Conceptualising Students' Goals and Self-Concept as Multidimensional and Hierarchically Structured

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The purpose of the present study was to examine the potential multidimensional and hierarchical structure of student's motivational goals and academic self-concept (SC). Specifically, this paper tests the ability of a hypothesised second-order measurement model comprising achievement motivation variables (mastery, performance & social goals) and academic self-concept variables (English and math self-concept) to fit data collected over two years from 1 515 Australian High School students, and to test whether the model fits equally well across sex groups. Results of first order Confirmatory Factor Analyses (CFA) demonstrate that the combined General Achievement Goal Orientation Scale (GAGOS) and Academic Self Description Questionnaire II (ASDQ II) provide adequate reliability estimates on each scale and validly measure the constructs. Higher order CFA results provided support for an hierarchical representation (with goodness-of-fit indices for Time 1 (T1) and Time 2 (T2) ranging from .86 to .92). The model fitted the data equally well for males (with goodness-of-fit indices for T1 and T2 ranging from .83 to .92) and females (with goodness-of-fit indices for T1 and T2 ranging from .85 to .92). Thus, the study provides a measurement framework within which the interaction of multiple achievement goal orientations and academic self-concept variables may be examined further.

Review of the Literature

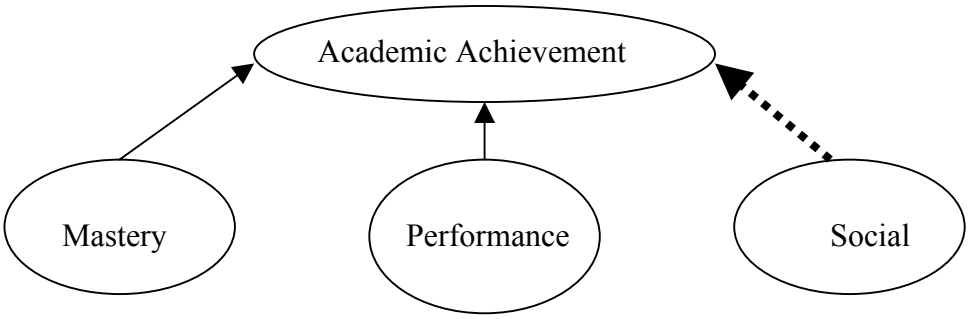
Achievement Motivation and Academic Achievement

Research has been conducted on the relations between academic achievement motivation and academic achievement. Traditionally, a dichotomous motivational goal approach comprising mastery and performance goals has received the most attention. Personal development and acquisition of new skills and knowledge are dominant concerns of mastery focused individuals. Maintaining favourable judgments of one's own ability by demonstrating superior performance relative to others is the dominant concern of performance focused individuals (Bouffard, Vezeau & Bordeleau, 1998; Kaplan & Maehr, 1999). Studies have examined the pursuit of multiple goals with specific focus on the independent and interactive effects of mastery and performance goals (Ainley, 1993; Barron & Harackiewizc, 2001; Linnenbrink & Pintrich, 2000; Dowson & McInerney, 2001; Pintrich, 2000). Although there is little debate about the positive effects of mastery goals, performance goals reveal inconsistent results, with negative, null and positive effects on measures of performance (Harackiewicz, Barron, Tauer, Carter & Elliot, 2000).

Although not as extensively examined as mastery and performance goals, social goals are another important class of goals (Dowson & McInerney, 2001). Social reasons for trying to achieve in academic situations are the dominant concerns for individuals pursuing social goals (McInerney, Roche, McInerney & Marsh, 1997; Urdan & Maehr, 1995). Few direct links between social goals and academic achievement have been established in the literature (Urdan & Maehr, 1995). Of the limited studies, varying results attempt to explain the relations (Covington, 2000).

Figure 1 is a pictorial representation of the literature reviewed above. Paths from academic achievement to mastery and performance goals have been extensively researched in contrast to the path between academic achievement and social goals.

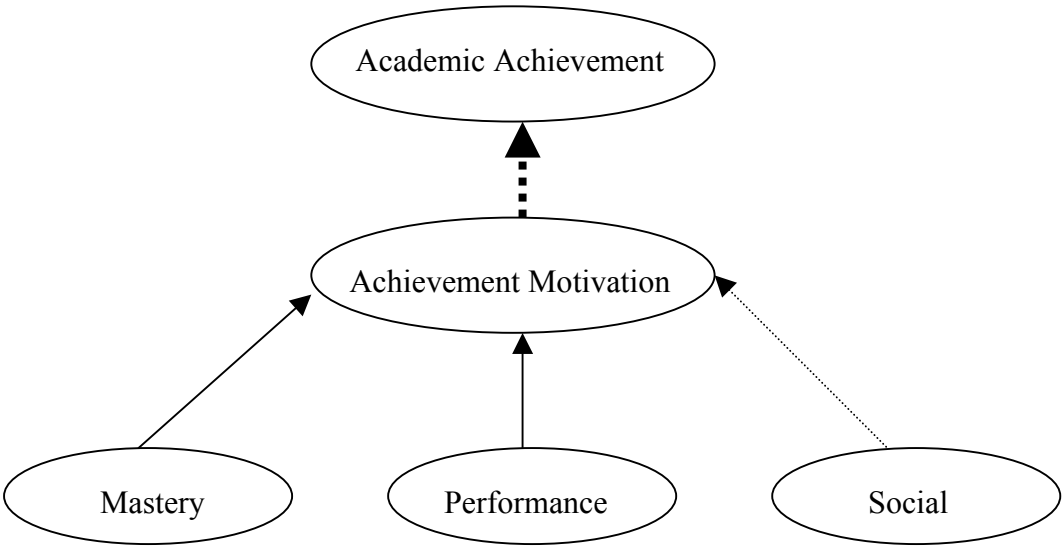
Figure 1:



In retrospect, the examination of multiple goals (mastery, performance and social), while allowing considerable scrutiny of the individual goals, limits the opportunity to investigate the multidimensional and hierarchical construct and the nature of interaction of these goals (McInerney, Marsh & Yeung, 2003). To our knowledge only one other study explores a holistic approach to examining multiple goals and their effect on achievement (McInerney et al., 2003). Examining individual goals and their effect on achievement provides a fragmented and superficial view. This study explores a higher order achievement motivation structure comprising mastery, performance and social goals.

Figure 2 depicts the higher order factor that is examined in the present study. Unless some studies investigate the multidimensionality and hierarchical nature of achievement goals, then the remaining research is of limited theoretical and applied value.

Figure 2:

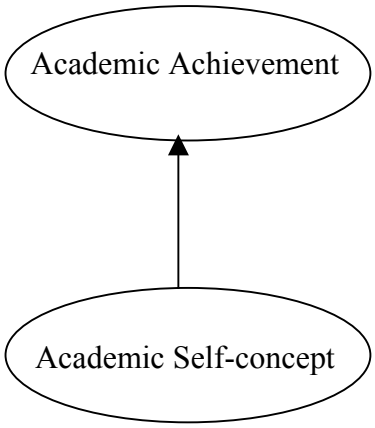


Academic Self-concept and Academic Achievement

A substantial body of literature indicates that self-concept is related to academic performance (Bandura, 1986; Schunk, 1981; Zimmerman, 1989). Moderate to strong relations between academic achievement and academic self-concept has been found in a large proportion of research (Hodge, Smit, Crist, 1995; Skaalvik & Valas, 1999). Notably, findings between self-concepts and achievements measured in specific content areas are more highly correlated (Marsh & Yeung, 1997).

Figure 3 shows the path between academic achievement and academic self-concept that has been explored by hundreds of studies.

Figure 3.:

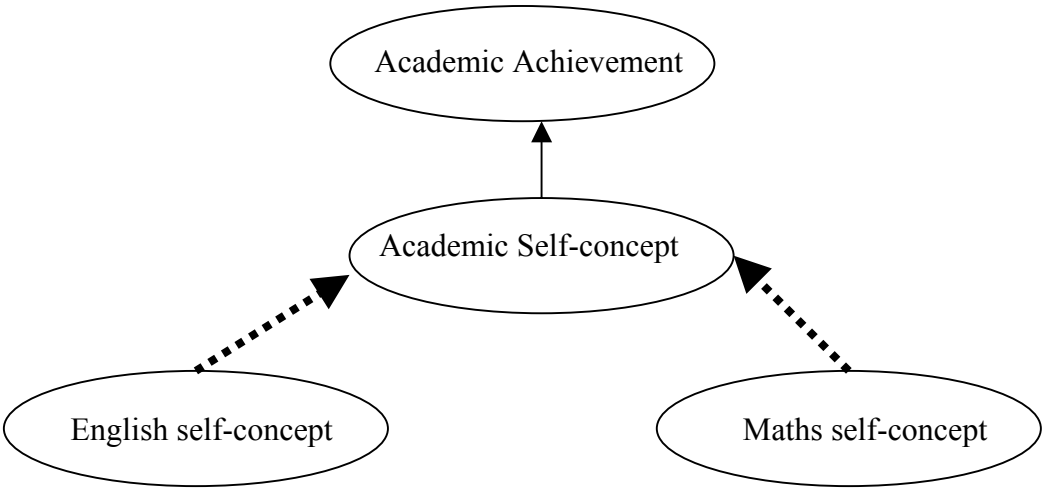


Casual ordering of academic self-concept and academic achievement has long been considered a vexing question that has provided varying and indeterminate results. Three competing models attempt to explain causality. The self-enhancement model proposes self-concept is a determinant of academic achievement. In contrast, the skill development model proposes academic achievement is causally predominant over self-concept. The third model describes reciprocal effects, that is, prior academic achievement influences subsequent self-concept and prior academic self-concept influences subsequent achievement.

A significant body of research on the relations between self-concept and academic achievement has been tested using the higher order factor of academic self-concept rather than using a first order analytic approach (Hodge et al., 1995). Findings indicate that the hierarchical structure is more complex than originally hypothesised (Byrne & Shavelson, 1987). For this reason, the present study examines first order and second order factor models. Importantly, without investigating the varying levels of self-concept one could not interpret the relationship between self-concept and academic achievement.

Figure 4 displays the hierarchical and multidimensional nature of self-concept and its relation to academic achievement.

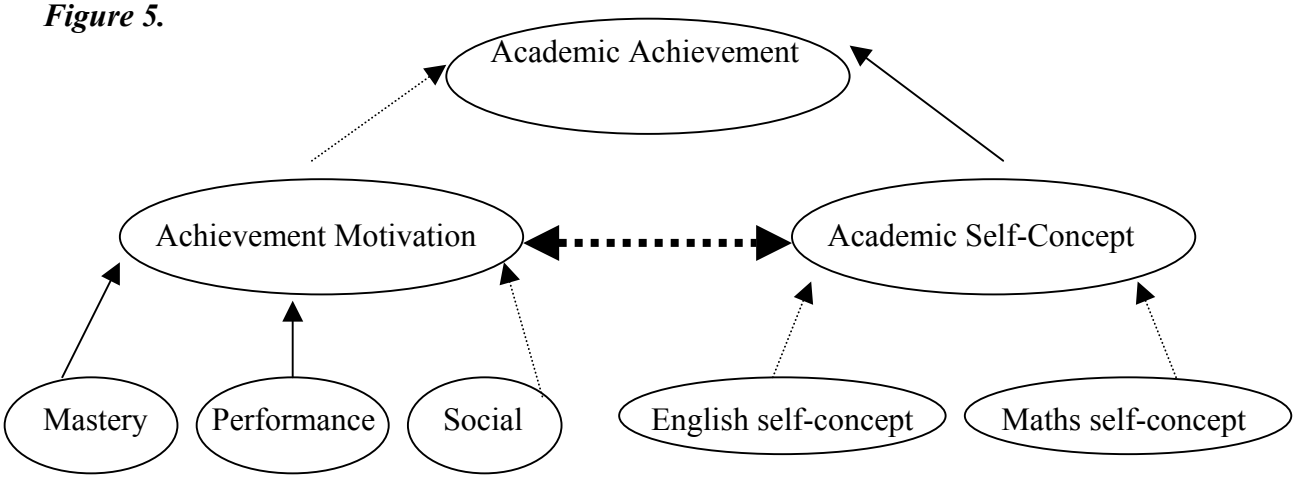
Figure 4:



The next procedure after exploring the construct of achievement motivation and academic self-concept, which the present study aims to do, would be examining relations between both achievement motivation and academic self-concept and their combined effects on academic achievement. Exploring causality of achievement motivation, academic self-concept and academic achievement is the ultimate goal of the researcher. To date, only one researcher and his colleagues (Skaalvik, Valas, & Sletta, 1994) has explored a similar path however limited their examination to mastery and performance goals.

Figure 5 combines figure 2 and figure 4 to show that the relations between achievement motivation and academic self-concept interact to effect academic achievement.

Figure 5.



Method

Participants

Participants in the study were 1 515 secondary school students in Years 7, 8 and 9 in the first year of data collection and in the second year, Years 8, 9 and 10. Participants were from eleven high schools broadly representative of school settings in New South Wales, Australia. 52% of these students were female and 48% were males, with the mean age of students at Time 1 13.10 years and at Time 2 14.20 years.

Measures

5 items measuring English self-concept (eg. "I am good at English.") and 5 items measuring math self-concept (eg. "I am good at maths.") were adopted from the Academic Self-Description Questionnaire II (ASDQ II) (Marsh, 1990). These items, and their numerical identifiers, are recorded in Table 1.

Table 1: **SDQ II Items**

English Self-concept (T1=. 87 T2= .88)	
ENGLSC1	I am good at English
ENGLSC2	I have always been good at English
ENGLSC3	Work in English is easy for me
ENGLSC4	I get good marks in English
ENGLSC5	I learn things quickly in English
Maths Self-concept (T1=.91 T2=.92)	
MATHSC6	I am good a mathematics
MATHSC7	I have always been good at mathematics
MATHSC8	Work in mathematics is easy for me
MATHSC9	I get good grades marks in mathematics
MATHSC10	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.

Students responded to the items in Table 1 on a five-point Likert scale ranging from "strongly disagree" to "strongly agree".

Achievement motivation was measured using 3 scales containing 18 items adopted from the General Achievement Goal Orientation Scale (GAGOS) (McInerney, 1997). The GAGOS was designed to measure general motivation in three goal areas, namely, General Mastery (eg. "I am most motivated when I see my work improve."), General Performance (eg. "I am most motivated when I am praised."), and General Social (eg. "I am most motivated when I work with others."). The GAGOS comprises five items measuring General Mastery, eight items measuring General Performance, and five items measuring General Social orientation. These items, and their numerical identifiers, are recorded in Table 2.

Table 2: **Achievement Motivation Items**

Mastery Goal (T1=.77 T2=.75)	
A27MAG	I am most motivated when I see my work improve
A32MAG	I am most motivated when I am good at something
A37MAG	I am most motivated when I solve a problem
A42MAG	I am most motivated when I am becoming better at my work
A50MAG	I am most motivated when I am confident that I can do my schoolwork
Performance Goal (T1=.82 T2=.82)	
A58PERG	I am most motivated when get a reward
A62PERG	I am most motivated when I get good marks
A72PERG	I am most motivated when I am noticed by others
A78PERG	I am most motivated when I am competing with others
A83PERG	I am most motivated when I am in charge of a group
A90PERG	I am most motivated when I am praised
A95PERG	I am most motivated when I am doing better than others
A98PERG	I am most motivated when I become a leader
Social Goal (T1=.75 T2=.75)	
A35SOCG	I am most motivated when I work with others
A55SOCG	I am most motivated when I am in a group
A67SOCG	I am most motivated when I work with friends at school
A101SOCG	I am most motivated when I am helping others
A108SOCG	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 and Time 2.
As with items from the ASDQ II, students responded to the items in Table 2 on a five-point Likert scale ranging from "strongly disagree" to "strongly agree".

Procedure
The items listed in Tables 1 and 2 were combined in a single instrument. A standardised explanation of the purpose of the survey was delivered to participants before each session. The questionnaire 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 in administration procedures from school to school and (d) to assist slow learners. At each session there were at least two research assistants present to assist students to complete the survey. The same questionnaire and procedure was delivered one year later.

Analyses
Confirmatory Factor Analyses (CFAs: eg. Hau, Kong & Marsh, 2000; Kaplan, 2000) using LISREL and Reliability Analyses (Pedhazur & Pedazur-Schmelkin, 1991) using SPSS were used to determine the psychometric properties of the combined GAGOS and ASDQ II scales at Time 1 and Time 2, for the full sample and for sex groups within the sample. Specifically, fourteen first-order nested models were tested in a structured approach to determining the properties of the combined scales. These models were:

a. Model 1 (M1): the null (no factor) model for the full set of 28 items at Time 1.

b. Model 2 (M2): the hypothesised (five factor) model for the full set of 28 items at Time 1.
c. Model 3 (M3): the null model with the six poorly fitting items from M2 deleted at Time 1.
d. Model 4 (M4): the hypothesised model with the revised set of 22 items at Time 1.
e. Model 5 (M5): the null model with the revised set of 22 items at Time 2
f. Model 6 (M6): the hypothesised model with the revised set of 22 items at Time 2
g. Model 7 (M7): the null model with 22 items for males at Time 1
h. Model 8 (M8): the hypothesised model with 22 items for males at Time 1
i. Model 9 (M9): the null model with 22 items for males at Time 2
j. Model 10 (M10): the hypothesised model with 22 items for males at Time 2
k. Model 11 (M11): the null model with 22 items for females at Time 1
l. Model 12 (M12): the hypothesised model with 22 items for females at Time 1
m. Model 13 (M13): the null model with 22 items for females at Time 2
n. Model 14 (M14): the hypothesised model with 22 items for females at Time 2

Next, second-order models were tested to determine the multi-dimensional and hierarchical structure and to assess stability as the data were collected over two years. The multiple goals construct was related to the higher order factor Goals while English and maths self-concept were related to the higher order factor Academic Self-concept. The models tested were:

o. Model 15 (M15): the second-order null model with 22 items for the total sample at Time 1
p. Model 16 (M16): the hypothesised second-order model with 22 items for the total sample at Time 1
q. Model 17 (M17): the second-order null model at Time 2 for the total sample
r. Model 18 (M18): the second-order hypothesised model at Time 2 for the total sample
s. Model 19 (M19): the null model at Time 1 for males
t. Model 20 (M20): the hypothesised model at Time 1 for males
u. Model 21 (M21): the null model at Time 2 for males
v. Model 22 (M22): the hypothesised model at Time 2 for males
w. Model 23 (M23): the null model at Time 1 for females
x. Model 24 (M24): the hypothesised model at Time 1 for females
y. Model 25 (M25): the null model at Time 2 for females
z. Model 26 (M26): the hypothesised model at Time 2 for females

Appropriate indices used to assess overall model fit in this study were the Chi-square/degrees of freedom, GFI, AGFI, TLI, PRNI and RMSEA (Byrne, 1998). Kelloway (1998, p.27) describes the GFI as "a ratio of the sum of the squared discrepancies to the observed variances". The AGFI differs from the GFI because adjustments have been made to take into account the degrees of freedom implied in the model. Values above 0.9 indicate good fit to the data for both the GFI and the AGFI (Loehlin, 1998).

Null models serve as a valuable baseline for comparing alternative models to assess improvements in fit (Byrne, 1998). Typically, the researcher compares a baseline model that is known a priori to provide a poor fit to the data. Poor fit is established in a null model as all variables are typically specified to be uncorrelated, that is, no relationship between the

variables is specified (Kelloway, 1998). The TLI and the PRNI both compare a null model with a hypothesised model. These indices were computed using formulae given in Marsh, Balla, & Hau (1996). The TLI and PRNI should ideally be greater than 0.95, although values greater than 0.90 indicate acceptable fit (Marsh, Balla, & Hau, 1996).

The RMSEA takes into account the 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).

Results

Model Fit

Reliability estimates for each scale were computed and ranged from .77 to .91 for Time 1 and .75 to .92 for Time 2. Results from the reliability estimates are reported in Tables 1 and 2. Overall results for the goodness-of-fit of the first order models tested are presented in Table 3 and second order models tested are presented in Table 4.

Table 3: **Model Fit Statistics**

Model	χ^2	df	χ^2/df	GFI	AGFI	TLI	PRNI	RMSEA	Model Description
									First-Order Models
M1	15249.38	378	40.34						Null model T1 (28 items)
M2	2724.29	340	8.01	0.87	0.85	0.80	0.84	0.07	Hypothesised model T1
M3	11433.01	231	49.49						Null model T1 (22 items)
M4	1288.05	199	6.47	0.92	0.90	0.87	0.90	0.06	Hypothesised model T1 (22 items)
M5	13323.89	231	57.81						Null model T2 (22 items)
M6	1369.74	199	7.02	0.92	0.90	0.87	0.91	0.07	Hypothesised model T2 (22 items)
M7	5887.99	231	25.50						Null model T1 (22 items males)
M8	806.08	199	4.07	0.90	0.87	0.84	0.89	0.07	Hypothesised model T1 (22 items males)
M9	6854.84	231	29.67						Null model T2 (22 items males)
M10	724.98	199	3.64	0.91	0.89	0.88	0.92	0.06	Hypothesised model T2 (22 items males)
M11	5741.36	231	24.85						Null model T1 (22 items female)
M12	615.86	199	3.09	0.93	0.91	0.87	0.92	0.06	Hypothesised model T1 (22 items females)
M13	6694.56	231	28.98						Null T2 (22 items females)
M14	852.96	199	4.29	0.91	0.88	0.85	0.90	0.07	Hypothesised model T2 (22 items females)

Table 4: **Model Fit Statistics**

Model	χ^2	df	χ^2/df	GFI	AGFI	TLI	PRNI	RMSEA	Model Description
									Second-order Models
M15	11433.01	231	49.49						Null model T1
M16	1329.26	203	6.55	0.92	0.90	0.86	0.90	0.06	Hypothesised model T1
M17	12679.17	231	54.89						Null model T2
M18	1361.63	203	6.7	0.92	0.90	0.87	0.91	0.07	Hypothesised model T2
M19	5887.99	231	25.49						Null model T1 males
M20	843.76	203	4.16	0.90	0.87	0.83	0.89	0.07	Hypothesised model T1 males
M21	6854.85	231	29.67						Null model T2 males
M22	756.63	203	3.73	0.91	0.89	0.87	0.92	0.06	Hypothesised model T2 males
M23	5741.36	231	24.85						Null model T1 females
M24	652.43	203	3.21	0.92	0.90	0.87	0.92	0.06	Hypothesised model T1 females
M25	6694.56	231	28.98						Null model T2 females
M26	889.19	203	4.38	0.90	0.88	0.85	0.89	0.07	Hypothesised model T2 females

Note: GFI = Goodness-of-fit; AGFI = Adjusted Goodness-of-fit; TLI = Tucker-Lewis Index; PRNI = Parsimony Relative Noncentrality 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 both the TLI and PRNI.

TLI =χ Chi-square/degrees of freedom (null model) χ˜ χ Chi-square/degrees of freedom (hypothesised model) χ
Chi-square/(degrees of freedom˜ 1) (null model)

PRNI =χ Chi-square˜ degrees of freedom (null model) χ˜ χ Chi-square˜ degrees of freedom (hypothesised modelχ
Chi-square˜ (degrees of freedom˜ 1 (null model)

RMSEA= Square Root χ (Chi-square˜ degrees of freedom) (n˜ 1) degrees of freedomχ

All hypothesised models considered in this study converged to proper solutions. General Mastery, General Social, English Self-concept and Mathematics Self-concept were each inferred from five items. General Performance factors were inferred from eight items.

Factor Structure of Achievement Goals and Academic Self-concept

Model 2 (M2) tested the hypothesis of 28 items loading on five factors. Once six poorly fitting items were removed from Model 2 (M2), the model (M4 - without the six items) was tested with the same constraints as M2. M4 showed a better fit to the data than M2. Unlike M2, M4's GFI and AGFI are above 0.90 and the RMSEA is less for M4. The TLI and the PRNI increased for M4, approaching 0.90. Consequently, removing the six poorly fitting items from the original hypothesised model lead to an improved overall model fit to the data. To assess whether M4 is a significantly improved overall fit to the data than M2, the Chi-square and degrees of freedom for M4 were subtracted from the Chi-square and degrees of freedom for M2. Results from this computation attest M4 fits the data significantly better than M2. The revised model (M4) was tested with the second wave of data (M6). M6 also fitted the data well. M6 has the same GFI (0.92) and AGFI (0.90) as M4 however the RMSEA is slightly larger for M6 at 0.07. These results support the convergent and dicriminant validity of the measures, and indicate that these students differentiated among their achievement goals and self-concepts in the two curriculum areas, thus supporting the multidimensionality of both achievement goals and academic self-concept for two waves of data.

Models for Males and Females

The models for Time 1 (M4) and Time 2 (M6) fitted the data well and were used to determine whether the models fit equally well for males and females for two waves of data. At Time 1,

the models for males (M8) and females (M12) showed good fit with the data. For females, the GFI and AGFI are both above 0.90 and for males approaching 0.90. The TLI is slightly below 0.90 and the PRNI above 0.90 for females. For males, the TLI is 0.84 and PRNI is 0.89. Adequate fit for the RMSEA is provided for males and females at Time 1. Importantly, good fit to the data is also evident at Time 2 for both males (M10) and females (M14). At Time 2, for males and females, the GFI is above 0.90 and the AGFI approaching 0.90. Both M10 and M14 have a TLI slightly below 0.90 and a PRNI above 0.90. Adequate fit for the RMSEA is evident at Time 2 for males and females.

Higher Order Relations of Achievement Goals and Academic Self-concept

Model 16 (M16) at Time 1 and Model 18 (M18) at Time 2, tested the ability of an hierarchical representation of multiple achievement goal factors by the *Goal* factor and tested the ability of an hierarchical representation of English and maths self-concept by the *Academic Self-concept* factor. M16 and M18 demonstrated a good fit to the data. The GFI, AGFI and PRNI for M16 and M18 were above 0.90 and the TLI was 0.86 and 0.87 respectively. The RMSEA was greater than 0.05 for both models. Significant and substantial paths were evident from global goals to mastery, performance and social goals as well as the paths from academic self-concept to English and maths self-concept. These results support an hierarchical representation of both achievement goals and academic self-concept for Time 1 and Time 2.

Models for Males and Females

The higher order models for Time 1 (M16) and Time 2 (M18) fitted the data well and were used to determine whether the models fit equally well for males and females for two waves of data. At Time 1, the models for males (M20) and females (M24) demonstrated good fit with the data. For females, the GFI and AGFI are both above 0.90 and for males approaching 0.90. The TLI is slightly below 0.09 and the PRNI equal to 0.92. For males, the TLI is 0.83 and the PRNI 0.89. Adequate fit for the RMSEA is evident for males and females at Time 1. Importantly, good fit to the data is also evident at Time 2 for both males (M22) and females (M26). At Time 2, for males and females, the GFI is above 0.90 and the AGFI approaching 0.90. Both M22 and M26 have a TLI slightly below 0.90 and the PRNI for M22 is above 0.90 however slightly less than 0.90 for M26. Adequate fit for the RMSEA is evident at Time 2 for males and females.

Discussion

The purpose of this paper was threefold; first it examined the multidimensional nature of achievement motivation and academic self-concept. Second, it tested the ability of an hierarchical representation of achievement goals and academic self-concept. Third, it tested whether models fitted the data equally well across sex groups.

Multidimensionality was investigated using a hypothesised first-order factor model comprising academic achievement motivation and academic self-concept variables for secondary school students. The findings demonstrate that the adjusted model fitted the data well at Time 1 and Time 2 and provided equal fit to the data at both time points for males and females. Notably, the twenty-two items reflecting general mastery, general performance, general social goals and English self-concept and math self-concept, loaded significantly on the five targeted factors. Thus supporting the multidimensionality of the constructs, achievement motivation and academic self-concept.

As indicated previously, recent research has begun to examine the possibility of students pursuing a range of salient goals. Rather than limit the focus to traditional achievement goals, this study sought to investigate such an array of potential goals that may impact on students' achievement. Important to future research, the models in this study worked well with the inclusion of social goals, this suggests that social goals in addition to academic goals are important for students in educational settings. The combined ASDQ II and GAGOS provided adequate reliability estimates on each scale and validly measured the constructs. Thus, the study provides a measurement framework within which the interaction of multiple goal orientations and self-concept variables may be examined further.

Similar to a minority of studies, this study found support for an hierarchical achievement goal (Dowson & McInerney, 2003; McInerney, 1997) structure and an hierarchical academic self-concept (Yeung, Chui & Lau, 1999) structure. Achievement motivation studies more regularly examine individual goals as separate fragments rather than investigate the interaction of goals from a holistic perspective by posing a higher order factor. The convergent results drawn from the combined GAGOS and ASDQ II provide strong argument for the meaning of motivation being defined by mastery, performance and social goals and the meaning of academic self-concept being defined by English and math self-concept. Research in the area of achievement goals and academic self-concept will be of limited theoretical and applied value unless a holistic perspective is considered (McInerney et al, 2003).

Conclusion

Findings from this research provide support for the hypothesised longitudinal measurement model comprising academic achievement motivation and academic self-concept variables. Furthermore, the proposed models support the stability, convergent and discriminant validity of the measures, and indicate that these students differentiated among their achievement goals and academic self-concepts, thus supporting the multidimensionality and hierarchical nature of the two constructs. Importantly, the models fitted the data equally well for males and females thereby supporting cross sex validity.

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