	20***	-00	1.00									
MACHT2								-00	-02	-09	-02	21***	28***	1.00								
MAST3															1.00							
PERT3															50***	1.00						
SOCT3															16**	30***	1.00					
ESCT3															20***	12*	-05	1.00				
MSCT3															15**	28***	-01	20***	1.00			
EACHT3															12*	-06	-21***	41***	05	1.00		
MACHT3															03	01	-19**	08	36***	65***	1.00	

Note. Decimals omitted. Coefficients are significant at * $p < .05$. ** $p < .01$. *** $p < .001$. FC = Factor correlations, MAS = Mastery goal items, PER = Performance goal items, SOC = Social goal items, ESC = English self-concept items, MSC = Mathematics self-concept items, EACH = English achievement, MACH = Mathematics achievement, EA = English achievement, MA = Mathematics achievement, T1 = Time 1, T2 = Time 2, T3 = Time 3.

Table 6
Path Coefficients and Total Effects for the Full-forward Model

	Time 1							Time 2						
	MAS	PER	SOC	ESC	MSC	EACH	MACH	MAS	PER	SOC	ESC	MSC	EACH	MACH
PC														
MAST2	29***	14	12	15*	13*	-23***	-16*							
PERT2	11	55***	-03	04	01	14	01							
SOCT2	-15*	-13	32***	-11	-08	-04	-01							
ESCT2	24*	13	01	56***	-08	14	-17							
MSCT2	-17	-20*	-03	-15	60***	-03	26**							
EACHT2	06	-51**	-18	33*	01	68***	32							
MACHT2	-06	39*	13	27	-02	-06	27							
MAST3	20**	01	05	01	-08	-02	-00	36***	04	08	00	10	07	06
PERT3	-14	07	-10	-08	00	-01	-01	12	49***	-10	02	-01	-02	-09
SOCT3	08	09	22	05	08	07	07	07	04	43***	-05	04	-01	01
ESCT3	-07	02	06	18	08	18	05	01	-05	-03	52***	-15*	06	-14
MSCT3	18*	05	06	01	09	-16	-11	-06	06	13	-10	57***	-09	15*
EACHT3	02	12	-14	10	-06	03	-12	16	11	06	12	21	48**	28*
MACHT3	04	-14	02	-12	08	24	38	07	-15	-11	-06	-12	20	42**
TE														
MAST2	29***	14	12	15*	13*	-23**	-16*							
PERT2	11	55***	-03	04	01	14	01							
SOCT2	-15*	-13	32***	-11	-08	-04	-01							
ESCT2	24*	13	01	56***	-08	14	-17							
MSCT2	-17	-20*	-03	-15	60***	-03	26**							
EACHT2	06	-51**	-18	-33*	01	68***	32							
MACHT2	-06	39*	13	27	-02	-06	27							
MAST3	28***	04	10	03	03	-08	01	36***	04	08	00	10	07	06
PERT3	-02	35***	-14*	-03	03	03	-06	12	49***	-10	02	-01	-02	-09
SOCT3	03	05	37***	-02	09	03	07	07	04	43***	-05	04	-01	01
ESCT3	10	01	03	44***	-04	15	-10	01	-05	-03	52***	-15*	06	-14
MSCT3	02	03	11	-09	42***	-22***	08	-06	06	13	-10	57***	-09	15*
EACHT3	08	04	-16	07	07	29*	12	16	11	06	12	21	48**	28*
MACHT3	05	-11	02	-08	03	33*	52***	07	-15	-11	-06	-12	20	42**

Note. Decimals omitted. Coefficients are significant at * $p < .05$. ** $p < .01$. *** $p < .001$. PC = Path Coefficients, MAS = Mastery goal items, PER = Performance goal items, SOC = Social goal items, ESC = English self-concept items, MSC = Mathematics self-concept items, EACH = English achievement, MACH = Mathematics achievement, T1 = Time 1, T2 = Time 2, T3 = Time 3.

Table 7

Chi Square Difference Tests

	χ^2 difference	df
Models		
M5 and M6	28.34	18*
M5 and M7	3.42	18

DISCUSSION

Research reporting correlations between goal orientations and self-concept are informative and heuristic, however, a vital question remains unanswered concerning the underlying mechanisms responsible for the results. Consequently, an important contribution this study makes is the application of structural equation models utilising longitudinal data to disentangle the causal relations of goal orientations, domain-specific self-concepts, and academic achievement. This study pursues a more challenging question which goes beyond considering the nature of relations between the constructs and attempts to extricate the causal ordering of goals and academic self-concept and whether they influence achievement across time.

Fundamental to exploring the provocative question on causal ordering was application of Marsh et al.'s (1999) guidelines for testing causal ordering models. Also deemed pivotal to this quest was the adoption of Marsh and Craven's (2006) prototype for assessing causal models. Although application of Marsh and Craven's (2006) prototype was problematic due to the smaller number of significant cross-paths between the constructs, the model providing the best representation of the data was the model with self-concept causally predominant. This judgement was based on the fact that the full-forward model provided an equivalent explanation of the data such that the chi square test resulted in no significant difference between the full-forward model and the self-concept predominant model, and the pattern and strength of paths between the two models were highly comparable. Finally, since the self-concept predominant model is more parsimonious than the full-forward model, it is deemed to

be the best explanation for the causal pattern of relations between goal orientations, domain-specific self-concept, and academic achievement.

Interpretation of this model assumes that prior self-concept significantly affects the learning goals students adopt when engaging in subsequent academic tasks. Furthermore, these adopted goals affect subsequent academic achievement. Whether an individual has a high or low self-concept in English or mathematics will affect the type of goals pursued in subsequent tasks and depending on the goals adopted, subsequent academic achievement will be influenced. For an achievement-related situation in English or mathematics, according to the proposed causal model in this study, students will initially ask themselves how competent they think they are in English or mathematics and subsequently ask themselves what is the purpose for achieving at the task. The questions “Can I do this and for what reason am I doing this” combine to influence future academic achievement.

The significance of these findings is grounded in the fact that self-perceptions play a vital role in predicting the goals students choose to adopt to engage in academic tasks. Self-perceptions of ability in English and mathematics facilitate future goal adoption. These results support experimental research studies which show the effect of classroom contexts and structures that influence goal pursuit (Ames, 1990). Taken together, the results from correlations across three waves simultaneously (7W3V) and longitudinal structural equation model (self-concept predominant), it appears that it might be best for teachers to enhance students’ self-concepts in both English and mathematics so as to influence their subsequent pursuit of mastery goals, especially since mastery goals positively influence subsequent academic achievement in both English and mathematics.

Substantively, the causal findings in this study contend that both self-perceptions and perceptions of tasks are key variables in achievement-related situations. Self-concept and goal orientations are fundamental psychological drivers of performance attainment. Since domain-specific self-concepts and goal orientations have been proven in this study to be interconnected and to combine to affect achievement, it is important to consider both constructs (self-concept and goals) when examining academic achievement. If one construct is examined to the exclusion of the other,

then a holistic account of these two fundamental constructs causally combine to affect achievement will be absent and an insufficient explanation of academic achievement will be provided.

This study highlights the fundamental importance self-perceptions play in facilitating student goal adoption, and that this process influences subsequent academic achievement. Results from this investigation provide important contributions to the study of student motivation. Gaps in the research of student motivation have been directly addressed. These gaps include examining goals and their long-term effects on important educational outcomes. Goals were investigated across a three year time span and were integrated with domain-specific self-concept, which is an important outcome in its own right, and also associated with academic achievement in English and mathematics. Furthermore, this study extended beyond showing that goals and self-concept are related but demonstrated how they relate in a causal manner to affect subsequent academic achievement.

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APPENDIX

Appendix 1

Items from academic self-concept subscales

Subscale	Numerical Identifier	Item
English self-concept		T1 α =.85 T2 α =.88 T3 α =.87
	ESC1	“I am good at English”
	ESC2	“I have always been good at English”
	ESC3	“Work in English is easy for me”
	ESC4	“I get good marks in English”
	ESC5	“I learn things quickly in English”
Maths self-concept		T1 α =.89 T2 α =.90 T3 α =.89
	MSC1	“I am good a mathematics”
	MSC2	“I have always been good at mathematics”
	MSC3	“Work in mathematics is easy for me”
	MSC4	“I get good marks in mathematics”
	MSC5	“I learn things quickly in mathematics”

Note: Numbers in brackets refer to Cronbach’s alpha reliability for each scale at Time 1 and Time 2.

Appendix 2

Items from the achievement motivation subscales

Subscale	Numerical Identifier	Item
Mastery goals		T1 α =.74 T2 α =.84 T3 α =.79
	MAG27T1	“I am most motivated when I see my work improve”
	MAG32T1	“I am most motivated when I am good at something”
	MAG37	“I am most motivated when I solve problems”
	MAG42	“I am most motivated when I am becoming better at my work”
	MAG50	“I am most motivated when I am confident that I can do my school”
Performance goals		T1 α =.79 T2 α =.80 T3 α =.81
	PERG58	“I am most motivated when I receive rewards”
	PERG62	“I am most motivated when I receive good marks”
	PERG72	“I am most motivated when I am noticed by others”
	PERG78	“I am most motivated when I am competing with others”
	PERG83	“I am most motivated when I am in charge of a group”
	PERG90	“I am most motivated when I am praised”
	PERG95	“I am most motivated when I am doing better than others”
	PERG98	“I am most motivated when I become a leader”
Social goals		T1 α =.73 T2 α =.76 T3 α =.76
	SOG35	“I am most motivated when I work with others”
	SOG55	“I am most motivated when I am in a group”
	SOG67	“I am most motivated when I work with friends at school”
	SOG101	“I am most motivated when I am helping others”
	SOG108	“I am most motivated when I am showing concern for others”

Note: Numbers in brackets refer to Cronbach’s alpha reliability for each scale at Time 1, Time 2 and Time 3.