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THE ROLES OF ACADEMIC MOTIVATION, SELF-CONCEPT, AND 
COGNITIVE AND BEHAVIOURAL ACTION IN PREDICTING 
EDUCATIONAL OUTCOMES: FINDINGS FROM LARGE-SCALE, 
CROSS-SECTIONAL, AND LONGITUDINAL MODELLING

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A thesis submitted to the University of Sydney in fulfilment of the requirements
for the degree of Doctor of Philosophy

January, 2009

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AUTHOR'S DECLARATION

This is to certify that:

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Signature:

[Signature]

Name: JASMINE GREEN
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ABSTRACT

Relatively little research has investigated the respective salience of academic motivation and academic self-concept in predicting academic processes and outcomes in the one analytical model. Given this, the present study proposes an integrative process model that assesses the relative roles of academic motivation, academic self-concept, cognitive action, and behavioural action in predicting test performance and test effort. In developing the hypothesised process model, the study harnessed three distinct lines of theoretical and methodological enquiry: (1) Connell and colleagues' self-system process model; (2) a cognitive-behavioural perspective; and (3) a construct validity approach.

Data were collected from high school students in years 7 through 12 at six Australian high schools. Time 1 (N=3,450 students) data were collected in the middle of the academic year and Time 2 (N=3,261 students) data were collected one year later (resulting in a longitudinal sample, N=1,866 students). Using confirmatory factor analysis, key psychometric findings demonstrated sound factor structure (for both first- and higher-order factor solutions) that was invariant across gender and year-level. Structural equation modelling (SEM) supported the hypothesised academic self-system process model at each time wave, such that: (a) academic motivation and academic self-concept predicted cognitive action; (b) cognitive action positively predicted class participation and homework completion and negatively predicted absenteeism; and (c) class participation and homework completion positively predicted test performance and test effort whilst absenteeism negatively predicted test performance and test effort. Importantly, longitudinal SEM demonstrated that Time 1 factors positively predicted their corresponding Time 2 factors and the majority of predictive paths at Time 2.
remained significant after controlling for shared variance with Time 1 counterparts. Findings from this research hold implications for the theoretical understanding of the constructs predictive of academic outcomes in high school, and also for educational practice and research relating to students' academic processes.
CHAPTER 1

INTRODUCTION

The investigation of the impact of academic motivation and self-concept on academic outcomes is a major field of study in psycho-educational research. Surprisingly, only a relatively small body of research has examined the combined and unique effects of academic motivation and academic self-concept on academic processes and outcomes in the one analytic model. Of the studies that have attempted to examine the juxtaposition of these central constructs, most have examined their effects in separate models or examined these constructs and their relations to academic achievement only (ignoring other potential processes relevant to academic outcomes). Stemming from this, a number of authors have criticised educational research for utilising limited, unidimensional, and unintegrated conceptualisations of motivation, self-concept, and engagement that has led to a lack of conceptual clarity and diffuse findings in these fields (e.g., Bong, 1996; Fredricks, Blumenfeld, & Paris, 2004; Marsh & Craven, 1997; Murphy & Alexander, 2000).

In order to facilitate a more comprehensive understanding of the underlying academic processes involved in attaining academic outcomes, the present study aims to extend previous research by proposing an integrated and multidimensional model which draws on three distinct lines of theoretical and empirical enquiry. The first line of theoretical enquiry is drawn from the self-system process model proposed by Connell and colleagues (Connell, 1990; Connell & Wellborn, 1991; Skinner, Wellborn, & Connell, 1990). This model posits relations between individuals' experience of 'social context', their self-system processes (i.e., 'self'), their pattern of 'action', and contextually relevant 'outcomes'. The second line of theoretical enquiry stems from the...
cognitive-behavioural approach which recognises distinct dimensions of self-system processes and actions that are relevant to the proposed integrative process model. The third and final perspective is a methodological one which promotes a construct validation approach to inform decisions on how to operationalise the hypothesised model, its measurement, and the appropriate analyses to better understand it. The substantive-methodological synergy of these three distinct but interrelated perspectives forms the basis of the measurement and modelling vital to understanding the relative roles of academic motivation, academic self-concept and academic action in students' academic outcomes, thus resulting in the hypothesised academic self-system process model.

Specifically, this integrative and comprehensive model proposes that, 'self' factors (conceptualised as multidimensional academic motivation and academic self-concept) predict cognitive action (conceptualised as positive school appraisal and positive academic plans). In turn, cognitive action is hypothesised to predict behavioural action (homework completion, class participation, and absenteeism), and behavioural action is proposed to influence academic outcomes (test performance and test effort on a standardised achievement measure). To test this hypothesised process model, the present investigation:

(a) Employs a cross-sectional and longitudinal research design;

(b) Utilises a large, representative cross-sectional and longitudinal sample;

(c) Examines the construct validity of the instrumentation underpinning the hypothesised academic self-system process model, both cross-sectionally and longitudinally;
(d) Applies appropriate methodological and statistical recommendations and techniques to empirically evaluate the theoretical links proposed in the academic self-system process model; and

(e) Examines the stability of the hypothesised academic self-system process model via sophisticated multivariate statistical analyses.

In sum, the current investigation is an attempt to unify the literature on motivation, self-concept, engagement and academic outcomes. In doing so, the study’s findings have the potential to:

(a) Develop an integrative measurement model of academic motivation, academic self-concept, cognitive action, behavioural action and academic outcomes underlying the hypothesised academic self-system process model;

(b) Extend previous research by specifying more encompassing approaches in which a range of constructs are considered simultaneously in the one analytical model;

(c) Extend motivation and self-concept research by examining the relative salience of academic motivation and academic self-concept on academic processes;

(d) Highlight and demonstrate the importance of a substantive-methodological synergy in educational and psychological research;

(e) Demonstrate the complex nature of relations between academic motivation, academic self-concept, cognitive action, behavioural action,
and academic outcomes from cross-sectional and longitudinal perspectives;

(f) Identify conceptual and methodological implications for future researchers and theorists; and

(g) Identify applied implications for educational policy and practice.

In working towards these yields, the early chapters in this thesis traverse important theory, research, and methodology relevant to the central issues. Chapter 2 presents a brief orientation to the guiding frameworks underpinning the hypothesised academic self-system process model. Chapter 3 examines the literature comprising the formulation of the links proposed in the hypothesised academic self-system process model and scopes the theoretical issues relevant to the present investigation. Chapter 4 presents the construct validity approach guiding the measurement and methodological element of the current research. In Chapter 5, relevant hypotheses and research questions based on the review of literature presented in the previous chapters are outlined and Chapter 6 provides an orientation to the methodology and methodological considerations relevant to the present investigation.

The remaining chapters present the results of statistical analyses and the discussion of findings. Specifically, Chapter 7 details the Time 1 psychometric properties of the instrumentation underpinning the hypothesised academic self-system process model. Chapter 8 examines the Time 1 relations between academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes using structural equation modelling (SEM). Based on the empirical findings at Time 1, necessary amendments are made to the a priori hypothesised academic self-system process model for subsequent testing of the model. Chapter 9 presents Time 2
psychometric property testing as well as the testing of the Time 2 relations between academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes using SEM. Chapter 10 presents psychometric findings for the longitudinal sample as well as the results of the longitudinal SEMs. Chapter 11 provides a general discussion of the key findings relevant to the cross-sectional and longitudinal analyses, the significance of findings for educational research and conceptualising, the relevance to educational intervention, as well as an examination of limitations and suggestions for future research. Finally, Chapter 12 summarises the key findings and provides concluding thoughts and statements.
CHAPTER 2

A BRIEF ORIENTATION TO THE GUIDING FRAMEWORKS
UNDERPINNING THE HYPOTHESESED ACADEMIC SELF-SYSTEM
PROCESS MODEL

Introduction

Over the past century, the elaboration of self-related phenomena, and the psychological study of self, have been shaped by a number of cognitive, social, and behavioural theoretical perspectives. Although these perspectives are distinct in numerous ways, one unifying theme is the identification and study of factors and processes that can most effectively explain thought and behaviour. The education domain and the academic processes within that domain are the focus of the present study which seeks to better understand the thought and behaviour underpinning high school students' academic motivation, academic self-concept, academic action, and academic outcomes. It does so by drawing on three distinct lines of theoretical and empirical enquiry to guide the overall conduct of the study. The first is drawn from Connell and colleagues' (Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990) self-system process model that casts academic development and achievement in terms of social context, self, action, and outcomes. This framework assists in shaping the research design (e.g., ordering of factors and their hypothesised relations). The second line of enquiry is the cognitive-behavioural approach (see Dobson & Dozois, 2001; Hughes & Hall, 1989; Kraus, 1995 for an overview of the cognitive-behavioural perspective), which recognises distinct dimensions of self-system processes that are relevant to practice and intervention. The cognitive-behavioural approach informs the particular facets of academic motivation and academic action to be assessed. The third
perspective is a methodological one that advocates a construct validation approach (see Marsh, 1997, 2002 for an overview of the construct validation approach), to most effectively assess the processes and outcomes under focus in this study. Taken together, the confluence of these three distinct but interrelated perspectives forms the basis of the measurement and modelling vital to understanding the relative roles of academic motivation, academic self-concept, and academic action in influencing students' educational outcomes.

The Guiding Conceptual Framework: The Self-system Process Model

A conceptual framework can be described as a collection of broad ideas and principles taken from relevant fields of enquiry which in turn are used to structure the subsequent production of ideas (Reichel & Ramey, 1987). Therefore, a clearly articulated conceptual framework has the potential to be an important research tool in that it can scaffold research, guide research questions, guide research design, and facilitate an informed interpretation of subsequent findings (Guba & Lincoln, 1989). Indeed, the importance of a strong theoretical underpinning has been highlighted by Tracey and Glidden-Tracey (1999), who state that:

Research adds little without a strong theoretical framework of the phenomenon of interest guiding the investigation. Purely exploratory examinations of the relations among a set of variables tell us little and do not help us integrate or understand the importance of such relations. (p. 306)

As previously indicated, one of the three central frameworks guiding this research is the general process model of relations among context, self, action, and outcomes proposed by Connell and colleagues – the self-system process model
(Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990). Specifically, the model posits links between individuals' experience of the social context (e.g., school), their self-system processes (e.g., motivation), their patterns of action (e.g., class participation), and contextually relevant outcomes (e.g., academic performance) that can be applied in the academic setting (see Figure 2.1).

![Figure 2.1. A simple process model of the relations among context, self, action and outcomes (adapted from Skinner et al., 1990).](image)

From this perspective, the notion of 'self' is viewed as a set of appraisal-related processes whereby the individual evaluates himself or herself within particular contexts and these context-specific appraisals of self (operationalised by Connell and colleagues as competence, autonomy, and relatedness) predict subsequent actions. These resulting patterns of activity or inactivity (operationalised by Connell and colleagues as engagement vs. disaffection) are considered to be a function of the variation in self-system processes within a specific context (e.g., school). In turn, these patterns of activity are proposed to impact on culturally or contextually relevant outcomes (e.g., achievement test scores).

Over the past decade, this general model of context, self, action, and outcomes (and pieces thereof) have been used to explore the self-system processes in a variety of social contexts, life stages, and populations. For example, the application of this framework has been utilised to study: (a) infant-caretaker relationships from an attachment theory perspective (e.g., Connell, 1985; Connell & Thompson, 1986); (b)
high school drop out (Vallerand, Fortier, & Guay, 1997); (c) self-determination in work
organisations (Deci, Connell, & Ryan, 1989); (d) grade retention effects in early
adolescence (Pierson & Connell, 1992); (e) perceived control and autonomy effects on
children's behaviour and emotion (Patrick, Skinner, & Connell, 1993); (f) perceived
control in early adolescence (Skinner et al., 1990); (g) effects of autonomy support on
adolescent motivation and achievement (Guay & Vallerand, 1997; Klem & Connell,
2004; Skinner, Furrer, Marchand, & Kindermna, 2008); and (h) academic risk and
resilience amongst African-American youth (Connell, Spencer, & Aber, 1994).

The multiple self-to-action-to-outcome linkages proposed by this framework are
important in that they differ from a majority of research which show only linkages or
direct relations between the self-perceptions (i.e., self) and educational outcomes. In
comparison to the framework outlined here, these direct relations are relatively
fragmented approaches to understanding these processes. In the self-system model
proposed by Connell, patterns of action are thought to mediate the relations between
self-system processes and the acquisition of skills or outcomes within certain
enterprises (Connell, 1990; Connell & Wellborn, 1991). Therefore, an important
principle underlying this self-system model is that the experience of the self is part of a
single, dynamic system with multiple constructs. It is, then, considered a useful basis
for hypothesising processes relevant to academic outcomes in the present study.

A Cognitive-behavioural Approach to the Self-system Process Model

The self-system process model described above provides a theoretical
framework that includes a set of self factors believed to be influenced by context (e.g.,
school) and that these appraisals of self then result in patterns of action (e.g., class
participation). The model also posits that these patterns of action contribute directly to
culturally or contextually defined outcomes (e.g., academic achievement). Although the model shares factors and themes that are common to many frameworks in education and psychology (e.g., motivation), as detailed below there are some key elements that align particularly closely with cognitive-behavioural approaches to academic processes and achievement striving.

The cognitive-behavioural approach is best understood as a general group of theories that share common assumptions, techniques, and strategies about the links between cognition and behaviour (Dobson & Dozois, 2001; Reinecke & Clarke, 2004). Put simply, the term 'cognitive-behavioural' reflects the importance of both cognitive and behavioural approaches to understanding individuals whilst integrating the principles of behavioural research (see Dobson & Dozois, 2001; Hughes & Hall, 1989). With this in mind, the current research not only retains the overarching cognitive-behavioural theme proposed by Connell and colleagues in which appraisals of 'self' predict 'action', but also extends the model by considering a more encompassing approach to the conceptualisations of 'self' and 'action'.

In relation to the 'self' component of the hypothesised academic self-system process model, the current research includes cognitive (e.g., self-efficacy) and behavioural (e.g., task management) facets of motivation. In relation to the 'action' component of the hypothesised academic self-system process model, the study includes cognitive (e.g., positive school appraisal) and behavioural action (e.g., homework completion). Through harnessing cognitive-behavioural distinctions, Connell's self-system model can be expanded to conduct a more encompassing analysis of academic processes, which assists in better differentiating the factors significant to outcomes relevant in the academic domain. This expanded approach to the self-system process
model, presented in Figure 2.2, shows a set of self variables (e.g., academic motivation and academic self-concept) embedded within the high school domain. These appraisals of self are then posited to result in patterns of action (such as cognitive action and behavioural action) within these endeavours. Connell's self-system process model goes on to posit that these patterns of action contribute directly to contextually defined outcomes relevant to the academic domain (e.g., test performance and test effort).
Figure 2.2. Adapted self-system process model of the relations among context, self, action, and outcomes (adapted from Connell 1990, 1991).
Methodological Guiding Framework: Construct Validation Approach

The guiding conceptual framework proposed by Connell and colleagues, and its expansion using a cognitive-behavioural perspective (see Figure 2.2), are vital for informing this study's factor selection, model ordering, and theoretical orientation. Importantly, however, alongside these conceptual and substantive perspectives are some key methodological considerations that help shape better research questions and model specification. These methodological considerations assist decisions on how to operationalise the model, the nature of measurement, and the selection of one instrument over another. Hence, the third perspective informing the conduct of the study and model formulation is a methodological one. Specifically, it is proposed that the construct validation approach has the potential to enhance the study of the substantive issues at hand through sound measurement and rigorous modelling.

The construct validation approach highlights the relations between the theoretical elaboration of a construct under investigation as well as its methodological validation (Kenny & Kashy, 1992; Morey, 2003; Tracey & Glidden-Tracey, 1999). The construct validation approach contends that theory, measurement, modelling, and practice are intimately related and therefore each has the potential to enhance the rigour with which hypothesised constructs are identified (Marsh, 1997, 2002). As a result of this rigour, construct validation investigations can be categorised as within-network and between-network studies (Marsh, 1997, 2002). A within-network study is one that explores the internal structure of a construct using statistical procedures such as factor and reliability analysis. A between-network study, however, aims to establish a logical and theoretically consistent pattern of relations between measures of a target construct and other related (in the case of convergent validity) or distinct (in the case of
discriminant validity) constructs (Marsh, 1997, 2002). The present study is shaped by these dual approaches to construct validity by establishing the descriptive, distributional, reliability, and measurement properties of constructs (the within-network component). Having established these core measurement properties, the next step is to incorporate them into a model that examines their inter-relationships (the between-network component). This construct validity approach, is crucial to ensuring that the factors presented in Figure 2.2, and the structural relations between these factors, are examined in robust and valid ways.

Chapter Summary

The guiding self-system framework proposed by Connell and colleagues and the cognitive-behavioural framework that informs the identification of specific factors are the cornerstones for assessing the academic processes hypothesised in this study. The construct validation framework is crucial for guiding the conduct of analyses to assess the hypothesised processes posited in the academic self-system process model. The confluence of these three frameworks is proposed as a substantive-methodological synergy (e.g., Marsh & Hau, 2007) to better understand the processes and factors relevant to students' academic outcomes – processes and factors that are addressed at a more detailed level in the following chapter.
CHAPTER 3

THE ACADEMIC SELF-SYSTEM PROCESS MODEL:
CONCEPTUALISATIONS OF CONTEXT, SELF, ACTION, AND OUTCOMES

Introduction

As briefly detailed in Chapter 2, the present research draws on three distinct lines of theoretical and empirical enquiry – self-system, cognitive-behavioural, and construct validation – to investigate the respective roles of academic motivation, academic self-concept, and related academic processes in predicting students' educational outcomes. These three frameworks are the key underpinnings of the substantive model, the questions surrounding it, and the methodology used to answer them. The focus of the present chapter is on the conceptual underpinnings of the hypothesised academic self-system process model. Hence, the first two of these three conceptual frameworks are presented in the present chapter: the self-system process model and the cognitive-behavioural approach. This chapter begins by outlining the importance of proposing an academic self-system process model. The chapter then proceeds to examine each of the major components of this model. Here, the context in which this research is embedded is outlined. Following this, the operationalisation of the 'self' component of the hypothesised process model is discussed. The role of the self in predicting cognitive action is then detailed, as well as the influence cognitive action has on behavioural action. Finally, the relations between behavioural action and academic outcomes are hypothesised. Taken together, these elements detail each component of the self-system process model proposed by Connell and colleagues (Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990) and are adapted for the
purposes of the present study assessing a hypothesised academic self-system process model.

Why Propose an Academic Self-system Process Model?

Before embarking on a discussion of the relevant frameworks informing the present investigation, the rationale and bases for proposing an academic self-system process model are first worth considering. Psychologists, researchers, and educators in the field of education have closely considered the role of various motivation constructs in academic development and learning (Bong, 1996; Graham & Weiner, 1996). Although academic outcomes such as achievement remain valued factors in the educational domain, these are not the only outcomes of importance to students' academic development during approximately 10 to 13 years of schooling (Linnenbrink & Pintrich, 2002a). Indeed, there is growing awareness and interest in other constructs that can be considered key ‘outcomes’ of formal education (Diperna & Elliot, 1999, 2002; Pintrich, 2000b). Summarising their report in the Australian context, McGaw, Piper, Banks, and Evans (1992) commented that:

School effectiveness is about a great deal more than maximising academic achievement. Learning and the love of learning; personal development and self esteem; life skills, problem solving and learning how to learn; the development of independent thinkers and well-rounded confident individuals; all rank as highly or more highly as the outcomes of effective schooling as success in a narrow range of academic disciplines. (p. 174)

In response to the growing awareness that academic competence extends beyond achievement measures (i.e., grades), educational research commonly assesses other constructs such as motivation, self-concept, engagement, cognition, affect, and well-
being dimensions (Pintrich, 2000b). It seems, then, that students require not only the ‘skill’ to do well in school, but also the ‘will’ to do well in school and that the ‘will’ to achieve or acquire a skill is indeed an outcome in itself (Covington, 1998, 2000, 2002; McCombs & Marzano, 1990; Pintrich & Schunk, 2002). However, although there is increasing recognition of the multidimensionality of academic processes and outcomes, much research continues to explore these constructs as predominantly independent phenomena and rarely in the one analytic model (Alexander, 2000; Pintrich, 1994).

According to Wigfield and Wentzel (2007), over the last 30 years, researchers have predominately focused on individuals’ beliefs, goals, and values as the major motivational underpinnings of academic behaviour. The need for a comprehensive and coherent model which can fully incorporate the dynamic interactions of these and other variables has been emphasised in recent commentaries by a number of prominent authors (Alexander, 2000; Bong, 1996; Pintrich, 1994).

The present research is an attempt to integrate a range of theoretical perspectives in one dynamic process model. Hence, in response to the calls for a more comprehensive and integrative model, the present research seeks to assess not only academic outcomes (measured by performance and effort on a standardised achievement measure) but also to incorporate and investigate other important processes – such as academic motivation, academic self-concept, and academic action – required to attain relevant educational outcomes. The broad selection and ordering of these constructs is influenced by Connell and colleagues’ integrative modelling of key constructs relevant to the academic domain. Using a synergy of substantive theory and methodological rigour, the present investigation models the multiple pathways involved in attaining a range of academic processes that then lead to important product outcomes such as performance. The theory and research surrounding each of the constructs under
focus in this present investigation will be presented according to the ordering of the constructs in the self-system process model proposed by Connell and colleagues—context, self, action, and outcomes.

**Adolescence and School as ‘Contexts’ in the Hypothesised Academic Self-system Process Model**

The first component of the hypothesised academic self-system process model (although not directly measured in this investigation) comprises the ‘context’ at which to situate the model (see Figure 2.2). In the case of the present research, two key aspects of context are adolescence (i.e., developmental context) and high school (i.e., academic context). Adolescence has been described as a pivotal stage of development characterised by significant physical, psychological, and social changes (Lord, Eccles, & McCarthy, 1994; Plancherel, Bolognini, & Halfon, 1998). Although all adolescents experience these developmental changes at one time or another, the effects of these changes are not uniform across all adolescents (Wigfield, Byrnes, & Eccles, 2006). For some individuals, adolescence marks the beginning of a ‘downward spiral’ (e.g., Eccles, Lord, & Midgley, 1991) described by some as a period of ‘storm and stress’ (see Arnett, 1999) that can eventuate in school dropout, maladaptive behaviours and poor psychological functioning (Rudolph, Lambert, Clark & Kurlakowsky, 2001). Interestingly, however, more recent research has challenged this perspective by adopting a more qualified ‘storm and stress’ approach that suggests that most individuals are able to successfully negotiate this developmental period without excessively high levels of turmoil or dysfunction (Eccles et al., 1993). What is not in question, however, is the fact that many academic challenges such as decreased motivation, low self-perceptions, and disengagement are more prevalent during the
adolescent years and so this period remains an important developmental context to investigate (Anderman & Maehr, 1994; Lerner & Galambos, 1998; Maehr & Meyer, 1997; Marsh, Ellis, Parada, Richards, & Heubeck, 2005; Wigfield et al., 2006).

The Initial Transition to High School

According to research, the transition from primary (i.e., elementary) school to high school appears to be an especially challenging period for students. It has been posited that this may be because adolescents face new demands associated with changes in school structure, classroom organisation, teaching strategies, academic standards, and teacher expectations (for a review of transition literature see Anderson, Jacobs, Schramm, & Splittberg, 2000; McGee, Ward, Gibbons, & Harlow, 2003; MacIver & Epstein, 1993). These changes can exert an adverse influence on adolescent functioning that includes declines in levels of academic achievement (Alspaugh, 1998; Blythe, Simmons, & Carlton-Ford, 1983; Eccles et al., 1989; Lipps, 2005), interest in school (Epstein & McPartland, 1976), and school engagement (Newman, Lohman, Newman, Myers, & Smith, 2000; Seidman, Aber, Allen, & French, 1996). It is also associated with a decline in self-esteem (Seidman, Allen, Aber, Mitchell, & Feinman, 1994; Simmons & Blyth, 1987, Wigfield, Eccles, Maclver, Reuman, & Midgley, 1991), and an increase in psychological distress (Chung, Elias, & Schneider, 1998; Lucey & Reay, 2000).

Of particular relevance to the present study, there is also a decline in academic motivation and engagement (e.g., Fredricks & Eccles, 2002; Harter, 1981; Martin, in press a; Otis, Grouzet, & Pelletier, 2005) and self-concept (e.g., Cole et al., 2001; Marsh, 1989) during adolescence. Although declines on these dimensions are not extreme for all adolescents, there is sufficient evidence to suggest that they warrant
detailed investigation (Seidman, et al., 1996; Seidman et al., 1994). In fact, notable researchers such as Anderman and Maehr (1994) contend that, "While important at all ages and stages, issues of motivation have a degree of uniqueness and certainly a special sense of urgency about them during middle grades. It is a period where there is heightened awareness of emerging adulthood." (p. 287).

A host of research has revealed general developmental declines in many of the important motivational constructs during the transition to high school. Harter (1981), for example, reported a shift from an intrinsic motivation orientation to an extrinsic motivation orientation over third grade to ninth grade, with the largest decline being between sixth grade and seventh grade. The notion of declining student motivation and attitudes has also been highlighted by the work of Simmons and colleagues (e.g., Blyth, Simmons, & Carlton-Ford, 1983; Simmons & Blyth; 1987), who found evidence of school transition effects whereby females moving into a traditional middle school showed more marked declines in self-esteem than females who remained in the same school setting (i.e., K-8). No comparable transition effect was found for males' self-esteem. Similarly, Harter, Whitesell, and Kowalski (1992) examined individual differences in the effects of secondary school transitions on early adolescents' perceptions of competence. A considerable amount of students in this study exhibited declines in self-perceptions following the school transition; however, a general finding of this study revealed that motivational declines were dependent on the individual resources children bring with them to the new school environment.

Likewise, Jacobs, Lanza, Osgood, Eccles, and Wigfield (2002) found that there was a steady decline in both students' self-perceptions of competence and subjective task value ratings as students got older (year 1 to 12) and the extent and rate of this
decline varied across school subjects. More generally, age differences in competence beliefs favour primary children across several activity domains (see Eccles, Midgley, & Adler, 1984; Stipek & MacIver, 1989, for reviews). Other domain specific research has found that children are more pessimistic about their ability and potential in mathematics and more negative about the value of mathematics from fifth to tenth grades with a sharp decline evident after the transition to junior high school (Eccles et al., 1983; Eccles et al., 1984).

**Beyond the Initial High School Transition**

Moving away from the investigation of the initial high school transition, Martin (2003a, 2004, 2007) and colleagues (Green, Martin, & Marsh, 2005) have examined variations in motivational cognitions and behaviours across year-levels and generally report that middle high school students (years 9 and 10) reflect less adaptive patterns of motivation. Recent Australian research has also begun to focus on the final two years of high school (years 11 and 12) - a period often ignored in motivational research. These final years may be important to investigate as students are likely to consider this period of school to be the most important because student performance outcomes have important ramifications for gaining entry into university and can affect other career pathways (Smith, 2004; Smith, Sinclair, & Chapman, 2002). Results of these studies indicate that declines occur in students' performance-approach goal orientations and academic self-efficacy in their final two years of senior high school and that concomitant increases occur in students' non-productive attributes such as self-handicapping strategies, performance-avoidance goal orientations, anxiety and depression (Smith, 2004; Smith, et al., 2002). Additionally, Australian studies have found that almost 50% of year 11 and 12 students experienced 'at risk' levels of
psychological distress during the highly competitive final years (Hodge, McCormick, & Elliot, 1997) suggesting that this is a developmental period that cannot be ignored (Smith & Sinclair, 2000). Indeed these important year levels are included in the current investigation's assessment of academic processes.

Empirical research surrounding self-concept also indicates that many of the domains of self-concept tend to decline during early adolescence (Cole et al., 2001; Eccles et al., 1989) and then rebuild slowly during later adolescence. Researchers have suggested that many adolescents become more negative about school and themselves after the transition from primary school to high school (Eccles et al., 1984; Wigfield et al., 1991). For example, research by Marsh, Parker, and Barnes (1985), found a decline in self-concept measures in years 7 to 9 and then a levelling out effect in years 9 to 11. Subsequent research by Marsh (1989) reported a decline in several domains of self-concept after year 7, reaching their lowest level in years 8 and 9 – most subject domains however manifested linear increases after that, through to year 11. Recent research also shows support for a curvilinear or 'U-shape' age effect (Harter, 1999; Marsh, 1992b; Marsh, Ellis et al., 2005) whereby many domains of self-concept drop during pre-adolescence and early adolescence, level out in middle adolescence, and then increase in late adolescence and early adulthood. To summarise this line of research, self-concept is expected to be highest in the junior and senior high school years and lowest in middle high school years (Marsh, Ellis et al., 2005).

Other studies, however, have not found such consistent year-level effects. For instance, Dusek and Flaherty (1981) found no consistent age effects in multiple dimensions of self-concept during the adolescent years. Interestingly, in 1984 Piers was not able to replicate earlier research findings (Piers & Harris, 1964) of a self-concept
increase in year 10 (using the Piers-Harris Children's Self-concept Scale). Similarly, subsequent research has found self-concept to remain stable across the high school transition (e.g., Chung et al., 1998; Hirsch & Rapkin, 1987) or has found many domains of self-concept to increase with age (Shapka & Keating, 2005). Thus, previous research has indicated that although adolescents generally report a decline in self-concept following the transition to secondary school there still appears to be no consistent pattern of age effects in adolescents' reports of self-concept.

Having described this general trajectory, it seems that variations in self-concept and motivation appear to be most prominent during the initial secondary school transition. It must be noted, however, that a large majority of the research reviewed here ignores the other important pathways that take place during adolescence such as the progression from junior high school to senior high school. While a number of studies have followed students from primary to secondary school, less is known about their transitioning throughout the high school years. Thus, in the proposed study, students will be assessed throughout all high school year levels (year 7 to 12).

The Role of Gender in Motivation and Self-concept

Of similar importance are the gender differences in motivation and self-concept commonly reported and the inconsistent findings that typify research on gendered development (Marsh & Yeung, 1998). Studies of gender differences in self-concept and motivation have typically yielded inconclusive results particularly in the case of gender by year-level interactions. For example, Martin (2003a, 2004, 2007) and colleagues (Green et al., 2005) have identified significant differences between male and female students with regards to motivated cognitions and behaviours. Their findings tend to show that females reflect a more adaptive pattern of motivation than their male
counterparts but that females also report higher levels of anxiety. Males on the other hand are found to report higher levels of maladaptive motivation dimensions such as self-handicapping and disengagement. Studies adopting a goal orientation perspective have found that males most often adopt performance goals and females more strongly endorse social and mastery goals (Giota, 2002; Meece & Holt, 1993; Wentzel, 1989, 1996a). Contradictory results, however, have been reported by Henderson and Dweck (1990) who found that females were more inclined than males to adopt performance goals. Similar contradictory findings were reported by Dowson, McInerney and Nelson (2006) who examined the influence of gender and school context on students’ goal orientation and found that females reported a greater adherence to both performance and mastery goals than males.

In regards to academic outcomes, females generally outperform males in a greater number of subjects (Collins, Kenway, & McLeod, 2000). For example, recent research conducted by Watt (2004) has shown declines in emotional and behavioural engagement through year 7 and between year 10 to 11 for both males and females. However, gender differences were most clear in the senior year-levels where males report greater declines in intrinsic value for English than females. Interestingly, the complex developmental patterns suggest that females report greater and earlier declines in the valuing of English than males, and the reverse later. In contrast, a longitudinal study (see Jacobs et al., 2002) examining gendered developmental trajectories found that in general, gender differences in task valuing declined with age. The gender differences that are magnified the most during adolescence surrounded the subject of language arts, with males’ feelings of competence and values decreasing more rapidly than females’ during junior high. They also conclude that males evidence more negative changes than females in English over the high school years (Jacobs et al., 2002).
When gender differences do emerge they are usually consistent with traditional
gender role expectations and stereotypes (e.g., gender differences in mathematic self-concept tend to favour males), which are suggested to be a result of gender role socialisation patterns by teachers, parents, and/or peers (Marsh, Byrne, & Shavelson, 1988; Meece & Courtney, 1992). It has been found that males evaluate their ability in mathematics as higher than their verbal ability (Rosenberg, 1979), and males tend to have more positive beliefs about their competence in mathematics than females (Eccles et al., 1993). Females, however, appear to have higher task values and higher self-perception of ability in English (Marsh, 1989; Wigfield et al., 1991) whereas males hold higher performance-approach orientations than females in mathematics (Middleton & Midgley, 1997). Amongst a Norwegian sample, Skaalvik and Skaalvik (2004) found that males report a higher self-concept for mathematics than females, however, older students (year 11) had higher verbal self-concept than mathematic self-concept regardless of gender. Likewise, Meece, Parsons, Kaczala, Goff, and Futterman (1982) found that by junior high school, females have lower mathematic self-concept than do males. Few gender differences in mathematic self-concept, however, are reported during primary school. Marsh, Byrne et al. (1988) also report higher mathematic and general self-concept for males but that females report higher verbal and academic self-concepts. A recent study examining gender differences, found that males were significantly higher in physical abilities, physical appearance, parental relations, emotional stability, general self-esteem, and mathematic self-concepts whereas females were significantly higher in same-sex relations, honesty, and verbal self-concepts (Marsh, Ellis et al., 2005). Other research which has found gender stereotypic differences suggests that these gender differences emerge during an early age and

These inconsistencies in the gender and year-level research further support the modified ‘storm and stress’ perspective which acknowledges that some adolescents will adapt well to the high school environment whereas others may find their high school years difficult and experience a decline in these motivational constructs. Accordingly, gender and year-level are warranted inclusions in the preliminary analyses of the academic process but are not the central focus of the thesis. Figure 3.1 shows the context of the present study (i.e., adolescence and high school) which is the initial component of the hypothesised academic self-system process model. Academic motivation and self-concept comprise the second component of the hypothesised academic self-system process model and will be detailed in the following section.
The context component of the hypothesised academic self-system process model.

The "Self" Component in the Hypothesised Academic Self-system Process Model

The next and possibly the most central component of the hypothesised academic self-system process model comprises the "self" related constructs. Connell and colleagues (Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990) emphasise the importance of appraisals of self embedded within social contexts. They view the self-system not as traits but as a set of dynamic adaptations to social contexts. An important principle underlying this model is the experience of self in concert with a
variety of self-system constructs. Thus, the self and other academic related processes are malleable and amenable to intervention. The self can also be seen as a dynamic formulator of intentions, enactor of choices, and generator of ‘will’ to engage in cognitive and behavioural action (McCombs & Marzano, 1990). Consistent with Connell and colleagues, the present research proposes motivationally-based conceptualisations of the self hypothesised to encompass academic motivation and academic self-concept embedded in the adolescent high school context.

**Academic Motivation**

The psychological study of self has been shaped by a wide range of theoretical perspectives including individual differences, social, neuropsychological, and clinical perspectives. Educational psychologists study self from an integrative perspective encompassing, *inter alia*, developmental, social, and cognitive frameworks – and within these frameworks the study of motivation is not an uncommon one. The term motivation can be conceptualised as the *reason* for action – a factor giving purpose, energy and direction to action (Frydenberg, Ainley, & Russell, 2005). Along these lines, academic motivation has been broadly described as students’ energy and drive to learn, engage, and achieve in the academic domain (Martin, 2003a, 2003b, 2007), hence most motivational theories are concerned with the energising and directing of behaviour (Ainley, 2001; Pintrich & Schunk, 2002). When endeavouring to model the academic process, Ainley (2001) highlighted the importance of including a range of key components that represent motivation because it is these components that are thought to direct and energise the learner’s behaviour in the academic process. Indeed, identifying these key components under the motivation framework is important because the ways in which researchers define their constructs plays a critical role in framing research.
questions, research design and ultimately findings (Alexander, 1996; Bong, 1996; Keith, 2002).

As briefly mentioned in a previous section, researchers are inclined to investigate motivational dynamics from particular and limited theoretical perspectives with relatively minimal emphasis on multidimensional perspectives (Byrnes & Miller, 2007; Martin, 2007). Although it is appreciated that these more tightly focused studies have contributed considerably to our understanding of motivation, there is also a need for research that successfully integrates theoretical perspectives into a coherent and comprehensive picture (Alexander, 2000; Bong, 1996; Murphy & Alexander, 2000; Pintrich, 1994, 2003a; Schunk, 2000). According to Linnenbrink and Pintrich (2002a) motivation is a multifaceted construct and as such students can be motivated in multiple ways. Research which aims to define and integrate diverse motivational perspectives has highlighted the complexity of the phenomena and the conceptual confusion and diffuse findings characterised by the field (Bong, 1996; Murphy & Alexander, 2000). For example, Pintrich (1994) reported that a majority of research on the processes involved in learning and achievement had predominately focused on cognitive, motivational, and affective components independently of each other.

On a related matter, some reviews of motivation research (e.g., Ames, 1992; Bong, 1996; Lepper, 1988; Murphy & Alexander, 2000) have identified that more or less parallel constructs have been developed from a range of different theoretical perspectives. For example, Wentzel and Wigfield (2007) highlighted that the terms motivation and engagement are often used interchangeably in the literature despite the important distinctions between motivation as a process that energises and directs action. Indeed this is a contention of the present study and is the next component of the
academic self-system process model (i.e., academic motivation related factors predict cognitive action). Stemming from this issue, Marsh, Craven, Hinkley, and Debus. (2003) highlighted the 'Jingle-Jangle fallacy' as an important impediment to research. This fallacy posits that different or distinct motivational constructs are being given the same label (jingle effect) and similar motivational constructs are being given different labels (jangle effect) thereby doing little to improve conceptual clarity. Put simply, a number of motivational orientations with apparently different labels appear to be actually measuring the same constructs and conceptually distinct constructs are labelled as conceptually similar (Murphy & Alexander, 2000; Schunk, 2000).

As a result of the lack of clear definitions and inconsistent approaches to measurement, there is confusion as to how these various motivational constructs are related and how the findings are interpreted and applied to practice (Murphy & Alexander, 2000; Schunk, 2000). For example, when reviewing research which takes a traditional goal orientation perspective, a profusion of research has shown that the adoption of mastery goals relate positively to adaptive patterns of cognition, affect, and behaviour in educational settings (Elliot & Dweck, 1988; Harackiewicz, Baron, Carter, Lehto, & Elliot, 1997; Harackiewicz, Baron, Tauer, Carter, & Elliot, 2000; Meece, Anderman, & Anderman, 2006; Nolan, 1988; Urdan & Mestas, 2006). However, a significant limitation of goal orientation research is the failure to consistently find a positive link between mastery goals and academic performance (McInerney, 2003). Some studies have found a positive relationship between mastery goals and academic performance (e.g., Ames, 1992; Finney, Pieper, & Barron, 2004; Linnenbrink, 2005; Sideridis, 2004; Tanka & Yamauchi, 2001; Urdan, 2004) whereas other studies have either failed to find a strong relationship between mastery goals and academic achievement (e.g., Grant & Dweck, 2003, Harackiewicz et al., 1997, Harackiewicz et
Despite advances in motivation research in the educational domain (e.g., goal theory), Covington (2000) has acknowledged much still remains to be discovered about the actual cognitions underlying the construction and commitment to goal directed strategies. An example of the lack of awareness about underlying cognitions can be seen in research surrounding self-protective strategies that may serve to influence the relations between more adaptive goals and academic achievement. In particular, research by Martin and colleagues (Martin, Marsh, & Debus, 2001a, 2001b, 2003; Martin, Marsh, Williamson, & Debus, 2003) emphasises the need to look beyond the mastery and performance dichotomy to include the self-protective strategies of defensive pessimism and self-handicapping. This line of emerging research further demonstrates that conceptualisations of motivation must consider a multi-dimensional perspective of motivation that extends well beyond the traditional mastery and performance goal distinction.

Other attempts to specify relations between constructs have found mixed results depending on the motivational construct under investigation. For example, Schmidt and Padilla (2003) found that after controlling for family characteristics (e.g., authoritative parenting style), self-esteem was not a significant predictor of grades or extracurricular
involvement, whereas family characteristics were positively associated with school grades (but not extracurricular involvement). Other constructs such as expectancies and values (e.g., Eccles et al., 1983), intrinsic motivation (e.g., Gottfried, Fleming, & Gottfried, 1994), and relatedness to significant others (e.g., Furrer & Skinner, 2003) have also been found to be significant predictors of school-related outcomes. Indeed a range of motivational constructs have been shown to relate to academic related outcomes however inconsistent findings continue to characterise this field. Various authors speculate that a number of inconsistent research findings are suggestive of major variations across studies, such as differences in definitions and in the quality of the measures used to assess motivation (Meece et al., 2006; Murphy & Alexander, 2000). According to Keith (2002), researchers (and consumers of research) should be wary that the variability in findings largely depends on: (a) the theoretical framework underpinning the research; (b) the constructs included in the research; and (c) how those constructs are defined and conceptualised.

A limitation that is characteristic of motivation research pertains to the conceptualisation of motivational constructs as unidimensional. In response to the somewhat fragmented picture of motivational findings, there have been repeated calls for more multidimensional and integrative approaches to the study of academic motivation (Bong, 1996; Dörnyei, 2000; Martin, 2007; Murphy & Alexander, 2000; Pintrich, 2003a). In fact, it is increasingly recognised that several motivations can underlie a student's behaviour and this multidimensionality is extremely important to consider if the complex nature of motivation is to be further understood (see Vallerand, 1997). In adopting more holistic approaches to motivation research, it is important to consider the variety of motivational constructs and theories and assess how and to what extent they relate to one another (Murphy & Alexander, 2000; Pintrich, 2003a). This is
seen as a first step in building an encompassing, multidimensional model of the processes relevant to academic outcomes. In recent years a number of educational researchers have undertaken such work and developed instrumentation to reflect the multidimensional nature of motivation. For example, Midgley et al. (1997) have developed Patterns of Adaptive Learning (PALS), Pintrich, Smith, Garcia, & McKeachie (1991) have developed the Motivated Strategies for Learning Questionnaire (MSLQ), McInerney and Ali (2006) have developed the Inventory of School Motivation (ISM), and Martin (2003b, 2007, 2008a) has developed the Motivation and Engagement Wheel (see Appendix A) and its accompanying instrumentation, the Motivation and Engagement Scale – High School version (MES-HS). The Motivation and Engagement Wheel (referred to hereafter as the Wheel) is but one example of recent attempts aimed at providing more integrative and encompassing approaches. This is the framework utilised in the present study to assess multidimensional academic motivation.

**Multidimensional Conceptualisation of Academic Motivation**

Although many models explore academic motivation, there are few integrative models seeking to explain motivated behaviour and cognition (Bong, 1996). According to Pintrich (2000b, 2003a), educational psychology – and educational research more broadly – should work towards 'use inspired basic research' which reflects a focus on not only a deeper scientific understanding of motivational constructs but also applied utility to improve motivation in educational settings. Partly in response to this, the Wheel was designed with a view to bridging the gap between diverse motivation theorising on the one hand and educational practice on the other.
The Wheel separates motivation into factors that reflect enhanced motivation and those that reflect impeded or reduced motivation. The Wheel comprises four higher-order dimensions: adaptive cognition, adaptive behaviour, impeding/maladaptive cognition, and maladaptive behaviour. It also possesses a first-order level comprising eleven factors. Adaptive cognition encompasses: (1) ‘self-efficacy’ (drawn from self-efficacy and social cognitive theory; e.g., see Bandura, 1997), (2) ‘valuing’ school (drawn from expectancy-value theory; e.g., see Eccles et al., 1983; Wigfield, 1994), and (3) ‘mastery orientation’ (drawn from goal theory; e.g., see Elliott & Dweck, 1988; Kaplan & Machr, 2002; Nicholls, 1989). Adaptive behaviour comprises: (4) ‘persistence’ (drawn from choice theory; Glasser, 1998), (5) ‘task management’, and (6) ‘planning’ (drawn from research into self-regulation; e.g., Miller, Greene, Montalvo, Ravindran, & Nichols, 1996; Miserandino, 1996; Zimmerman, 2001).

Impeding/maladaptive cognition includes: (7) ‘anxiety’ (Sarason & Sarason, 1990; Spielberger, 1985), (8) ‘uncertain control’ (drawn from control and attribution theories; e.g., Connell, 1985; Weiner, 1994), and (9) ‘failure avoidance’ (drawn from need achievement theory, goal theory, and self-worth motivation theory; Atkinson, 1957; Covington, 1992; Elliot & Sheldon, 1997; McClelland, 1965). Maladaptive behaviour includes: (10) ‘self-handicapping’ and (11) ‘disengagement’ (also drawn from need achievement theory, goal theory, and self-worth motivation theory; Atkinson, 1957; Covington, 1992; Elliot & Sheldon, 1997; McClelland, 1965). Martin (2007) provides an in-depth discussion of the origin and rationale for the factors underpinning the MES-HS.

The Wheel is operationalised and ‘measured’ through the MES-HS. Research surrounding the MES-HS has demonstrated that this instrument possesses a strong first-order and higher-order factor structure (Green, Martin, Marsh, & McInerney, 2006a;
Green, Martin, & Marsh, 2007; Martin, 2003b, 2004, 2007), is invariant across gender and year-levels (Green, Martin, Marsh, & McInerney, 2006b; Martin 2004, 2007; Martin, Marsh, McInerney, Green, & Dowson, 2007; Martin, Marsh, McInerney, & Green, in press), is significantly associated with various academic related outcomes (see Green et al., 2006a; Green et al., 2007; Martin, 2001, 2003b; Martin, Green & Marsh, 2004), is significantly associated with flow in learning (Jackson, Martin, & Eklund, 2008; Martin & Jackson, 2008), is applicable across various performance domains including sport, music, and work (Martin, 2008b, 2008c, in press b; in press c), and has been the basis for assessing educational interventions (Martin, 2005a, 2008a). It is this instrument that is the focus of multidimensional and integrative motivation measurement in the present study – and is discussed more fully in Chapter 6.

**Self-concept**

Alongside academic motivation, academic self-concept is proposed as another important component of 'self' under the self-system model. The definition of self-concept as "a person's perception of himself ... formed through his experience with his environment" (Shavelson, Hubner, & Stanton, 1976, p. 411) is broadly parallel with the general conceptualisation of the self component of the self-system model proposed by Connell and colleagues – that is, appraisals of self are embedded within a context. It is therefore reasonable to consider that a positive self-concept is valued as a desirable or critical goal across many educational settings (Australian Education Council, 1989; Brookover & Lezotte, 1979). A positive self-concept has long been understood as not only a desirable educational outcome or goal in itself (Marsh & Hau, 2003) but also as a predictor of other important and valued outcomes (Marsh & Craven, 2006; Marsh & Hattie, 1996). Importantly, during adolescence a positive sense of self can aid in
improving academic achievement (e.g., Chapman, Tunmer, & Frochnow, 2000; Guay, Marsh, & Boivin, 2003; Marsh, 1990b), course selection (e.g., Marsh & Yeung, 1997a), educational attainment (e.g., Guay, Larose, & Boivin, 2004), and the amount of effort a student exerts within the academic domain (e.g., Stipek & Gralinski, 1996).

Akin to motivation research, self-concept research is also characterised by inconsistent findings. Although a relationship between academic self-concept and academic achievement has been shown to exist, there is little agreement about the specific causal ordering of these constructs. That is, does academic performance influence academic self-concept, or does academic self-concept influence performance? Of the researchers who have attempted to examine causal relations between academic achievement and self-concept, most have estimated correlations based on cross-sectional studies (for an overview, see Byrne, 1996a, 1996b; Skaalvik, 1997). Based on the available literature, it is has been suggested (see Calsyn & Kenny, 1977) that there are three distinct models regarding the ordering between self-concept and academic achievement: (1) the self-enhancement model; (2) the skill development model; and (3) the reciprocal effects model.

The self-enhancement model posits self-concept as a primary determinant of academic achievement. As a result of this self-enhancement model, many of the self-concept enhancement programs rely on this assumption as the justification for such interventions (Calsyn & Kenny, 1977; Marsh, Hau, & Kong, 2002; Marsh, Trautwein, Ludtke, Koller, & Baumert, 2005). That is, educational interventions should devote effort to enhancing students' self-conceptions rather than fostering achievement. Conversely, if the direction of causality is from achievement to self-concept, then a skill development model which implies that academic self-concept emerges principally as a
consequence of academic achievement may be a more plausible explanation. This model assumes that the most effective way to enhance self-concept is to develop stronger academic skills (Calsyn & Kenny, 1977; Marsh et al., 2002; Marsh, Trautwein et al., 2005). Despite the importance of this issue, well-established paradigms for testing these models did not exist prior to the 1980s. Since self-conceptions do not lend themselves to experimental manipulation, longitudinal studies in which self-concept and achievement are measured on at least two occasions have been established as the most popular and effective method available to test these competing models (Marsh, Byrne, & Yeung, 1999).

A compromise between the skill development and self-enhancement controversy has been proposed in the reciprocal effects model, which implies that self-concept and academic achievement are reciprocally related and mutually reinforcing. That is, prior self-concept affects subsequent achievement and prior achievement affects subsequent self-concept (Guay, Marsh et al., 2003). This model has major implications for the importance placed on academic self-concept as a means of facilitating other desirable educational outcomes, as well as being an important outcome variable. According to Marsh et al. (2002), if students' academic self-concepts are enhanced without improving academic achievement then the gains in self-concept are likely to be short-lived. The same can be said for improving academic performance without fostering students' academic self-concept. If only one construct is under focus in an education setting then both are likely to suffer.

The first study to provide clear support for the reciprocal effects model was conducted by Marsh (1990b). In this study, he tested the causal ordering of academic self-concept and academic achievement with four waves of data (last 3 years of high
school and 1 year after high school graduation) based on standardised test scores, school grades, and academic self-concept. These results showed reasonably sound support for the reciprocal effects model in which the largest paths were from prior academic self-concept to subsequent school grades. A later study by Marsh and Yeung (1997b) also found strong support for the reciprocal effects model. They found that all paths from achievement to self-concept were significant (supporting the skill development model) and a vast majority of paths were significant for the self-enhancement model (self-concept to achievement). In their review, they concluded that research provides reasonably consistent support for the reciprocal effects model (see also Valentine, DuBois, & Cooper, 2004) with only a few notable exceptions. For example, Byrne (1986) found no cross-lagged effects, Shavelson and Blous (1982) reported only self-concept effects, and Newman (1984) reported only achievement effects (but in 1988, Marsh reanalysed this data and found some evidence for self-concept effects). As a result of these findings, academic self-concept is indeed a useful measure to include in the 'self' component of the academic self-system process model. Despite the support for the reciprocal effects model and the self-enhancement component of that model, there is a need for further research juxtaposing the combined effects of academic self-concept and motivation on academic outcomes beyond academic achievement. Indeed, this is something the present investigation aims to address through the hypothesised academic self-system process model.

The Conceptualisation and Measurement of Self-concept

Just as the field of motivation is beset with a lack of clearly defined motivational constructs, so too is the field of self-perception research. For example the conceptual difference between self-efficacy and self-concept is not always clear to researchers (see
Bong & Clark, 1999; Pajares, 1996; Pietsch, Walker, & Chapman, 2003; Valentine et al., 2004 for further discussion on the distinction between self-efficacy and self-concept research), with some researchers using these terms interchangeably (Reyes, 1984) and others who describe self-esteem as a generalised form of self-efficacy (Harter, 1990). In regards to self-concept, some research construes self-concept to be a unidimensional and global construct (see Baumeister, Campbell, Kruger, & Vohs, 2003; Rosenberg, 1979; see also Hattie, 1992a for a meta-analysis review). However, this perspective has been called into question (see Marsh & Craven, 1997; Wylie, 1979). Relying on unidimensional definitions of self-concept, without understanding its underlying multidimensional structure, has been shown to be the source of many of the problems encountered by much of the traditional self-concept research (Marsh & Craven, 1997; Shavelson et al., 1976). This is especially relevant when reviewing the abundance of contradictory self-concept intervention research, which many authors attribute to the use of imprecise theoretical and methodological foundations (see Hattie, 1992a; Marsh & Craven, 2006; O’Mara, Green, & Marsh, 2006; O’Mara, Marsh, Craven, & Debus, 2006).

Shavelson et al. (1976) developed a theoretical model of a multidimensional, hierarchical self-concept in which general self appears at the apex and is divided into academic and non-academic components that are further divided into more specific elements. This ‘landmark’ review of the theoretical construction of self-concept has had a profound influence on subsequent self-concept research (Marsh, 1990a), which has consequently led to considerable advances in the quality of self-concept research due to much stronger theoretical models, better measurement instruments, and improved methodology (Marsh & Craven, 1997).
Subsequent research (Marsh, 2007; Marsh, Byrne et al., 1988; see also Marsh & Craven, 1997 for review) has also been important in demonstrating the existence of separate dimensions of self-concept as well as the increasing differentiation and complexity of self-concept with age (e.g., Marsh, 1989; Marsh, Ellis et al., 2005). A wealth of research continues to support the multidimensionality of self-concept (e.g., Marsh, 1986; Marsh, Ellis et al., 2005; Marsh & Yeung, 1998; Shavelson & Bolus, 1982), indicating that academic self-concept is clearly differentiated from general self-concept and that academic self-concept is more highly correlated with academic achievement and other academic behaviours than is general self-concept.

Although there has been weak support for the proposed hierarchy of self-concept (e.g., Byrne, 1996a; Marsh, 1990a), its domain specificity has received substantial support, leading to recommendations to consider the differentiated nature of self-concept in educational research and educational settings (much akin to recent calls in the motivation literature, e.g., Bong, 1996; Murphy & Alexander, 2000; Pintrich, 1994, 2000a, 2000b, 2000c, 2003a). For example, Marsh, Byrne, and Shavelson, (1988) found that none of the general self-concept scales from three different instruments were significantly correlated with grades in all the school subjects under investigation, whereas academic self-concept scales were substantially correlated with achievement. Similarly, Marsh and Craven (2006a) confirmed that academic achievement is more positively and strongly related with the academic components of self-concept than with the non-academic components. These patterns of responses remain consistent with the recognised need for educational research to utilise academic self-concept (under the multidimensional framework) rather than general self-concept (under the undimensional framework) scales (Marsh & Craven, 1997). Accordingly, the present study adopts the domain-specific and differentiated approach to self-concept (Marsh, 1992b) by
assessing students’ academic self-concept (and not their general self-concept, non-academic self-concept, or general self-esteem).

Significantly, however, although self-concept has attracted considerable research attention in recent years, some have noted the relative dearth of empirical research considering the combined and unique roles of motivation and self-concept in the one analytic model (e.g., Barker, Dowson, & McInerney, 2005a, 2005b, 2006a, 2006b; Martin, Green, Marsh, McInerney, & Colmar, 2008). Indeed, these researchers have identified this as a fruitful direction for research and given its potential importance, is considered another central part of the present investigation.

Academic Motivation and Academic Self-concept: Towards an Integrated Model

As outlined above, academic motivation and academic self-concept are but two of the many constructs which feature in the hypothesised academic self-system process model. According to various researchers (e.g., Barker, 2007b; Barker et al., 2006a, 2006b; Skaalvik, 1997; Skaalvik, Valas, & Sletta, 1994), surprisingly there appears to be little integrative research investigating motivation and self-concept in the one analytic model. The investigations of self-perceptions have featured prominently in motivational research and remain a salient feature of several theoretical perspectives (see Maehr & Meyer, 1997 for a review) such as self-efficacy (e.g., Baumeister et al., 2003). However, researchers of motivation theory can appear to avoid explicit discussion of self-concept, instead, referring more specifically to perceptions of ability or self-efficacy (Anderman, Anderman, & Griesinger, 1999; Pajares, 1996). Similarly, although self-concept researchers have asserted the motivational properties of self-concept (Byrne, 1984; Craven & Marsh, 2004; Hattie 1992), they tend not to engage in direct discussion of other motivational frameworks. The importance of these two
constructs has been echoed by the Organisation for Economic Co-operation and Development (OECD) which reports that motivation and self-concept are “closely tied to students’ economic success and long-term health and wellbeing” (OECD, 2003, p. 9).

Thus, although an abundance of research has examined the relations between (a) academic motivation and educational outcomes, and (b) academic self-concept and educational outcomes, little research has directly investigated the relative salience of motivation and self-concept in the one model. Some notable exceptions include research conducted by Barker and colleagues (Barker, 2007a, 2007b; Barker et al., 2005a, 2005b, 2006a, 2006b; Dowson, Barker, & McInerney, 2003) who have investigated the causal relations between academic self-concept and varying dimensions of motivational goals. This research has shown that both mastery goals and self-concept have positive effects on mathematic and English achievement, and that self-concept is effective in balancing out the negative effects of performance and social goals on achievement – thus showing that considering motivation and self-concept in the one model provides important information over and above research which considers each in isolation.

Although this research has shown that self-concept is causally predominant over goal orientations, no research has investigated the relative salience of a diversity of motivation constructs and self-concept on the various academic processes that may also lead to academic related outcomes such as achievement. The present research seeks to directly address this issue by going beyond the separate analyses of these key constructs and assessing the combined and unique roles of multidimensional academic motivation and academic self-concept in the academic process (see Figure 3.2). It proposes an integrated model which not only incorporates both motivation and self-concept theory,
but also relates these constructs to cognitive and behavioural action and academic outcomes (i.e., test performance and test effort). This academic self-system process model demonstrates how these constructs interrelate but, more importantly, how they relate over time. Indeed, this is consistent with the self-system model proposed by Connell and colleagues, suggesting that 'self' is located in the context of a multitude of constructs within a broader dynamic model.
The 'Action' Component in the Hypothesised Academic Self-system Process Model

As reported earlier, according to the self-system model proposed by Connell and colleagues, variation in self-system processes produce variability in patterns of action (see also Figure 2.1). Moreover, these patterns of action are thought to mediate the relations between self-system processes and contextually-related outcome measures. Thus far, the processes explored have focused on the ‘self’ factors (academic motivation and academic self-concept) relevant to achievement-relevant patterns of
action. In the hypothesised academic self-system process model, motivation is also
proposed to give rise to action or propel individuals into action. This prediction is in
line with Nuttin (1984), who suggested that:

It is generally accepted that a state of need or motivation activates an
individual’s behaviour... Motivation activates not only a subject’s overt
behaviour and movement but his [her] cognitive functions as well. In other
words, a state of need makes us think, as much as it makes us move (p. 12).

Thus, consistent with the cognitive-behavioural framework articulated at the
outset of this study, it is also proposed that ‘action’ in the academic self-system process
model comprises cognitive and behavioural dimensions. Also consistent with the
cognitive-behavioural perspective, it is hypothesised that cognitive action is predictive
of behavioural action. Thus, ‘self’ factors (academic motivation and academic self-
concept) are hypothesised to predict cognitive action. In turn, cognitive action is
proposed to predict behavioural action. The notion of ‘action’ fits well as an essential
pathway in a process through which motivation and academic self-concept influence
important school-related outcomes. Hence, under focus now is the action component of
the proposed model. In the current investigation and consistent with Martin and
colleagues (Martin, 2007; Martin, Green et al., 2008), cognitive action is proposed to
comprise positive school appraisal and positive academic plans. Behavioural action is
proposed to comprise homework completion, class participation, and absenteeism.

**Cognitive and Behavioural Action**

As identified at the outset of the introduction, the present study conceptualises
‘action’ from a cognitive-behavioural perspective. That is, students are proposed to
'act' as a result of their beliefs or cognitions about themselves, their environment, and their academic achievement experiences (Pearl, 1985). As previously acknowledged in this thesis, educational literature presents a range of terms for somewhat similar constructs - to which the notion of 'action' in the student academic process is no exception (see Marsh et al., 2003 for a discussion on the jingle-jangle fallacy).

The conceptualisation of 'action' in the academic self-system process model can be considered to share conceptual overlap with processes labelled by some researchers as 'academic enablers' (see Diperna, 2006; Diperna & Elliot, 1999, 2002). These authors conceptualise academic enablers as student attitudes and behaviours that facilitate student participation in the classroom but which also feature motivation constructs in their definition of academic enablers. However, under the hypothesised academic self-system process model, the notion of 'action' is most closely aligned with the concept of academic 'engagement' which has attracted growing attention in recent years (Appleton, Christenson, & Furlong, 2008; Fredricks et al., 2004; Jimerson, Campos, & Greif, 2003; Zyngier, 2008).

Broadly speaking, engagement is commonly understood as motivation in action (Frydenberg et al., 2005) and there are a number of facets relevant to students' engagement with school. As is the case with motivation research and literature, shortcomings in defining and operationalising student engagement have resulted in limited conceptual clarity for the engagement field (Appleton et al., 2008; Fredricks et al., 2004; Zyngier, 2008). For example, some researchers conceptualise engagement as a composite of specific classroom behaviours only (e.g., DiPerna, 2006; Greenwood, Horton, & Utley, 2002), whereas others investigate a combination of either the cognitive, behavioural, and emotional components (e.g., Furlong & Christenson, 2008;
Furrer & Skinner, 2003; Helme & Clarke, 2001; Jimerson et al., 2003; Newmann, Wehlage, & Lamborn, 1992; Skinner & Belmont, 1993). Interestingly, Connell and colleagues (see Connell, 1990; Connell & Wellborn, 1991) conceptualise action as 'engagement versus disaffected' patterns of activity. Under their framework, the engagement distinction refers to patterns of action which reflect either an acceptance of, or commitment to, the goals of learning. Conversely, the disaffected component refers to patterns of action which reflect a lack of commitment to goals. According to Connell (1990), patterns of action can include cognition, emotion, and behaviour which are proposed to result in six different prototypes of engagement and disaffection. These include: innovative, enmeshed, conformist, rebellious, ritualistic, and withdrawn (see also Connell & Wellborn, 1991). Despite this multidimensional perspective of engagement (i.e., action), a vast majority of research which utilises the self-system model tends to investigate only reports of behavioural and emotional engagement (see Connell et al., 1994; Patrick et al., 1993; Skinner & Belmont, 1993; Skinner et al., 1990) or fail to measure or incorporate engagement at all in their models (see Guay & Vallerand, 1997; Pierson & Connell, 1992).

In an extensive review of school and classroom engagement, Fredricks et al. (2004) acknowledged that there was considerable overlap between the underlying constructs of cognitive, affective, and behavioural engagement (particularly between affective and cognitive engagement, and behavioural and cognitive engagement) as well as overlap with motivational constructs previously studied (e.g., intrinsic motivation and cognitive engagement). Thus, the application of these terms varies between researchers and as such, engagement has been conceptualised as an outcome in itself as well as a predictor of academic outcomes such as achievement (Fredricks et al., 2004; Frydenberg et al., 2005).
In a bid to stay aligned with the self-system framework components, the term ‘action’ rather than engagement is utilised in the present investigation (see Appendix B for further discussion on the distinction between action and engagement). Consistent with the cognitive-behavioural perspective, the present study considers both cognitive and behavioural dimensions of action. Specifically, cognitive action comprises positive school appraisal and positive academic plans, and behavioural action comprises homework completion, class participation, and absenteeism. Also consistent with the cognitive-behavioural perspective, cognitive action is posited to predict behavioural action in the hypothesised academic self-system process model. Each of these dimensions and their links is now discussed.

**Cognitive Action**

Positive school appraisal and positive academic plans are constructs used in the present study to represent cognitive action. Obviously these two constructs are not intended to reflect the full breadth of cognitive action in students’ academic lives. Rather, they are used as indicators of cognitive action in the hypothesised academic self-system process model (see Martin, 2007, in press a). Importantly, however, these factors map onto an emerging area of research relevant to ‘present’ and ‘possible’ selves (Pintrich, 1994) and so represent a potentially important contribution to this evolving line of work.

Possible selves are cognitive representations of the self in the future that can orient behaviour and play a role in ongoing activity (Hoyle & Sherrill, 2006; Oyserman, Bybee, & Terry, 2006; Oyserman, Terry, & Bybee, 2002). This is consistent with the present study’s approach to model cognitive action predicting behavioural action. Indeed, since original treatments of the construct (see Markus & Nurius, 1986), possible
selves have been described as cognitive elements that direct one's self-relevant actions (Markus & Ruvolo, 1989). According to Hoyle and Sherrill (2006), much of the research on possible selves has focused on the content of this construct and not on testing the motivational consequences of possible selves in a context of models seeking to explain behaviour. The present study is an attempt to do this. Indeed, students’ positive school appraisal represents the current or present self at school and students’ positive academic plans represent the future or possible self in the academic domain; both of which are proposed to influence behavioural action in the hypothesised academic self-system process model.

Positive school appraisal\(^1\) reflects the extent to which students are currently and positively oriented towards school, appraise school as enjoyable, and experience school satisfaction. Since a positive cognitive evaluation of school also encompasses interest and satisfaction, its role in the learning context has implications for subsequent behavioural action such as high school completion, (see Batten & Russell, 1995; Holden & Dwyer, 1992) and school engagement (Fullarton, 2002). The importance of including a construct such as the cognitive appraisal of school in future educational research has been recently highlighted by Huebner and colleagues (Huebner, 1994; Huebner, Ash, & Laughlin, 2001; see also Epstein & McPartland, 1976).

\(^1\) It is recognised that the conceptualisation of students’ positive academic appraisals comprises not only a cognitive component but also an affective component. Indeed, research over the past decade attests to an ongoing debate about the differentiation between cognition and affect suggesting that these constructs are closely intertwined (e.g., Ainley, 2006; Izard, Ackerman, Schoff, & Fine, 2000; Scherer, Schorr, & Johnstone, 2001) and play an important role in determining behavior (see Dobson & Dozois, 2001; Kraus, 1995). Although positive academic appraisals encompass an affective component, the empirical assessment of these constructs (see Chapter 8), demonstrates that positive academic appraisal forms a single cognitive action factor with the ‘distinctly cognitive’ construct of positive academic plans. If positive academic appraisal were a predominately affective construct then distinct factors would have emerged in the empirical assessment of these constructs. As a result, the term cognitive action will be retained throughout this thesis.
**Positive academic plans** are another cognitive action relevant to the academic process, reflecting students’ positive intentions and aspirations for their continued schooling and education. Within the possible self framework, there is an underlying belief that present actions matter for the actualisation of the future or possible self. In the current investigation, students’ thoughts about whether to remain in school or continue education reflect an underlying belief along these lines and studies have indicated that students who have academic aspirations are less likely to drop out of school (e.g., Ekstrom, Goertz, Pollack, & Rock, 1986). Indeed, in a recent analysis of Longitudinal Surveys of Australian Youth (LSAY) data (1980 – 1999 LSAY data); educational aspirations were amongst the key factors found to be a significant influence on participation in the final year of school (Marks, Fleming, Long, & McMillan, 2000). Hence, a student with positive educational aspirations and a school-focused possible self will most likely engage in behaviours (such as regular school attendance) that assist in attaining their possible self. Research conducted by Martin and colleagues (Green et al., 2007; Martin, 2007; Martin, Green et al., 2008) have successfully used these constructs in motivation research as important validational constructs demonstrating sound psychometric properties, as well as demonstrating relations with motivation, in order to aid in a better understanding of the academic process.

**Behavioural Action**

According to Fredricks et al. (2004), behavioural action\(^2\) (i.e., engagement) can be broadly defined in terms of positive academic conduct (e.g., school attendance and homework completion), involvement in learning and tasks (e.g., concentration and

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\(^2\) Although the term ‘behavioural action’ may at first appear non-parsimonious, it is employed to clearly differentiate between the cognitive dimensions of action in the self-system framework proposed by Connell and Colleagues (Connell, 1990; Connell & Wellborn, 1991; Skinner, Wellborn, & Connell, 1990). This multidimensional conceptualisation is also used in engagement research (see Fredricks et al., 2004) to which the term ‘action’ is closely aligned.
contributing to class discussion), and participation in academic and non-academic school-related activities. Essentially, behavioural action can be conceptualised as what students ‘do’ to remain involved in learning and the learning process. The present study remains consistent with this conceptualisation of behavioural action – but extends this to encompass three domains salient in students’ academic behaviour: home-based behaviour, classroom-based behaviour, and school-relevant behaviour. Homework completion is used as a measure for home-based behaviour, class participation is used as a measure for classroom-based behaviour, and absenteeism (days absent from school) is used as a measure for school-based behaviour. Importantly, these three behavioural actions also broadly map onto Fredricks et al.’s (2004) conceptualisation of behavioural engagement. As is the case with cognitive action, they obviously do not reflect the potential breadth of behavioural action in students’ academic lives. Rather, they are used as indicators of behavioural action in the hypothesised academic self-system process model (see Martin, 2007, in press a).

*Homework completion* in this research reflects the engagement with and completion of work set by teachers that students are expected to undertake outside of school hours - presumably in the home (Sharp, Keys, & Benefield, 2001; Trautwein, Lüdtke, Schnyder, & Niggli, 2006). *Class participation* reflects students’ active involvement within the classroom. Some behaviours which are considered indicative of classroom participation are involvement in class discussion, involvement in group work during class as well as participation in general classroom activities. *Absenteeism* is conceptualised as a period of not attending school (i.e., broken attendance; Teasley, 2004). According to Kearney (2007), absenteeism refers to excusable or inexcurable absences from school. Absenteeism and truancy are among the most visible signs of
behavioural disengagement from school (Reid, 1999; 2005; Teasley, 2004) and found to be especially prevalent in high school (Attawood & Croll, 2006).

Several studies have demonstrated significant links between behavioural action and achievement-related outcomes (e.g., standardised tests and grades) for primary and high school students (e.g., Skinner et al., 1990), as well as school completion and school drop-out (e.g., Ekstrom et al., 1986). These behavioural action-to-outcome links are dealt with in more detail below. Behavioural action is proposed as another important component in the hypothesised academic self-system process model and the present study is specifically aimed at assessing its role.

Motivation, Self-concept, and Links to Cognitive Action

As proposed in the original self-system model (Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990), variations in self-system dimensions produce variations in patterns of action. The self-to-action-to-outcome linkages proposed by this framework offer an encompassing perspective on the direct relations between self, patterns of action, and academically related outcomes. Furthermore, in this model, patterns of action are proposed to mediate the relations between self (e.g., academic motivation and academic self-concept) and contextually relevant outcome measures (e.g., test performance and test effort). As discussed above, academic action in the present study comprises cognitive action (positive school appraisal and positive academic plans) and behavioural action (homework completion, class participation, and absenteeism) – consistent with the guiding cognitive-behavioural perspective and recent conceptualisations of academic engagement research (Fredricks et al., 2004).

Hypothesised relations between motivation, self-concept, and academic action are now
addressed. This is followed by a subsequent section of hypothesised links between cognitive and behavioural action.

Motivation and Cognitive Action

Motivation in this research is a set of processes that energises and directs action and is based on the idea that when individuals are motivated, they become more cognitively engaged in the academic process. In the last two decades, cognitive research has come to more fully appreciate the importance of motivational constructs in shaping student cognition. Conversely, motivational researchers have also become cognisant of the influences of motivational beliefs and student cognition in the academic domain (see Pintrich, 2000a, 2000b, 2003b). This motivation-to-cognitive action link is supported by a variety of Australian studies. For example, Martin (2003b, 2007, in press a) has extensively demonstrated relations between motivation and the cognitive action constructs utilised in the present investigation (i.e., positive academic plans and positive school appraisal; see also Green et al., 2007). Martin’s work on academic buoyancy has also shown significant positive relations between student evaluations of efficacy and positive school appraisal (Martin & Marsh, 2006, 2008b) and positive academic plans (Martin & Marsh, 2008b). Similar research assessing students’ goals has also demonstrated significant links between cognitive motivation and positive academic plans and positive school appraisal (Martin, 2006). Other Australian-based research investigating the motivational behaviours and cognitions of Indigenous and non-Indigenous high school students found adaptive academic motivation constructs to be related to self-reported appraisals of school (Bodkin-Andrews, 2008; Bodkin-Andrews, Craven, Marsh, & Martin, 2005b). Taken together, these Australian studies are some examples of research which supports the hypothesised link between
motivation and various aspects of cognitive action (e.g., positive school appraisal and positive academic plans).

The hypothesised link between motivation and these academic actions is also supported by Bandura (1986, 1993) who proposed that students' belief in themselves to master academic activities (i.e., self-efficacy) determines not only their academic performance (e.g., cognitive abilities) but also their career and educational aspirations (see also Bandura, Barbaranelli, Caprara, & Pastorelli, 1996, 2001). School satisfaction research is another area of research which has attempted to identify the impact of self-efficacy on academic relevant processes. This line of research has demonstrated intrapersonal variables such as academic self-efficacy (along with a host of environmental variables) to be a related with students' reports of school satisfaction (see Baker, 1998; Dobson, Campbell, & Dobson, 1982; Huebner & McCullough, 2000). More recently, Huebner et al. (2001) have extended this research and have demonstrated that adolescents' locus of control orientation is also effective in mediating the association between negative life events and school satisfaction reports. For example, acute negative life events were associated with external perceptions of control which in turn were associated with reduced reports of school satisfaction.

Other researchers have demonstrated similar motivation-to-cognitive action links with a host of other motivational constructs. For example, it has been shown that students higher in motivation (e.g., valuing) aspire to more advanced or optional courses throughout their schooling and are also more likely to report positive future enrolment intentions (Eccles, Wigfield, & Schiefele, 1998; Hackett, 1985; Meece, Wigfield, & Eccles, 1990; Nota, Soresi, & Zimmerman, 2004; Otis et al., 2005; Wolters, 2004). Conversely, students with low levels of motivation are less likely to
aspire to advanced or optional courses in mathematics (Sherman & Fennema, 1977). In related work, researchers have shown that self-regulation is positively related to positive appraisals of learning (Goetz, Hall, Frenzel, & Pekrun, 2006) and positive attitudes towards school (Pekrun, Goetz, Titz, & Perry, 2002). A positive appraisal of school is also found to be related to the goals students have for their academic experience whilst at school as well as in their further education and training beyond school (Elliot & Sheldon, 1997; Lee et al., 2003; Remedios, Lieberman, & Benton, 2000). That is, individuals with mastery goals tend to report positive evaluations and absorption in a task as well as enjoyment of challenging tasks (Dweck & Leggett, 1988; Elliot & Church, 1997). In other research, positive appraisals of task were found to be closely aligned to task motivational orientation (e.g., Lepper, 1988; Marsh et al., 2003).

In other domains at school, research examining music and physical education/activity has shown motivation constructs to be positively related to appraisals of school (Biddle, Wang, Chatzisarantis, & Spray, 2003; Martin, 2008b, 2008c; Scanlan & Simons, 1992; Sloboda, 2005; Wang & Liu, 2007) and positive academic plans (Martin, 2008b, 2008c; Sloboda, 2005; Watson, 1986). Additionally, it has been found that self-efficacy, instrumentality, and goal orientation have a significant impact on students’ cognitive engagement and achievement (Greene, Miller, Crowson, Duke, & Akey, 2004). This body of research demonstrates clear links between students’ motivation and various cognitive action constructs that are akin to the present study’s positive appraisal of school and positive academic plan constructs.

**Self-concept and Cognitive Action**

The hypothesised link between self-concept and cognitive action also has an evidence base. For example, using a nationally representative longitudinal study of high
school students, Marsh (1991) investigated the effect of school-average ability on a wide range of educational outcomes including academic aspirations. When controlling for academic self-concept, the previously confirmed negative effects of school-average ability were reduced, and as such, academic self-concept showed considerable total and direct effects on educational aspirations. Self-concept research has also shown that high self-concept in specific school subjects predicts students' future course selections (Marsh & Yeung, 1997a) and that academic self-concept (and other related self-concept factors) significantly predict a positive appraisal of school as well as student aspirations in both Indigenous and non-Indigenous samples (Bodkin-Andrews, Craven, & Martin, 2006; Bodkin-Andrews, Craven, & Marsh, 2005a; Craven, Martin, Munns, & Ha, 2006).

Some researchers have also shown that academic self-concept influences student interest (e.g., Krapp, 2000) whilst others have further proposed that the effect of achievement on interest may be mediated by academic self-concept (Baumert, Schnabel, & Lehrke, 1998). As a way to align self-concept research more closely to mainstream motivation research, a recent study by Marsh, Trautwein et al. (2005) reported on longitudinal data from two nationally representative samples of year 7 German students. It was found that prior self-concept significantly affected subsequent mathematic interest (as well as school grades and test scores), whereas prior mathematic interest had only a small effect on subsequent mathematic self-concept. In summary, consistent with research on motivation and cognitive action, it is hypothesised that the link between academic self-concept and cognitive action is a defensible one to examine.
Summary of Motivation, Self-concept, and Cognitive Action

In the present study, academic motivation and academic self-concept are integrated into the one analytic model as predictors of cognitive action (assessed in the present study through positive school appraisal and positive academic plans). This part of the model is presented in Figure 3.3. By including both motivation and self-concept as predictors of cognitive action in the one analytic model it is possible to assess their combined and unique effects in the academic process. Having established the self-related factors (academic motivation and academic self-concept) hypothesised to predict cognitive action (positive school appraisal and positive academic plans), the following section explores the links between cognitive action and behavioural action (homework completion, class participation, and absenteeism).
Figure 3.3. The context, self and cognitive action components of the hypothesised academic self-system process model.
The first component of the hypothesised process model addresses the links between self-related factors (academic motivation and academic self-concept) and cognitive action (positive school appraisal and positive academic plans) – and is presented in Figure 3.3. The second component addresses the links between cognitive and behavioural action. As indicated earlier, in guiding predictions about this component of the model, the cognitive-behavioural tradition is relevant. Not only is the cognitive-behavioural perspective important in demarcating academic action into cognitive and behavioural components (see above discussion), it is also informative in specifying the nature of relationships between the two forms of academic action.

The cognitive-behavioural approach is a rigorous, extensively developed, and logically coherent conceptual framework that can be best understood as comprising a number of context-relevant theories connected by common assumptions, techniques, and strategies about cognition and behaviour (Dobson & Dozois, 2001; Reinecke & Clarke, 2004). The cognitive-behavioural approach therefore denotes a series of theories each of which draws on a formal conceptual statement regarding the links between thought, affect and behaviour (see Beck, 1976; Meichenbaum, 1977 for further information of specific cognitive-behavioural therapies). The union of cognitive experimental psychology and behavioural psychology to inform cognitive-behavioural theories was a consequence of the gradual emergence of cognitive perspectives in the field of psychology underpinned by controversies in the 1960s and 1970s surrounding cognitive psychology and behavioural psychology (Graham, 2004; Zimmerman & Schunk, 2003). The role of cognition in the study of behaviour and behavioural change gained considerable attention during this period (see Bandura, 1969, 1977, 1986). The
cognitive-behavioural approach was developed as a purposeful attempt to preserve the positive elements of behaviourism (such as methodological rigour) while incorporating the recent developments in experimental research concerning cognition, development, motivation, memory, and learning (Dobson & Dozois, 2001; Hughes, 1988). Hence, the cognitive-behavioural approach is essentially the convergence between groups of ideas which until that point had generally been discussed as quite independent traditions. As such, the important role cognition plays in determining overt behaviour within the larger social context became fully recognised (Kendall, 1993). The fundamental assumption underlying the cognitive-behavioural approach is that attitude or cognition can guide and predict behaviour.

In broad terms, there are three primary contentions which underlie the cognitive-behavioural approach: (1) individuals' thoughts, images, perceptions, and other cognitive factors affect behaviour; (2) individuals are active participants in their own learning (not passive recipients of environmental influences/social contexts) such that behavioural change may be affected through cognitive monitoring and change; and (3) the utility of cognitive constructs in behaviour change must be empirically demonstrated to support the cognitive-behavioural model (e.g., see Dobson & Dozois, 2001; Hughes & Halls, 1989). These three primary contentions of the cognitive-behavioural perspective align well within the self-system model proposed by Connell and colleagues.

Evidence over the past decade supports the hypothesis that cognition plays an important role in determining behaviour (see Dobson & Dozois, 2001; Kraus, 1995; Reinecke & Clark, 2004) with the proposed links between cognition and behaviour being supported by numerous branches of educational and psychological research (Hughes,
In the Australian context, for example, recent work by Martin (2007; see also Martin & Marsh, 2006, 2008a, 2008b) and colleagues (Green et al., 2007) in the educational domain, has explored and demonstrated relations between a range of cognitive constructs (e.g., positive school appraisal, academic resilience, and buoyancy) and behavioural constructs (e.g., class participation). In fact, some of the major findings to come out of the 2002 analysis of LSA Y data, are that students who report plans to enrol in tertiary education and students who report being generally happy with school and learning (as measured by a positive affect scale) were more highly cognitively and behaviourally engaged (measured by participation and identification with the school) than those students who do not report such academic aspirations or positive appraisals of school (Fullarton, 2002).

Related work also reflects support for the principles of cognitive-behavioural theorising, with cognitive-behavioural therapeutic interventions aiding children manifesting anxiety (e.g., Kendall, 1993; Tomb & Hunter, 2004), attention deficits (e.g., Robinson, Smith, Miller, & Brownell, 1999), delinquency (e.g., Gregory, Kehle, & McLoughlin, 1997), low self-esteem (e.g., Larkin, & Thyer, 1999; Ogier & Hornby, 1996), school refusal (e.g., King, Tonge, Heyne, & Ollendick, 2000; King et al., 1998), and academic problems (e.g., Larkin & Thyer, 1999; Meyers & Cohen, 1982; Meyers & Craighead, 1984; Swanson, 1985). Although cognitive-behavioural ‘therapy’ is not the focus of the present investigation, the cognitive-behavioural perspective underlying this therapeutic approach emphasises the importance of cognitions as mechanisms for behavioural change.

In the present study, cognition and behaviour are modelled to understand more fully the processes underlying academic-related outcomes. Specifically, it is
hypothesised that they are a key means for understanding cognitive and behavioural action in the proposed academic self-system process model – with particular interest in the extent to which cognitive action (positive school appraisal, positive academic plans) predicts behavioural action (homework completion, class participation, and absenteeism). This hypothesised link is now discussed.

**Cognition and Links with Homework Completion**

There are contradictory findings regarding the link between cognition and homework completion. Some research has found a positive relationship between students' attitude toward school (e.g., positive cognition to learning) and homework completion. For example, Trautwein, Ludke, Schnyder, and Niggli (2006) found that students' homework behaviours (e.g., effort, time spent on homework, and learning strategies) are influenced by homework expectancy and value cognitions. Similar findings were derived for Chen and Stevenson (1989) and Corno (2000). Related research has found that adolescents' perceptions of adult beliefs about their academic competence predict scholastic behaviour (including homework completion; Bouchey & Harter, 2005) and that perceived academic buoyancy is positively associated with homework completion (Martin & Marsh, 2008b). However, in contrast to these findings is work by Cooper (1989), who found no significant relationship between homework and pupils' perceptions of school, teachers, or subject matter. As identified earlier in the discussion of class participation and cognitive action links, 'possible selves' research has also found that students who report possible selves with associated mental academic plans, spend more time doing homework than their peers (Oyserman et al., 2004).

Taken together, although there seems to be more evidence supporting a link between
cognition and homework completion, it is evident the findings are mixed and so the present study is an important contribution in this respect.

Cognition and Links with Class Participation

The relations between cognition and class participation have been explored in the Australian context by Martin and colleagues. They have shown that adaptive cognition (e.g., self-efficacy) is positively correlated with participation in the classroom (Green et al., 2007; Martin, 2007), as well as participation in other domains such as music and sport (Martin, 2008c). Establishing personal bests in the education setting (Martin, 2006), as well as cognitive evaluations of academic buoyancy (Martin & Marsh, 2006, 2008b), have also been shown to positively relate to participation in the classroom.

Research related specifically to the notion of possible selves has found that when adolescents adopt academic possible selves with a self-regulatory focus rather than a self-enhancing focus (i.e., students who had thought of an action plan aimed at working towards attaining possible self through various behaviours/strategies) demonstrated higher class participation rates (as well as more time spent doing homework; Oyserman, Bybee, Terry, & Hart-Johnson, 2004). In other work, Valiente, Lemery-Chalfant, Swanson, and Reiser (2008) found classroom participation to mediate the relationship between cognitive attention and grades, as well as mediate the relationship between cognitive attention and school absenteeism. Physical education research has also shown that a positive orientation towards school is a critical factor in determining continued participation in exercise settings (e.g., Kremer, Trew, & Ogle, 1997; Wankel, 1993; Weiss, 1987). Furthermore, a study investigating a school-based intervention aimed at increasing participation in physical activity of adolescent females,
found that increased self-reported levels of enjoyment not only mediated the positive effects of the intervention but also significantly increased the females' participation in physical activity (Dishman et al., 2005). In sum, participation - particularly in the classroom setting - is a behavioural action deemed relevant to the hypothesised self-system model investigating the influences of cognition on behaviour.

**Cognition and Links with Absenteeism**

The final cognition-behaviour link in the academic self-system process model is that between cognitive action and a student's pattern of school attendance (i.e., absenteeism). Previous research has shown that negative attitudes to teachers and low valuing of education are related to absenteeism (Attwood & Croll, 2006; Otis et al., 2005). Research also suggests that students with low coping expectations and anxious thoughts about school predict school refusal behaviour (see King et al., 2000 for an overview of school refusal behaviour). Similarly, Vallerand et al. (1997) found that negative intentions about high school predicted subsequent drop-out behaviour. Australian-based research has found negative correlations between various facets of self-concept and absenteeism for both Indigenous and non-Indigenous samples (Bodkin-Andrew et al., 2005a). Similarly, Martin and Marsh (2008b) have found that perceived buoyancy is negatively associated with absenteeism. Finally – and of particular relevance to the present study – educational aspirations have been found to negatively influence school absenteeism – indeed, the effect of negative aspirations on absenteeism was found to be twice that of the effect of absenteeism on aspirations (Crespo, 1984). In fact, intervention work which aimed to help students to create possible selves with a self-regulatory focus (i.e., thinking about strategies to reach
possible selves) led to increases in school attendance for male and female intervention participants (Oyserman et al., 2006; Oyserman et al., 2002).

**Summary of Cognitive Action and Behavioural Action Links**

Taken together, there are demonstrated links between various dimensions of cognitive action and behavioural action. The present study is an opportunity to test these links in an encompassing model of the academic process. This model is one in which: (a) ‘action’ is demarcated into cognitive and behavioural dimensions; (b) positive school appraisal and positive academic plans are indices of current and future-oriented cognitive action; (c) homework completion, class participation, and absenteeism are indices of home-, class-, and school-related behavioural action respectively; and (d) these aspects of cognitive action predict these aspects of behavioural action. The action-related component of the modelling process is now presented in Figure 3.4, along with the specific factors hypothesised under the respective cognitive and behavioural elements. The final component of the hypothesised model addresses the influence of behavioural action on academic outcomes. This final component is now addressed.
Figure 3.4. The context, self, cognitive action, and behavioural action components of the hypothesised academic self-system process model.
The ‘Outcomes’ Component in the Hypothesised Academic Self-system Process Model

The final component of the hypothesised model involves the link between behavioural action (homework completion, class participation, and absenteeism) and academic outcomes. Thus far the discussion has centred on the link between ‘self’ factors (academic motivation and academic self-concept), cognitive action (positive school appraisal and positive academic plans), and behavioural action (homework completion, class participation, and absenteeism). Importantly, in the proposed process model, patterns of action also mediate the relations between self and the acquisition of skills (test performance) and effort expenditure (test effort). Hence, the final component of the hypothesised model assesses the links between behavioural action and academic-related outcomes.

In identifying feasible outcome factors to include in the model, it is useful to note that Connell and colleagues (e.g., Connell et al., 1994; Pierson & Connell, 1992; Skinner et al., 1990; Skinner, Zimmer-Gembeck, Connell, Eccles, & Wellborn, 1998) and other researchers utilising the self-system process model (e.g., Furrer & Skinner, 2003; Guay & Vallerand, 1997) often operationalise academic ‘outcomes’ as academic achievement assessed via average school grades or standardised test scores. Hence, achievement scores represent one form of academic outcome relevant to the academic process. Importantly, Connell and colleagues (Pierson & Connell, 1992; Skinner et al., 1990) also acknowledge the importance of investigating the actual effort students exert in performing academic tasks. Hence, effort can be viewed as another form of academic outcome relevant to the academic process. Accordingly, the current research proposes test performance and test effort as two relevant outcomes to examine in the
hypothesised academic self-system process model. In the present study, test performance comprises achievement in standardised spelling and mathematic assessment and test effort reflects the effort expended during this assessment (described in more detail in Chapter 6). The direct and indirect evidence underpinning the role of behavioural action (assessed by way of homework completion, class participation, and absenteeism) in predicting these types of academic outcomes is now presented.

**Links between Behavioural Action and Outcomes**

**Homework Completion and Links with Academic Outcomes**

The present investigation proposes homework completion as a measure of behavioural action predictive of academic outcomes. An extensive body of research has demonstrated positive empirical links between homework completion and student achievement (Cooper, 2001a, 2001b; Cooper, Lindsay, Nye, & Greathouse, 1998; Keith & Benson, 1992; Schmitz & Skinner, 1993). Cooper (2001a) reviewed the literature and identified a range of positive and negative effects of homework. The positive effects of homework include immediate academic benefits (e.g., better retention of factual information), long-term academic benefits (e.g., better study habits), and non-academic benefits (e.g., greater self-discipline). The negative effects include satiation (e.g., loss of interest in academic material), parental interference (e.g., conflicting instructional techniques), and cheating behaviours. In Cooper's (1989) early meta-analysis, and then Trautwein and Koller's (2003) more recent review, homework completion was found to positively contribute to achievement in experimental and non-experimental research studies (depending on the operationalisation of homework). It is important to note, however, that recent research has explored the distinction between time spent on homework, homework completion, and the amount of homework assigned by
educators. This body of research has generally found positive relations between the amount of homework completed by high school students and academic achievement (see Cooper & Valentine, 2001 for an overview of research). In contrast, however, findings on the relationship between time spent on homework and academic achievement are inconclusive such that research either demonstrates weak empirical links (Trautwein & Köller, 2003; Wagner, Schober, & Speil, 2008) or no relationship between the time spent on homework and scholastic achievement (e.g., DeJong, Westerhof, & Cremmers, 2000; Tymms & Fitz-Gibbons, 1992; Zammit, Routitsky, & Greenwood, 2002). Studies that have delved more deeply into this topic suggest that the amount of homework assigned by teachers is unrelated to student achievement, while the amount of homework actually completed by students is associated with higher achievement (Cooper et al., 1998). Some research has also shown that older students gain more academic benefits from homework than do younger students (Cooper 1989; Leone & Richards 1989; Muhlenbruck, Cooper, Nye, & Lindsay, 2000). Given the lack of clarity in relation to time spent on homework, the present study assesses homework by way of homework completion and it is hypothesised that homework completion (operationalised by how often a student completes homework or assignments) positively predicts performance and effort on a standardised spelling and mathematic achievement test.

Class Participation and Links with Academic Outcomes

Active participation in the classroom and its association with academic performance is routinely supported in empirical research of both primary aged children (e.g., Anderson, 1975; Cobb, 1972; Ladd, Birch, & Bubs, 1999; Llyod, 1978; Rowe & Rowe, 1992; Valiente et al., 2008; Yen, Konold, & McDermott, 2004) and high school
students (e.g., Kerr, Zigmond, Schaeffer, & Brown, 1986; Rowe & Rowe, 1992; Swift & Spivack, 1968; Yen et al., 2004). Indeed, class participation and the environments that promote student participation are also found to foster students' commitment to learning (Richter & Tjosvold, 1980), promote intrinsic motivation and a learning orientation (Dweck, 1989; Gottfried et al., 1994), and are positively related to academic engagement (Green et al., 2007; Martin, 2007) and resilience (Finn & Rock, 1997).

Conversely, a lack of class participation is found to lead to problematic educational outcomes (Finn, Pannozzo, & Voelkl, 1995) and processes, such as emotional withdrawal and poor identification with school (Finn, 1989), difficulty following rules and difficulty capitalising on learning opportunities (Bronson, Tivnan, & Seppanen, 1995; Hughes & Kwok, 2006), and poor academic performance (Finn, 1993). Similarly, there is also some evidence to suggest participation in extracurricular school activities is related to academic achievement (e.g., Holland & Andre, 1987; Marsh, 1992a). The empirical research, then, supports a link between class participation and academic-related outcomes. On these bases, it is hypothesised that class participation positively predicts academic-related outcomes operationalised in the present study (i.e., test performance and test effort).

**Absenteeism and Links with Academic Outcomes**

The final hypothesised link involves absenteeism and academic outcomes. Indeed, the beneficial effects of adaptive behavioural action such as class participation and homework completion stand in sharp contrast to the negative effects of maladaptive behavioural action such as absenteeism. As detailed earlier, absenteeism is broadly defined as a period of non-attendance at school which can be influenced by many factors including those related to school (e.g., poor enforcement of school absenteeism
policy), self-related factors (e.g., negative attitudes about school), as well as family and parental factors (e.g., low socio economic status, limited parental involvement in education; Corville-Smith, Ryan, Adams, & Dalicandro, 1998; Reid, 1999, 2000, 2005; Teasley, 2004). Although each of these factors constitute a different basis for absenteeism, what is clear across all of this research is that school absence dislocates students from the learning environment (i.e., non-attendees receive less hours of instruction) and this has detrimental effects on academic outcomes (Rothman, 2001, 2002). Supporting evidence shows that absenteeism is a strong predictor of early school leaving (Balfanz, Herzog, & MacIver, 2007; Barrington & Hendrick, 1989; Reid, 2005) and is associated with poor academic attainment (Caldas, 1993; Edward & Malcolm, 2002; Finch & Nemzek, 1935; Kersting, 1976; Laffey, 1982; Sutton & Soderstrom, 1999; Weitzman, Klerman, Lamb, Kane, Geromini, et al., 1985), and even poor employment prospects beyond school (Casey & Smith, 1995). Indeed, some research suggests students could be considered to be caught in a cycle of poor attendance, which affects their academic attainment and attitude to school and then leads onto further absence from school (Reid 1999, 2005). Similarly, relevant data from the OECD Program for International Student Assessment (PISA, 2000) study found that for a majority of countries, non-participation (measured by the frequency of absences, class skipping, and late arrival) had a stronger influence on literacy than a sense of school belonging (Willms, 2003). Absenteeism, then, is a maladaptive behavioural action hypothesised to be a proximal negative influence on academic outcomes as assessed by way of test performance and test effort.
Summary of Links between Behavioural Action and Academic Outcomes

This final component of the hypothesised model addresses relations between behavioural action (homework completion, class participation, and absenteeism) and academic outcomes (test performance and test effort). Moreover, this model holds that these behaviours – in conjunction with cognitive action – mediate the effects of self-related factors (academic motivation and academic self-concept) on these academic outcomes. This final stage of the model and the specific factors underpinning it are depicted in Figure 3.5.
Figure 3.5. The complete hypothesised academic self-system process model encompassing context, self, action, and outcomes.
The Academic Self-system Process Model: Constructs Relevant for all Students

The academic self-system process model proposed in this review of literature holds implications for a wide range of students on the academic spectrum. Every school irrespective of geographical location or type (e.g., co-educational, single-sex, comprehensive, selective, and public), will have students that range on the continuum from motivated, engaged, and high achieving to those students who are described as ‘at risk’, unmotivated, disengaged, and underachievers. ‘At risk’ students have been identified by and associated with such factors as poor socioeconomic backgrounds/economically disadvantaged backgrounds (e.g., Schinke, Cole, & Poulin, 2000), those at risk of dropping out or early school leaving (e.g., McMillan & Reed, 1994), those with behaviour problems (e.g., Yoshikawa, 1994), those with negative peer group associations (e.g., Voydanoff & Donnelly, 1999), and those with poor academic performance (e.g., Catterall, 1998). The constructs that comprise the academic self-system process model speak to this wide range of students and not merely the students who experience relatively few problems in school.

Chapter Summary

This chapter has presented an integrative academic self-system process model applied to the high school setting. In this model, ‘self’ factors (e.g., academic motivation and academic self-concept) represent a proximal influence on cognitive action that in turn predicts behavioural action. These behavioural actions are hypothesised to predict academic outcomes (Figure 3.5). The self-to-action-to-outcome model proposed under this framework differs from a majority of research which has only shown linkages or direct relations between the self and educational outcomes or between cognition and behaviour or between behaviour and outcomes. Thus, whereas
much educational research in the past has tended to focus on these components in isolation, the hypothesised academic self-system process model postulates patterns of action that mediate the relations between self and outcome variables. An important principle underlying this hypothesised model, therefore, is that the self is part of a dynamic model or system comprising multiple processes and constructs. It is, then, considered a useful basis for hypothesising processes relevant to achievement motivation in the present study. Taken together, the hypothesised academic self-system process model encompasses the following elements:

1) Self is comprised of multidimensional academic motivation and academic self-concept;

2) Self predicts cognitive action;

3) Academic action is demarcated into cognitive and behavioural components based on a cognitive-behavioural perspective;

4) Cognitive action is demarcated into present (e.g., positive school appraisal) and possible self (e.g., positive academic plans);

5) Behavioural action comprises home-based behaviour (e.g., homework completion), classroom-based behaviour (e.g., class participation), and school-based behaviour (e.g., absenteeism);

6) Cognitive action predicts behavioural action;

7) Behavioural action predicts academic outcomes; and

8) Academic outcomes comprise test performance and test effort.
Thus, the guiding conceptual framework proposed by Connell and colleagues, and its expansion using the multidimensional motivation perspective and the cognitive-behavioural perspective, has enabled the current research to integrate diverse educationally-relevant constructs under a single analytic model that can be fully tested using appropriate multivariate techniques. This brings into focus the third of the three frameworks guiding the design of this investigation – construct validity – and which is dealt with in the following chapter.
CHAPTER 4

CONSTRUCT VALIDITY: THE FRAMEWORK GUIDING MEASUREMENT AND METHODOLOGY

Introduction

As described in the introduction to the present investigation, it is useful and informative to consider empirical frameworks that assist decisions about how to operationalise the hypothesised academic self-system process model, the bases on which to conduct measurement, and decisions about selecting one instrument over another. The present investigation adopts the construct validation perspective as the basis for these considerations. Accordingly, it is the third and final perspective informing the conduct of the present study and model formulation.

Construct Validation: An Overview

A vast majority of the concepts in psychological and educational research are hypothetical constructs (to which the present study is no exception) and in order for the measurement of these hypothetical constructs to be useful in building and testing theory, the measures utilised in research must provide good empirical estimates of the constructs under focus (Marsh, Martin, & Hau, 2006). According to Brewer and Hunter (2006), the measurement stage of research has two phases: instrumentation and validation. The instrumentation phase typically consists of instrument construction or the use and adaptation of existing instrumentation appropriate to the concepts under focus. The validation phase of measurement determines how accurately those measures represent the theory’s concepts or constructs, thus a crucial and particularly relevant phase for the present investigation (see also Tracey & Glidden-Tracey, 1999).
During the 1950s, the field of psychological assessment moved toward the notion of construct validity. Broadly, this approach was aimed at assessing the extent to which an instrument or scale accurately reflected a theoretical construct – that is, a construct not open to direct observation (Kenny & Kashy, 1992; Marsh et al., 2006).

Due to the fact that many psychological factors cannot be observed explicitly, instruments and scales are devised in an attempt to measure or validate the hypothesised underlying latent nature or construct (Tracey & Glidden-Tracey, 1999). The construct validation approach is essentially concerned with the interplay between the theoretical elaboration of the construct under investigation as well as its methodological validation (Kenny & Kashy, 1992; Morey, 2003; Tracey & Glidden-Tracey, 1999). The chief assertion of the construct validation approach is that theory, measurement, empirical research, and practice are inextricably related. Therefore, the construct validation approach is a comprehensive attempt to increase the rigour with which hypothetical constructs are identified in research (Marsh, 1997, 2002). Specifically, the critical issue at the crux of the construct validation approach is the extent to which a theoretical construct is well represented by its indicators, well defined, related to variables and conditions to which it is theoretically and logically connected, and unrelated to variables and conditions to which it is not theoretically and logically connected (Marsh et al., 2006).

Ideally, the construct validation process is regarded as an ongoing procedure whereby theory and practice are used to develop a measure and subsequent empirical research is used to test the theory and the measure. Following this, both theory and research are revised and new research is conducted to test these refinements (Marsh, 1997, 2002; Marsh, Ellis et al., 2005). As theory and research are eventually used to inform practice such as interventions or educational and psychological programs,
ultimately the disregard of one component of this approach in research design will undermine the others (Marsh, 1997, 2002; Marsh & Craven 1997, Marsh, Craven et al., 1998; Marsh, Ellis et al., 2005). Thus, construct validation is an effective and systematic way to synergise both the substantive and methodological aspects of research. The approaches relevant to construct validation will now be discussed.

**Approaches to Construct Validation**

In working within a construct validation approach, there are three central ideas relevant to the current investigation: (1) the role of multimethod approaches to assessing substantive issues; (2) the importance of within-network validity that seeks to assess the internal properties of instruments; and (3) the importance of between-network validity that seeks to establish logical connections between factors and measures that are theoretically linked (see Marsh, 1990c; Marsh et al., 2006). Collectively, these three central ideas influence the research design, instrument construction, and data analysis techniques (including measurement and modelling of constructs) utilised in the present investigation.

**Multimethod Perspective**

Construct validity seeks to establish that concepts based on exploratory or confirmatory theorising actually measure those conceptually defined (or constructed) concepts (Brewer & Hunter, 2006; MacCallum & Austin, 2000). In a bid to establish the validity of psychological measures, Campbell and Fiske (1959) proposed the assessment of construct validity using multiple methods of measurement across multiple traits (i.e., constructs) to provide evidence of convergent and discriminant validity. They presented the multitrait-multimethod (MTMM) design as a way to assess convergent and discriminant validity (MacCallum & Austin, 2000; Marsh, 1993a).
Thus, much of the logic of the multimethod approach stems from the simple rationale of the MTMM design – that is, latent constructs manifest over a variety situations and are detectable with a variety of methods (Marsh, 2007; Wothke, 1996).

According to Campbell and Fiske and other prominent researchers in the construct validation arena (see Cronbach & Meehl, 1955; Hoyle, Harris, & Judd, 2002; Marsh et al., 2006; Marsh, 1997), good quality research is guided by an emphasis on multiple perspectives based on a multiple methods approach. That is, the multimethod approach to validation is to seek not one measure for a construct, but rather to systematically employ a set of measures whose indicators point to the same focal construct (Marsh et al., 2006; Marsh, 1997). In fact, Alexander (2000) highlighted that little attempt has been made by the research community to develop models and theories of academic development that integrate the kind of multidimensional, multimethod, and longitudinal studies that would allow such models to be defensible.

Importantly, the term multiple ‘methods’ was broadly used by Campbell and Fiske to refer to multiple instruments (e.g., self-concept measures and motivation measures), multiple methods of assessment (e.g., standardised achievement tests and school grades), multiple raters (e.g., student and teacher self-reports), or multiple occasions (e.g., the same measures used to analyses the same individuals repeatedly; Marsh, et al., 2006). Thus, some multimethod approaches to construct validity include: multiple indicators for each construct, multiple constructs and tests of their *a priori* relations, multiple outcome measures, multiple independent variables, multiple levels of analysis, and multiple methodological approaches (Marsh & Hau, 2007; Marsh, Smith, & Barnes, 1983; Marsh et al., 2006).
Measurement of latent constructs: 'More is better'.

The indicators of latent constructs are intended to serve as reflections of the construct under focus (MacCallum & Austin, 2000); therefore, in order to appropriately capture the meaning of a latent construct, a good latent variable model is one which utilises multiple operationalisations of latent constructs (McCoach, Black, & O’Connell, 2007; Marsh, Hau, Balla, & Grayson, 1998; Quintana & Maxwell, 1999). In order to establish the validity of the measurement component of a model (i.e., relations between indicators and the latent constructs they are intended to represent), many authors have recommended that as a general rule, there should be at least three indicators (preferably more) per latent factor (see Bollen, 1989; Kenny, 1979; Kline, 1998; Marsh & Hau, 2007). From a construct validity standpoint, the utilisation of multiple indicators allows researchers to minimise potential threats to construct validity. One of these potential threats is mono-operationalisation bias, whereby constructs are measured in only one way and results essentially become a function of the single operationalisation of constructs (Hartmann & Pelzel, 2005). The utilisation of multiple indicators also has a statistical advantage in that measurement error associated with each indicator can be estimated using structural equation modelling (SEM) procedures and these error estimates can be used to adjust the parameter estimates specified in SEMs (McCoach et al., 2007). This is particularly important for longitudinal data whereby the same items are used at each time wave hence resulting in correlated error or correlated uniqueness (Marsh & Hau, 2007; see also Chapter 6).

The abovementioned construct validity guidelines serve to influence the current investigation through the recommendations of using multiple indicators and a multidimensional conceptualisation for a majority of the constructs under focus, the use
of multiple time waves (i.e., occasions) of data, as well as the conduct of both withinside and between-network analyses at each time wave to test the hypothesised academic self-system process model. Through the construct validation approach, sound measurement of central constructs enables the appropriate testing of individual constructs and the testing of key inter-factor links in the proposed academic self-system process model.

**Level of focus relevant to proposing the hypothesised academic self-system process model.**

A related issue to construct validity is what level to conduct measurement and analyses. In determining the level to direct the proposed academic self-system process model, a variety of meta-analytical studies were reviewed. Although an extensive review is beyond the purpose of this section, a majority of research has shown that a significant portion of variance in student outcomes is attributable to student-level factors (e.g., Hattie, 2003; Rowe, 2003). In terms of academic achievement, Hattie’s (2003) meta-analysis of over 500,000 studies identified six sources (students’ attributes, teachers, home environment, principals, the school itself, and peer effects) which account for variance in students’ academic achievement. Of these six sources, student-level attributes accounted for most of the variance in achievement (approximately 50%) followed by teacher/class-level factors (approximately 30% of the variance). Similar findings have been found from the Victorian Quality Schools Project (VQSP) research conducted by Rowe and colleagues (e.g., Rowe & Hill, 1998; Rowe, Holmes-Smith, & Hill, 1993; Rowe & Rowe, 1999). Their multilevel SEM analyses found strong interdependent effects at both the student-level (e.g., student background characteristics, student ability), and the class/teacher-level between students’
achievement progress, attentive behaviours in the classroom, enjoyment of school, perceptions of curriculum, and teacher responsiveness. In terms of academic motivation, multilevel work conducted by Martin and Marsh (Martin & Marsh, 2005a, 2005b) have shown that a bulk of the variance in motivation occurs at the student level and on a small number of constructs there was significant variance at the class level. No significant variance was found at the school level in their research.

Martin (2008) has also used multilevel modelling to evaluate the effects of a multidimensional educational intervention on high school students' motivation. He found that the largest proportion of variance in motivation constructs could be attributed at the student level and on that basis conducted the intervention at the student level. Additionally, Koth, Bradshaw and Leaf (2008) recently examined the variation in perceptions of school climate based on individual-, classroom-, and school-level factors. They too found that student-level factors accounted for the largest proportion of variance in perceptions of school climate. In sum, the findings of existing research indicate that a large proportion of the variance predominately resides at the student-level. Thus, the academic self-system process model proposed in this present investigation is modelled and analysed at the student level.

**Within-network and Between-network Studies**

Following from the 'more is better' perspective (see Marsh, Hau et al., 1998) detailed above, construct validation investigations can be categorised as either within-network or between-network studies - with recommendations that within-network studies should be performed before moving onto between-network studies. A within-network study is one that explores the internal structure of a construct, hence forming the measurement basis of a study. Using statistical procedures such as factor and
reliability analysis, within-network studies test the dimensionality of a construct with a view to demonstrating that the construct has consistent and distinct multidimensional components (Marsh, 1990a, 1990c; Marsh et al., 2006; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2006).

In contrast, a between-network study aims to establish a logical, theoretically consistent pattern of relations between measures of a target construct and other related constructs (in the case of convergent validity), or distinct constructs (in the case of discriminant validity; Marsh, 1997, 2002). Convergent validity refers to the extent to which scores on a test or scale correlate with (or are related to) scores on other tests or scales that are designed to assess the same or similar construct. Discriminant validity is the degree to which scores on a test do not correlate or relate to scores on other tests that are designed to measure different or dissimilar constructs (Eid & Diener, 2006; Marsh et al., 1983). Therefore, a successful measure is expected to not only converge with other measures of the same or related focal concept but also show little empirical association with measures of concepts unrelated to the focal concept (those concepts it is not theoretically linked to). Researchers commonly make the mistake of pursuing between-network research before resolving at least some of the within-construct issues that are the logical prerequisites to between-network validation. According to Marsh and Hau (2007), it is important to establish the validity of the relations between multiple indicators and the constructs they are intended to measure before pursing more complex models of relations between constructs. Indeed, this ordering of analyses has been adopted in the present investigation.

As posited above, one role of construct validation is to establish the relations between a particular construct (e.g., motivation) and other constructs (e.g., self-concept
or achievement) to which it is hypothesised to be logically related. In isolation, a particular construct – or logically interconnected set of constructs – may appear to have a coherent factor structure. However, when analysed as part of a more extensive battery of related constructs, the factor structure may no longer be coherent. For example, although factor analyses of a single factor may show that items load highly on the factors they are designed to measure, there is no guarantee that this will be the case when multiple factors are incorporated in an integrative multidimensional factor analysis (Marsh et al., 2006). As a result, not only is it imperative to adopt within- and between-network analyses it is also necessary to conduct such analyses in an encompassing model – a method once again adopted in the present investigation.

Methodological Approaches to Analysing Multi-method Data

Theory and previous research are extremely important in determining the kinds of information that are required in research because they assist in defining the phenomena or constructs of interest. Of equal importance, however, are the methods with which the necessary information will be obtained and analysed. Methodology itself defines the appropriate data collection and data analysis procedures (Brewer & Hunter, 2006). The confluence of these two aspects of research allow for what Marsh and Hau (2007) label ‘methodological-substantive synergies’ – an approach which has been adopted in the present investigation. Indeed, addressing construct validation often requires adoption of complex research designs and advanced statistical techniques to test both convergent and discriminant validity and the hypothesised processes relevant to students’ academic development (Brewer & Hunter, 2006). Many data analytic techniques have been devised to test the reliability and validity of measures. In educational psychology, there is an increasing emphasis on multidimensional
conceptualisations of constructs which are based on theory, item and reliability analyses, factor analysis (exploratory and confirmatory factor analysis [CFA]), convergent and discriminant validity, criterion-related validity, as well as validity generalisations (Marsh & Hau, 2007). Two increasingly recognised and utilised statistical techniques of particular relevance to the construct validity approach are CFA and SEM. Each of these statistical procedures are discussed briefly here as relevant to testing the research issues and more fully later detailed in a technical nature in methodology (see Chapter 6).

**Confirmatory Factor Analysis and Structural Equation Modelling Approaches to Multimethod Data**

In the past decade, CFA and SEM techniques have become the method of choice for analysing multimethod data (Kenny & Kashy, 1992; Marsh & Hocevar, 1983; Tomarken & Waller, 2005). Although a detailed discussion of CFA and SEM techniques is beyond the scope of this section (see Chapter 6 for more detail), it is important to note that these statistical procedures (when applied appropriately) have many advantages over traditional statistical techniques such as factor analysis or multiple regression. Firstly and perhaps most importantly, these statistical procedures allow researchers to investigate multimethod data by specifying *a priori* the expected factor structure for the measures under focus as well as the relations between latent constructs, thereby encouraging the researcher to base predictions on prior research and theory rather than adopting an exploratory approach (Kline, 1998; Martens & Haase, 2006; Quintana & Maxwell, 1999). Unlike many other statistical techniques, the researcher can use SEM to test an entire theoretical model in one analysis — an application which is particularly important for testing the hypothesised academic self-
system process model. Specifically, these statistical procedures enable the researcher to model constructs as latent variables, therefore allowing for the estimation of relations among latent constructs and their manifest indicators (commonly referred to as the measurement model). Once the measurement component of a model is adequately established, SEM procedures also allow for the estimation of the relations among latent and/or observed constructs (i.e., the structural model). These advanced statistical procedures also account for the presence of measurement error associated with each indicator. Researchers can also posit an a priori model based on previous research and theory and test this a priori model against alternative models to assess fit (Chin, 1998; Eid, Lischetzke, & Nussbeck, 2006; Marsh et al., 2006; Quintana & Maxwell, 1999; Schmitt, 2006; Tomarken & Waller, 2005).

As mentioned earlier, the essence of a good latent variable model is one that utilises relevant multiple indicators for each construct (a method which is applied in the current research), thus allowing the researcher to establish validity of the measurement component of a latent variable model through CFA before pursuing more complicated models of relations between latent variables in SEM procedures (Marsh, Hau et al., 1998). Accordingly, even when there is clear support for the existing factor structure (as is the case with a number of scales in the present study) it remains important to establish that the factor structure underlying an instrument generalises to the sample used in the particular study (Marsh & Hau, 2007). As is the case with many latent variable models, the main substantive purpose is to appraise a priori hypotheses about the structural component of latent variable models (Tomarken & Waller, 2005). As this is a central focus of the present study, SEM procedures are utilised to assess those theoretically-proposed relations between the latent variables in the academic self-system process model (i.e., the structural model). Indeed, these structural relations will
be guided by not only substantive theory, but also by the nature of the data (i.e., methodological and statistical considerations). According to Quintana and Maxwell (1999), the quality of results from SEM analyses is first and foremost dependent on the quality of the conceptualisation underlying the hypothesised model. This notion has been echoed by a variety of authors who are quick to point out that advances in statistical procedures do not compensate for limitations in research design (Chin, 1998; Tomarken & Waller, 2005; Marsh & Hau, 2007). Hence, the present investigation can be seen as a substantive-methodological synergetic study whereby appropriate multivariate methods are utilised to answer central research questions that assist not only measurement conclusions but also substantive ones.

Mediation Models

An integrative model such as the one proposed in the current research is essentially concerned with the degree to which the broad component of ‘action’ influences the relationship between ‘self’ (motivation and self-concept) and ‘academic outcomes’ (test performance and test effort). As stated earlier, a vast majority of research typically examines the link between ‘self’ (i.e., motivation and academic self-concept) and outcome measures (e.g., achievement). Once a relationship such as this is established, it is not uncommon for researchers (particularly in psychological research) to begin investigating the role of a third variable in clarifying the nature of the relationship between predictor and outcome variables (Barron & Kenny, 1986; Frazier, Tix, & Barron, 2004; MacKinnon, Krull, & Lockwood, 2000; Shrout & Bolger, 2002). The introduction of a third variable can result in a model (such as the academic self-system process model proposed here) whereby measurable processes are proposed to intervene or mediate the predictor and outcome variables (Baron & Kenny, 1986;
MacKinnon, Warsi, & Dwyer, 1995; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). It has been highlighted that such relations should ideally be grounded in theory (Frazier et al., 2004; Holmbeck, 1997). In the case of the proposed academic self-system process model, the broad component of 'action' is conceptualised as the mechanism through which 'self' influences 'outcome'. In order to establish the plausibility of the causal sequences implied by theory (i.e., that imposed by the hypothesised academic self-system process model) the testing of mediating variables is deemed a useful lens through which to examine the processes by which variables are related (Frazier et al., 2004; MacKinnon et al., 2002). Although this investigation is not a formal mediation analysis, the concept of mediation allows the researcher to consider the role of 'action' (demarcated into cognitive and behavioural action) when situated between 'self' and 'outcomes'. Due to the advantages of SEM outlined earlier, SEM is the preferred method through which to explore mediating variables within the one analytical model (Barron & Kenny, 1986; Hoyle & Smith, 1994).

**Longitudinal Approaches to Multimethod Data**

The implementation of multimethod research to assess research questions requires the application of statistical approaches that also consider multimethod strategies to test validity and substantive research questions. This is especially the case for longitudinal data. The characteristic feature of a longitudinal research design is that the same measurements are obtained from the same sample at two or more points in time and thus can provide stronger empirical evidence of how variables influence one another (Goldstein, 1979; Joreskog, 1979; MacCallum & Austin, 2000; Menard, 1991; Quintana & Maxwell, 1999). Indeed, according to Bong (1996), in order to adequately explore the complex nature and relations of motivation and educational outcomes, it is
necessary to examine relationships between motivation and 'outcome' measures using a longitudinal design whereby the same students are assessed at a later point in time. The application of multiple occasions does not fundamentally change the above applications of CFA and SEM techniques; however, the temporal ordering of the variables under focus is taken into consideration. In fact, Robinson, Schmidt, and Teti (2005) strongly recommended that the conceptualisation, methodology, and data analyses of longitudinal studies remain tightly linked.

Longitudinal investigations provide an opportunity to assess the stability of hypothesised models over time, model the correlation of error terms, examine time-sensitive processes and ascertain the direction of relations between variables (Khoo, West, Wu, & Kwok, 2006; MacCallum & Austin, 2000; Morris, Robinson, & Eisenberg, 2006). In longitudinal SEM, the time dependence between measurements is taken into account in the statistical modelling, hence making it a useful statistical approach for longitudinal research (Van Der Kloot, 1998). Indeed, according to Morris et al. (2006), when the researcher is interested in the processes underlying a phenomenon, rather than merely assess the status of the phenomenon at one point in time, longitudinal methods should be adopted to more adequately understand the processes which underlie a phenomenon. The insensitivity of cross-sectional data to capture the dynamic processes in developmental research as well as findings of conflicting differences between cross-sectional results and longitudinal results has provided substantial momentum to the use of longitudinal designs in educational development (Rogosa, 1979). One of the most prevalent procedures for modelling longitudinal data through SEM is through autoregressive paths (Kenny & Campbell, 1989; MacCallum & Austin, 2000; Martens & Haase, 2006). Autoregressive paths are essentially paths which link variables measured at Time 1 with corresponding variables
measured at Time 2 (e.g., the path between Time 1 academic self-concept and Time 2 academic self-concept). Therefore the influence of any remaining constructs on the Time 2 construct is viewed as conditional on the Time 1 construct (Kenny & Campbell, 1989; MacCallum & Austin, 2000; Martens & Haase, 2006; Quintana & Maxwell, 1999).

In line with the multimethod approach, Marsh, Byrne, and Yeung (1999) emphasised the role of the researcher as a substantive 'data detective' and proposed four broad standards for 'ideal' longitudinal research (updated from Byrne's 1984 guidelines). According to these authors, longitudinal research should: (a) infer all latent constructs on the basis of multiple indicators; (b) measure the constructs under focus at least twice (i.e., a 2-wave study) at least one year apart; (c) consider a sufficiently large and diverse sample to justify the use of CFA and the generality of findings; and (d) fit the data to a variety of CFA models that incorporate measurement error and test for the likely residual co-variation among measured variables (i.e., correlated uniquenesses).

To fully and most appropriately assess the hypothesised academic self-system model, all these recommendations are adopted in the present research. These guiding principles are evident in the present investigation such that: (a) each latent construct is measured by multiple indicators (majority of constructs are measured by four items, with the exception of homework completion and absenteeism); (b) each construct is measured twice (two time waves of data, collected one year apart and the hypothesised academic self-system model is tested at each time wave as well as with the matched longitudinal sample); (c) a large and diverse sample is utilised (see Chapter 6 for sample description); (d) data at each time wave (as well as the longitudinal matched sample) are analysed using CFA and SEM thereby incorporating measurement error;
and (e) correlated uniquenesses are incorporated in all longitudinal modelling. Each of these methodological decisions and elements is discussed more fully in methodology (Chapter 6).

**Previous Construct Validation Aligned with the Present Investigation**

Prior construct validation work with some of the present study's central constructs has been conducted. In relation to motivation, previous research has typically adopted within- and between-network construct validation approaches. Martin (2001, 2003, 2007), for example, has tested the factor structure of the motivational constructs under focus in this research. Using a domain-general approach, Martin found that in terms of within-network validity: (a) the first-order and higher-order hypothesised model of motivation were good fitting; and (b) multigroup tests demonstrated invariance across gender and year-levels. In terms of between-network validity: (a) correlations with positive appraisals of school, class participation, and positive academic plans were in the hypothesised directions; (b) females reflected a more adaptive pattern of motivation; and (c) middle high school students tended to reflect less adaptive patterns of motivation. Additional construct validity research by Green and colleagues using a domain-specific approach (mathematics, English, science) found similar within- and between-network results as well as modest support for the domain-specificity of motivation and key educational correlates (Green et al., 2007).

Additionally, research adopting a construct validation approach to the empirical assessment of academic buoyancy (Martin & Marsh, 2006, 2008b) and their relations with academic motivation has also found within-network validity (by way of sound item and factor properties) and between-network validity (by way of demonstrating appropriate relationships with academic correlates). In sum, research surrounding the
motivational constructs under focus in the present study has consistently demonstrated construct validity by way of within- and between-network studies. The current investigation extends previous motivation research by examining these constructs longitudinally and in combination with other academic related constructs such as self-concept.

Perhaps the best demonstration of the construct validity approach is seen in self-concept research. Researchers have given considerable attention to the study of self-concept as an important educational outcome as well as a vehicle for the improvement of educational outcomes such as achievement. In their prominent review of self-concept research, theory, and measurement, Shavelson et al. (1976) reported that most research (prior to 1976) had been of a substantive nature with little attention given to the methodological issues related to the construct of self-concept. In particular, they identified a lack of within-construct research that sought to accurately define and identify the various facets of self-concept before attending to between-network research. As a result, early findings surrounding self-concept research were inconsistent, confounded, and ambiguous (for reviews see Byrne, 1984; Shavelson et al., 1976; Wylie, 1974) and a need for the interplay between theory and methods was prompted (Shavelson & Bolus, 1982). Consequently, Shavelson et al. (1976) developed a multidimensional, hierarchical model of self-concept which has since served to provide a crucial theoretical foundation for the development of a host of multidimensional self-concept instruments such as that administered in the present study (e.g., Marsh, 1990a, 1990c, 1992a, 1992b).

Certainly the most extensive work in testing academic self-concept from a construct validity approach has been that of Marsh and colleagues (see Marsh, 2007 for
an overview). They have investigated responses to self-concept instruments using a multimethod approach and the application of advanced statistical techniques such as CFA to evaluate and support the multidimensional structure of self-concept and SEMs to evaluate relations between self-concept and other constructs. Their research examined: (a) reliability and factor analyses based on cross-sectional responses and longitudinal responses (multiple occasions); (b) relations to other self-concept instruments that are also self-report in nature; (c) relations with other psychological constructs (such as the big five personality factors) based on self-report; (d) relations with achievement and responses not based on self-report; (e) self-other agreements based on self-concept ratings by significant others (such as teachers and parents); and (f) intervention studies designed to enhance self-concept responses (see Byrne, 1996a; Marsh et al., 1999; Marsh & Craven, 1997; Marsh, Ellis et al., 2005; Marsh & Yeung, 1997).

The Current Investigation: A Methodological-Substantive Synergy

Based on the above discussion it is evident that a multimethod approach to construct validation can assist in teasing out the substantive and methodological issues relevant to the hypothesised academic self-system model. Following the above guidelines and previous research, the present study adopts a 'more is better' approach by utilising multiple constructs and multiple indicators for each construct (e.g., multidimensional approach to the study of motivation), multiple outcome measures (e.g., academic related action, test performance, and test effort) as well as multiple time waves (two time waves). This multi-method approach comprises within-network validation to determine measurement properties (employing CFA and factor invariance techniques) and between-network validation (employing SEM techniques) to assess the
hypothesised academic self-system model. Adopting this construct validation approach will offer an enormous advantage to the current investigation by substantially enhancing the validity of findings and the confidence with which conclusions can be drawn. Thus, the guiding framework of self-system processes proposed by Connell and colleagues and the cognitive-behavioural tradition assist with factor selection and model ordering, whilst the construct validation approach aids in instrument selection, research design, and analytical approaches. It is the confluence of these three lines of theoretical and empirical enquiry that are the three pillars of the present study.

Chapter Summary

This chapter has presented the construct validity framework which underpins the research design, the measurement of constructs, and the methodological approaches to analysing the hypothesised academic self-system process model. An overview of construct validation and the ideas central to this approach (i.e., multimethod approaches, within-network studies, and between-network studies) has also been detailed. A brief orientation to the relevant methodological approaches (including longitudinal approaches) to analysing multimethod data has been presented as well as previous construct validation research relevant to the constructs contained in the hypothesised academic self-system process model. The construct validation approach works in concert with the previous guiding frameworks presented in Chapter 3 and is a clear attempt to employ a synergy of substantive and methodological approaches in modelling the academic process.
INTRODUCTION

This present investigation has as its central purpose to empirically evaluate a model of student academic processes that posits relations between academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes (see Figure 3.5). Three distinct but interrelated perspectives form the basis of the measurement and modelling vital to understanding the relative roles of academic motivation, academic self-concept, cognitive action and behavioural action in students' academic outcomes. These perspectives include: (1) the self-system process model proposed by Connell and colleagues; (2) the cognitive-behavioural perspective; and (3) the construct validity approach. The review of literature (see Chapters 3 and 4) has presented the substantive-methodological synergy underpinning the proposed academic self-system process model and the current chapter outlines the central hypotheses relevant to this investigation.

This proposed academic self-system process model is assessed at two time points one year apart (cross-sectionally) – as well as in longitudinal form which connects the two process models across time. As a result, there are three broad interrelated components relevant to testing the hypotheses of the present investigation. The first component is concerned with the construct validation of the quantitative instrumentation both cross-sectionally and longitudinally. The second component concerns the cross-sectional examination of the hypothesised academic self-system
process model at each independent cross-sectional data set (i.e., Time 1 and Time 2). The third component is concerned with examining the proposed academic self-system process model longitudinally (using a matched Time 1 and Time 2 sample).

Before embarking on a discussion of the hypotheses, it is important to highlight that the Time 2 instrumentation is identical to that described at Time 1. In order to reduce the likelihood of practice effects on the standardised achievement measures, alternate but equivalent items for the spelling and mathematic component were administered (described in Chapter 6). For completeness, there is a Time 1 data set, a Time 2 data set, as well as a matched Time 1 and matched Time 2 data set (i.e., only students with both Time 1 and Time 2 data included in the analyses). As the instrumentation was identical at each time wave, all of the instruments were included in each analysis conducted in this research. This is to ensure that the integrity of the separate scales is retained irrespective of them being placed together into a single battery of tests. Although detailed information about the instrumentation is presented in Chapter 6, a brief description of the instrumentation utilised in the present study is presented here. The instrumentation includes:

1) Academic motivation as measured by the Motivation and Engagement Scale – High School version (MES-HS);

2) Academic self-concept as measured by the Self-description Questionnaire II-Short (SDQII-S);

3) Cognitive action as operationalised by items measuring positive school appraisal and positive academic plans;
4) Behavioural action as operationalised by items measuring homework completion, class participation, and absenteeism; and

5) Academic outcomes as operationalised by a spelling and mathematic performance and effort score (subtests of the Wide Range Achievement Test – 3 [WRAT-3]).

The purpose of the present chapter is to present the hypotheses for each of these three components of the present research. In order to avoid repetition of the literature presented in Chapter 3 and Chapter 4, only the hypotheses (not the supporting literature) will be presented below.

**Part 1: Cross-sectional and Longitudinal Construct Validation of the Instrumentation**

The intention of the first component of the study is to demonstrate that each of the instruments used in the present investigation are valid measures for testing the links specified by the hypothesised academic self-system process model. In relation to this, the following cross-sectional and longitudinal construct validity hypotheses are advanced:

- The instrumentation will comprise normally distributed and demonstrate reliable (i.e., internally consistent) scales;

- Confirmatory factor analysis will support the *a priori* first-order and higher-order factor structure of the instrumentation as evidenced by satisfactory goodness-of-fit indices, configuration of factor loadings, variances, covariances, and uniquenesses;
There will be convergent and discriminant validity as evidenced by correlations between the academic motivation and academic self-concept scales and validity criteria. Specifically, it is hypothesised that, notwithstanding absenteeism (where higher scores reflect a maladaptive outcome), adaptive motivation, and academic self-concept will be positively correlated with the validity criteria, impeding/maladaptive motivation will be correlated around zero, and the maladaptive motivation will be correlated markedly negatively;

- The first-order and higher-order factor structure of the instrumentation will be similar for males and females and students of different year-levels as demonstrated by multi-group CFA tests of factor invariance;

- It is hypothesised that females will evince more adaptive motivation (with the exception of anxiety) than males; however, males will evince more maladaptive motivation; and

- In terms of year-level differences, it is broadly hypothesised that lower year-levels will reflect less adaptive motivation. No hypotheses are advanced in relation to the interaction of gender and year-level.

**Part 2: Cross-sectional Examination of the Hypothesised Academic Self-system Process Model**

The objective of the second component of the study is to test the hypothesised relations proposed in the academic self-system process model. An integrative SEM containing all instrumentation will be conducted independently for the Time 1 data, Time 2 data, matched Time 1 data, and matched Time 2 data. Appropriate
methodological design and statistical techniques (e.g., latent modelling) will be applied to not only empirically evaluate the hypothesised academic self-system process model but also to examine the stability of this hypothesised process model at each cross-sectional dataset (e.g., Time 1 and Time 2 samples).

Factors Predicting Cognitive Action

In terms of the academic motivation and academic self-concept factors in the hypothesised academic self-system process model, the following hypotheses are advanced:

- Adaptive cognitive and adaptive behavioural motivation dimensions will positively predict cognitive action (positive school appraisal and positive academic plans);
- Impeding/maladaptive motivation will marginally predict (positively or negatively) cognitive action;
- Maladaptive motivation will negatively predict cognitive action; and
- Academic self-concept will positively predict cognitive action.

Factors Predicting Behavioural Action

The second component of the hypothesised academic self-system process model is one in which cognitive action (positive school appraisal and positive academic plans) predicts behavioural action (homework completion, class participation, and absenteeism). The following hypotheses are therefore advanced.
• Cognitive action (positive school appraisal and positive academic plans) will positively predict homework completion and class participation; and

• Cognitive action will negatively predict absenteeism.

Factors Predicting Academic Outcomes

The final component of the hypothesised academic self-system process model is one in which behavioural action (homework completion, class participation, and absenteeism) predicts academic outcomes (test performance and test effort). The following hypotheses are therefore advanced.

• Homework completion and class participation will positively predict test performance and test effort; and

• Absenteeism will negatively predict test performance and test effort.

Part 3: Longitudinal Examination of the Hypothesised Academic Self-system Process Model

The final empirical component of this investigation will be to undertake a critical longitudinal examination of the hypothesised academic self-system process model (see Chapter 6 for a discussion of the longitudinal design). CFA and SEM connecting the two academic self-system process models across time will be conducted to assess the longitudinal stability of the hypothesised links specified in the academic self-system process model. Using appropriate methodological design and statistical techniques, this component of the investigation aims to assess a longitudinal SEM model to identify the significant paths between corresponding factors at Time 1 and Time 2 (e.g., Time 1 academic self-concept and Time academic self-concept) as well as
significant paths within each process model that exist at Time 2 after controlling for Time 1 variance. The following research questions are therefore advanced:

- What is the nature and extent of the test-retest relations between corresponding factors in the longitudinal SEM?
- What is the nature and extent of the relations between academic motivation, academic self-concept, and cognitive action at Time 2 after controlling for Time 1 variance?
- What is the nature and extent of the relations between cognitive action and behavioural action at Time 2 after controlling for Time 1 variance?; and
- What is the nature and extent of the relations between behavioural action and academic outcomes at Time 2 after controlling for Time 1 variance?

**Chapter Summary**

In light of the previous research and literature review presented in Chapter 3 and Chapter 4, hypotheses and research questions were presented in this chapter. In the first instance, construct validity hypotheses were proposed for the cross-sectional and longitudinal data sets. Next, hypotheses were made regarding the cross-sectional testing of the hypothesised links specified in the academic self-system process model. Finally, research questions regarding the longitudinal stability of the hypothesised links in the academic self-system process model were presented. Taken together, these hypotheses and research questions are aimed at testing and confirming the hypothesised relations between academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes in the high school setting. The following chapter details the methodology utilised to address these hypotheses and research questions.
CHAPTER 6

METHODOLOGY: SAMPLE, MEASURES, PROCEDURE, AND ANALYSES

Introduction

This chapter outlines the methods employed to address the hypotheses and the research questions posed in Chapter 5. This chapter also provides an overview of the samples at each of the two time waves as well as the measures, procedures, data management, and statistical analyses employed. To conclude, a brief orientation to the statistical considerations relevant to the cross-sectional and longitudinal analyses is provided.

Time 1 Sample

In the first year of the study (Time 1) respondents were 3,450 high school students in junior high school (years 7 and 8: 40%, approx. 12-14 years), middle high school (years 9 and 10: 38%, approx. 14-16 years), and senior high school (years 11 and 12: 22%, approx. 16-18 years) from six Australian high schools. Two of the high schools were government schools and four were independent schools. Government schools included one comprehensive school of mixed ability and one academically selective school. In the Australian setting, both systems of schooling subscribe to the same mandatory curriculum and external examinations, although some independent schools or larger government schools can offer a broader range of subjects within that curriculum. Single-sex and co-educational schools were included in this sample and over half (63%) the respondents were male and 37% were female. The respondents were aged between 12 and 19 years with a mean age of 14.47 (SD = 1.59) years.
The selection of schools represents a cross-section that, although not fully representative of the Australian population of high schools, comprises sufficient numbers of students to yield broadly generalisable results. Each school was initially requested to administer the instrumentation to all year levels, however, due to the demands placed on the year 12 students (the final year of schooling in Australia), two schools elected to exclude year 12 students from the administration of the instrument (hence, the slightly higher representation of junior high and middle high students). With few exceptions, all targeted students in attendance on the day of testing participated in the survey. Permission was obtained from the University of Western Sydney's Human Ethics Committee, as well as relevant departmental authorities.

**Time 2 Sample**

This longitudinal study was conducted in two stages: the first in Term 3 of the school year and the second at the same time one year later (Time 2). This second administration also meant that the sample was refreshed with a new year 7 (the first year of high school) cohort. The Time 2 sample comprises 3,261 high school students in junior high school (years 7 and 8: 36%, approx. 12-14 years), middle high school (years 9 and 10: 38%, approx. 14-16 years), and senior high school (years 11 and 12: 26%, approx. 16-18 years) from the same six Australian high schools sampled at Time 1. Again, due to the mix of single-sex and co-educational schools included in the study, over half (62%) the respondents were male and 38% were female. Students were aged between 12 and 19 years with mean age of 14.56 (SD = 1.53) years.

**Matched Time 1 and Time 2 Sample**

As is the case with many longitudinal research designs, there are issues concerning participant attrition and difficulties matching responses over time. In the
present study, these obstacles were a result of students: (a) not providing their name; (b) providing a false name; (c) being absent on the day of administration; (d) the inclusion of a new year 7 cohort at Time 2 (thus no Time 1 data for them); and (e) the loss of the year 12 cohort who had graduated at Time 1 (thus no Time 2 data for them). For these reasons, just over half the sample was matched and retained for the longitudinal analyses – a figure considered defensible given one cohort had graduated by Time 2 and one cohort was new at Time 2. Consequently, the matched Time 1 and Time 2 sample comprises 1,866 high school students who completed the survey at both Time 1 and Time 2 (one year later). Just under a third (29%) of the respondents were in year 7 at Time 1 and year 8 at Time 2; 24% were in year 8 at Time 1 and year 9 at Time 2; 23% were in year 9 at Time 1 and year 10 at Time 2; 18% were in year 10 at Time 1; and year 11 at Time 2, and 6% were in year 11 at Time 1 and year 12 at Time 2. As was the case for the sample at Time 1 and Time 2, over half (61%) the respondents in the matched sample were male and 39% were female. The mean age of respondents in the matched Time 1 sample was 13.86 (SD = 1.28) years and the mean age in the matched Time 2 sample was 14.79 (SD = 1.28) years.

**Instrumentation**

**Academic Motivation Measure: Motivation and Engagement Scale – High School (MES-HS)**

The Motivation and Engagement Scale – High School (MES-HS; Martin, 2001, 2003b, 2007, 2008a) is an instrument utilised in the present investigation to measure high school students’ multidimensional motivation. The MES-HS assesses multidimensional facets of motivation through three adaptive cognitive motivation dimensions, three adaptive behavioral motivation dimensions, three
impeding/maladaptive cognitive motivation dimensions, and two maladaptive behavioral motivation dimensions. Adaptive cognitions include self-efficacy (e.g., “If I try hard, I believe I can do my schoolwork well”), mastery orientation (e.g., “I feel very pleased with myself when I really understand what I’m taught at school”), and valuing of school (e.g., “Learning at school is important to me”). Adaptive behaviors include persistence (e.g., “If I can’t understand my schoolwork at first, I keep going over it until I understand it”), planning (e.g., “Before I start an assignment I plan out how I am going to do it”), and task management (e.g., “When I study, I usually study in places where I can concentrate”). Impeding/maladaptive cognitive dimensions are anxiety (e.g., “When exams and assignments are coming up, I worry a lot”), failure avoidance (e.g., “Often the main reason I work at school is because I don’t want to disappoint my parents”), and uncertain control (e.g., “I’m often unsure how I can avoid doing poorly at school”). Maladaptive behavioral dimensions are self-handicapping (e.g., “I sometimes don’t study very hard before exams so I have an excuse if I don’t do as well as I hoped”) and disengagement (e.g., “I often feel like giving up at school”).

Each of the eleven factors comprises four items – hence the MES-HS is a 44-item instrument. To each item, students rate themselves on a scale of 1 (‘Strongly Disagree’) to 7 (‘Strongly Agree’). Martin (2001, 2003b, 2007, in press a) has confirmed a strong first- and higher-order factor structure and has also shown that the MES-HS is a reliable instrument with approximately normally distributed dimensions and is significantly associated with literacy, numeracy, and achievement in mathematics and English, as well as being sensitive to age and gender-related differences in motivation. For more detailed information about the development of this scale, see Martin (2001, 2003b, 2007, 2008a, in press a).
Academic Self-concept Measure: Self Description Questionnaire II-Short (SDQII-S)

The SDQII-S is based on the Shavelson model of self-concept (Marsh & Shavelson, 1985; Shavelson et al., 1976) and is specifically designed to measure the multiple dimensions of the self-concept for adolescents in years 7 through to 12. The SDQII-S is adapted from the original extended version and retains the original eleven scales, including three areas of academic self-concept, two areas of physical self-concept, three areas of relationship self-concept, and also scales for emotional stability, honesty-trustworthiness, and general self-concept. SDQII-S items are rated on a 1 (‘False’) to 6 (‘True’) likert scale. Because the present study is a domain general one—not one located in specific school subjects (e.g., mathematics, science, English)—only the academic self-concept scale is included in the present study. The academic self-concept scale is a measure of students’ ratings of their skills and abilities relevant to schoolwork generally (e.g., “I am good at most school subjects”).

The SDQ instruments developed by Marsh are amongst the best measures that assess the multiple dimensions of self-concept, with strong psychometric properties and construct validity (Byrne, 1996a; Byrne & Shavelson, 1996; Hattie, 1992a; Wylie, 1989). Recent Australian evaluations of the SDQII-S (Ellis, Marsh, & Richards, 2002; Marsh, Ellis et al., 2005) revealed that the reliability of the instrument is close to the original version of the SDQII, with Cronbach’s alpha values ranging from .80 to .90. Additionally, external validity has consistently been demonstrated with academic achievement, significant other ratings, age, and gender (Marsh, 1992b, 1990c, 2007).

‘Action’ Measures

Students were also administered academic-relevant items designed to measure both cognitive and behavioural action. As discussed in the review of literature (Chapter
change in students’ lives than academic grades (Keith, 2002) – therefore suitable for the longitudinal nature of the present investigation. This involved the administration of the spelling and mathematic subsets of the Wide Range Achievement Test-3 (WRAT-3).

This measure is a widely used standardised achievement measure designed to assess reading, spelling and arithmetic abilities of people from 5 to 74 years of age (Wilkinson, 1993). Due to the need to administer the test in the classroom setting in a restricted period of time, the reading section (assessing correct verbal pronunciation) was not included, nor was a subset (i.e., the preliminary items relevant to young school-aged children) of the spelling and mathematic items. Students gained not only a spelling and mathematic performance score based on their performance on the test (raw score calculated, then normed according to age norms supplied in the WRAT-3 manual), but also a spelling and mathematic effort score, based on how many items they attempted (regardless if answers were correct). As this was a domain-general study (as opposed to a subject-specific study), the spelling and mathematic performance scores formed a general test performance factor and the spelling and mathematic effort scores formed a general test effort factor used throughout all analyses.

The spelling and mathematic subtests of the WRAT-3 consist of forty items each. The spelling subtest consists of a spelling dictation task in which students are presented with a word and the context (i.e., a sentence) in which the word belongs. Students are required to spell the word in English and one score is awarded for each item spelt correctly. The words students are required to spell are standard English words that appear in the ordinary course of a student’s literacy-based academic life – obviously depending on the student’s age and year-level at school. As such, the difficulty of the words increases over the forty items. The spelling subtest takes approximately 15 minutes to complete.
The mathematic subtest consists of a written arithmetic component (e.g., reading number symbols, solving arithmetic problems, performing written computations) to which students are given exactly fifteen minutes to complete as many of the forty mathematic items as possible. Students are not allowed to use calculators or receive assistance from the teacher and as is the case with the spelling subtest, the mathematic problems are presented in ascending order of difficulty. Once again, the items presented in this subtest are designed to reflect those problems presented to students in the ordinary course of their mathematic instruction – again, obviously depending on the student’s age and year-level at school.

There are two equivalent test forms (blue and tan) for both the spelling and mathematic subtests which can effectively be used as pre- and post-tests. Consequently, the blue form was utilised at Time 1 and the tan form at Time 2 for both the spelling and mathematic subtests. The WRAT-3 was scored according to the administration manual (Wilkinson, 1993). Reliability estimates range from .85 to .92 across the two tests and the correlation coefficient for raw scores between the blue and tan equated forms of tests is .98, indicating that either form of the test can be used with similar results. The WRAT-3 has been shown to be valid and reliable for use across a number of age groups (ages 5 to 75) and within different educational settings (Wilkinson, 1993). The instrument’s content and construct validity have been confirmed across a number of international (e.g., Roche & Thompson, 2007; Stevens & Price, 1999; see also Wilkinson, 1993) and Australian studies (e.g., Lucas, Carstairs, & Shores, 2003). Furthermore, norms have been established on a sample of 4,433 participants (based on a US population) and are provided for each of the 23 age groups. The total sample ratio of males to females in the norm sample is 50.7% to 49.3% (Parker, 2002; Wilkinson, 1993). As norms have been based on a US population caution must be taken when
interpreting these results. In sum the WRAT-3 is considered a reliable and objective measure of academic outcomes (i.e., test performance and test effort).

**Time 1 and Time 2 Procedure**

The procedure at Time 1 and Time 2 was identical. For each school (at each time wave), a designated classroom teacher was responsible for administering the entire questionnaire (see Appendix C) in a normally scheduled class. Each school was provided with a set of teacher instructions detailing the correct administration of the questionnaire (see Appendix D).

Before beginning the questionnaire, students were requested to provide their first and last name on the cover sheet of the survey. The first component of the questionnaire administered to students was the academic motivation, academic self-concept, cognitive action, and behavioural action items. The teacher first explained the rating scale of these items to students and then presented a sample item. Students were instructed to complete the instrument independently and to provide only one answer for each item. Once all students had completed the first component of the survey (approximately 20 to 30 minutes) they were instructed to attempt the spelling component of the questionnaire. During the administration of the spelling component, the teacher read aloud the target word as well as a sentence containing the target word (see Appendix E for the examiner's spelling list). Students were allowed approximately 15 seconds to write the target word on the paper provided in the survey. Once the spelling component was complete, students were then directed to self-complete a mathematic component (without the assistance of a calculator, teacher, or peers). After precisely 15 minutes, students were instructed to cease working on the mathematic component and to return their completed survey to the teacher. The Time 2 instrument
was identical to that described at Time 1, however in order to reduce the likelihood of practice effects, alternate but equivalent items for the spelling and mathematic component were administered (see Appendix C and E).

Once all surveys were collated, the cover sheet (containing the name of the participant) was discarded and all completed surveys were assigned a unique identification number that could be used to identify responses for matching Time 1 and Time 2 data for longitudinal analyses. This unique identifier was also used to ensure anonymity for all participants.

Overview of Statistical Analyses

The data were initially entered and screened in SPSS v14 (Jöreskog & Sörbom, 2007). All statistical analyses were performed using SPSS v14, PRELIS, and LISREL 8.80 (Jöreskog & Sörbom, 2006). Initial analyses involved screening for missing values, data entry errors (such as incorrect age and gender), univariate and multivariate outliers, and checking for assumptions of normality and linearity. In terms of the central measurement and substantive questions, various univariate and multivariate statistical analyses were employed in this study and each of these is now discussed in turn.

Reliability Analyses

In preliminary analyses, reliability coefficients were calculated for all psychometric scales (i.e., MES-HS, SDQII-S academic self-concept subscale, cognitive action, behavioural action, and academic outcomes) at Time 1, Time 2, as well as for the matched longitudinal sample. Reliability essentially measures the extent to which an instrument or a set of items are internally consistent, and the extent to which the set of test items can be treated as measuring a single construct (Anastasi & Urbina, 1997). The
most commonly used measure of estimating a scale’s internal consistency reliability is Cronbach’s alpha (de Vaus, 2002) with reliability coefficients ranging between 0 and 1, with values of .70 or above generally indicative of an acceptable level of reliability (see Anastasi & Urbina, 1997; Hills, 2003; Sattler, 2001).

**Confirmatory Factor Analysis**

In addition to the reliability of a scale it is also important to confirm the underlying factor structure of the instrumentation (i.e., within-network validity). CFA, performed with LISREL 8.80 (Joreskog & Sorbom, 2006), is the primary method used to test the psychometric properties and to assess the extent to which the observed indicators (items) in the instrumentation reflect the structure of the underlying latent constructs (Byrne, 2001). More specifically, this statistical technique allows the researcher to specify which particular items load onto which factors and to test the extent to which the proposed theoretically derived factor structure manifests in the empirical data as well as allowing for the systematic comparison of different proposed models (Quintana & Maxwell, 1999). This component of the modelling process is often referred to as the measurement model (the structural component to the modelling process is explained further below).

CFA is a statistical method by which the researcher hypothesises a model of relationships between observed measures and *a priori* factors, which are based on theory or empirical evidence (Byrne, 1998). An *a priori* structure is proposed and the researcher is able to test the ability of a model based on this structure to fit the data by demonstrating the following: (a) parameter estimates are consistent with theory and *a priori* predictions; (b) the solution is well defined; and (c) the $\chi^2$ and subjective indices of fit are acceptable (Marsh, Balla, & McDonald, 1988; McDonald & Marsh, 1990). In
CFA, models represent the configuration of the factor loadings, factor variances/covariances, and error terms (referred to here as uniquenesses) for each measured variable. The raw data at both Time 1 and Time 2 were imported into PRELIS and a covariance matrix produced and analysed using LISREL 8.80.

Parameter estimates are derived via model estimation. The method of model estimation used in this research is an iterative approach known as maximum likelihood (Kaplan, 2000). Researchers have shown that the maximum likelihood (ML) method of model estimation is generally regarded as one of the most robust methods available for CFA (especially with moderate to large sample sizes), and tends to be relatively robust with regard to violations of normality assumptions (Bollen, 1989; Boomsma, 1982; Hau & Marsh, 2004; Hoyle, 1995).

Model Evaluation

In order to assess how well the parameter estimates account for the observed covariances (i.e., model fit), a range of goodness-of-fit indices produced by LISREL can be assessed (Kline, 1998; Yuan, 2005). Although an array of goodness-of-fit indices are available, each will typically either: (a) assess the discrepancy between an hypothesised variance-covariance matrix and a sample variance-covariance matrix, or (b) compare the fit of an hypothesised model (with a specified factor structure) to a ‘null’ model (with no hypothesised factor structure). Following recommendations on establishing fit (Hoyle & Panter, 1995; Hu & Bentler, 1995; Marsh, Balla et al., 1988; Marsh, Hau, & Wen, 2004; Quintana & Maxwell, 1999; Vandenberg & Lance, 2000; Yuan, 2005), the Comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI), the Root Mean Square Error of Approximation (RMSEA), the $\chi^2$ test statistic, and an evaluation of parameter estimates were used in the current research to assess model fit.
The RMSEA index is less affected by sample size than the $\chi^2$ test statistic and values at or less than .08 and .05 are taken to reflect an acceptable and excellent fits respectively (see MacCallum, Browne, & Sugawara, 1996; Marsh, Balla, & Hau, 1996; Schumacker & Lomax, 1996; Yuan, 2005). The NNFI and CFI vary along a 0-to-1 continuum in which values at or greater than .90 and .95 are typically taken to reflect acceptable and excellent fits to the data respectively (McDonald & Marsh, 1990). The CFI contains no penalty for a lack of parsimony so that improved fit due to the introduction of additional parameters may reflect capitalisation on chance, whereas the NNFI and RMSEA contain penalties for a lack of parsimony (Holmes-Smith, 2000; Vandenberg & Lance, 2000; Yuan, 2005).

**Multigroup CFA and Factor Invariance**

CFA (i.e., the measurement model) and reliability analyses permit the researcher to determine if the scales underpinning their instrumentation are psychometrically sound for use with a particular sample. In addition to this, it is important to examine whether the factor structure is consistent or invariant across particular sub-groups within the sample. Of particular relevance to the present investigation, there is a paucity of research exploring the effects of age and gender on factor structures underpinning key constructs (see Harter, 1981; Hodge, McCormick, & Elliot, 1997; MacIver, Stipek, & Daniels, 1991; Watt, 2004).

Although most studies focus on mean-level differences between sub-groups (e.g., whether there are differences in mean scores between males and females or as a function of age and/or year-level), inadequate attention has been given to potential differences in factor structure (Martin, 2004, 2007; Vandenberg & Lance, 2000) — that is, the validity of comparisons between groups rests on the assumption that the same
construct is being measured in different groups. Factor invariance extends CFA findings by ensuring that the factor structure is consistent across sub-groups of interest within a larger sample (MacCallum & Austin, 2000). According to Marsh (1993), investigations about factor invariance are warranted because unless there is adequate support for the invariance of factor structure across key sub-groups it may not be justifiable or valid to pool data across such groups (see also Martin, 2004).

Invariance testing involves assessing measurement invariance between the unconstrained model (i.e., the hypothesised model) and a model where various parameters are constrained to be equal across groups (e.g., across gender or year-level). Invariance in factor structure is most appropriately evaluated using CFA to determine whether—and how—the structure of constructs varies according to gender and year-level (see Byrne & Shavelson, 1987; Hattie, 1992a; Marsh, 1993b). Formally testing for factor invariance involves comparing a number of estimated models in which aspects of the factor structure (parameters) are systematically held invariant across groups of interest in a logically ordered and restrictive fashion (Byrne, 2004). When successive elements of the factor structure are constrained, the fit indices of these models are assessed and compared. Although models are typically assessed using the chi-square difference test, as a result of the sensitivity of this statistic to sample size (Bentler & Bonnet, 1980; Loehlin, 1998; Marsh, Balla et al., 1988; Browne, MacCallum, Kim, Anderson, & Glaser, 2002), more focus here is placed on other goodness-of-fit indices (such as RMSEA, CFI, NNFI). The minimal criterion for factor invariance is the equivalence of the factor loadings in multiple groups (Byrne, 1998; Byrne, Shavelson, & Muthen, 1989; Marsh, 1993b). In the present investigation it is also of importance to test for invariance of factor correlations that reflect relations among different factors (Vandenberg & Lance, 2000). According to Cheung and Rensvold’s (2002) criterion, a
change of fit index of no more than 0.01 in fit indices (particularly for CFI) is indicative of factor invariance across groups.

In the present investigation seven successively restrictive models are examined across both gender and year-level (junior, middle, and senior high school). The first multi-group CFA model is completely free and the least restrictive model with no invariance constraints placed on the estimated parameters across groups. This multi-group CFA model can be considered the baseline model with no parameter constraints. Each multi-group CFA model following from this baseline model, are all slightly more restrictive than the first and selected parameters are held invariant across groups in a successively stringent manner. Hence, the second model holds the factor loadings invariant; the third holds both factor loadings and correlations/variances invariant; the fourth holds factor loadings and uniquenesses invariant; and the fifth holds the factor loadings, uniquenesses, and the correlations/variances invariant. The remaining two multi-group CFA models are higher-order invariance tests used to examine the comparative fit of a model in which the beta coefficients (higher-order loadings) are freely estimated and then these beta coefficients are subsequently held invariant. The baseline model is compared with the additional models and changes in fit indices are examined using Cheung and Rensvold’s (2002) criterion (change of fit index of no more than 0.01).

**Structural Equation Modelling**

Structural equation modelling (SEM) is a statistical technique employed in the current investigation to examine the relations between a number of predictor and outcome variables. SEM refers to the structural relationships among latent factors generated in the CFAs described earlier. Unlike CFA described earlier (which
primarily assesses the measurement properties of factors), SEM is aimed at testing substantive questions about relations between latent (e.g., motivation) variables (Hoyle, 1995). The measurement component of a model refers to how the latent constructs are measured by the observed variables (assessed via CFA) whilst the structural aspect refers to inter-relations of the latent variables (see Byrne, 1998; Kline, 1998; MacCallum & Austin, 2000). The advantage of adopting SEM over regression approaches is that it estimates latent constructs purged of measurement error (and so addresses the measurement error limitations that are associated with multiple regression techniques) and also enables researchers to use multiple dependent variables in the one model (Chin, 1998; Kline, 1998; Quintana & Maxwell, 1999). Hence, SEM: (a) examines the structural relationships between latent factors, (b) incorporates both the structural relations between latent variables as well as the observed variables, and (c) accounts for the error variance of multi-item factors. Once a theoretical model has been proposed it can then be tested against empirical data using SEM. In SEM, all hypothesised 'non-causal' or non-predictive relations between factors in the model (e.g., relationships between adaptive and maladaptive motivation variables) are constrained to zero. As with the CFAs described earlier, goodness-of-fit indices aid in the evaluation of model fit and relations are often represented in a pictorial fashion (Hoyle, 1995; Kline, 1998; MacCallum & Austin, 2000; Quintana & Maxwell, 1999). An example of the measurement and structural components which comprise a SEM can be seen in Figure 6.1.
In the present investigation, SEM was used to examine not only the role of academic motivation and self-concept in predicting cognitive action but also the juxtaposition of motivation variables with academic self-concept. Additionally, SEM provides the opportunity to assess the differentiation between cognitive and behavioural action as well as the impact of behavioural action on academic outcomes.

Multiple-Indicator-Multiple-Indicator Cause (MIMIC) Modelling

Multiple-Indicator-Multiple-Indicator Cause (MIMIC) modelling is a specific type of SEM used to explore mean-level differences between groups on a set of dependent variables. MIMIC is seen as superior to the traditional multivariate analysis of variance (MANOVA) and standard multiple regression techniques in that it enables researchers to more accurately determine which of the latent variables (e.g., motivation) are predicted by discrete observed grouping variables (e.g., gender) represented by a single indicator. An important advantage of MIMIC models over traditional
multivariate methods such as MANOVA is that analyses are conducted on the basis of
the latent factors (Grayson, MacKinnon, Jorm, Creasey, & Broe, 2000) and so the
researcher is not reliant on calculated scale scores that are not purged of measurement
error. An additional advantage of using the MIMIC approach is that it easily
incorporates both discrete and continuous variables as well as the interactions between
these independent variables thus representing group membership in more appropriate
ways and allowing the researcher to consider more familiar models of main effects and
interactions. The MIMIC approach can also better analyse cases in which sample size in
a given group may be too small to ensure stable estimates of variances and covariances
(Grayson et al., 2000; Kaplan, 2000).

MIMIC models were performed to assess the effects of gender, year-level
(treated as a continuous variable), and the gender x year-level interaction (see Figure
6.2). Consistent with recommendations by Aiken and West (1991), year-level was zero­
centered (put in deviation score form so that the mean is zero and the standard deviation
is 1) so as to reduce the multicollinearity between year-level and the corresponding
interaction term. Very high levels of multicollinearity can introduce technical problems
in estimating regression coefficients and centering variables often minimises these
potential problems. The zero-centered interaction term was calculated using gender by
the zero-centered year-level variable. The outcomes of the MIMIC models are
evaluated with the same goodness-of-fit criteria that were used in CFA and SEM
analyses. As the factor loadings of the latent variables are identical for the MIMIC and
CFA models, greater emphasis is placed on the significant beta coefficients (i.e., path
coefficients) that represent the effects of gender, year-level, and gender x year-level
interactions. Any significant interaction effects were interpreted through interaction
plots.
Figure 6.2. Example of a multiple-indicator-multiple-indicator cause model.
Figure 6.2. Example of a multiple-indicator-multiple-indicator cause model.
Statistical Considerations

Sample Size and Power

As with traditional statistical analyses, making an effort to sustain adequate statistical power (i.e., the ability to detect and reject a poor fitting model) in SEM is a critical issue. However, in contrast to traditional hypothesis testing (which aims to reject the null hypothesis of no difference), the objective in SEM is to produce a non-significant result – that is, the covariance matrix implied by a model is equal to the population covariance of the observed variables (Chin, 1998; McCoacb et al., 2007). As is the case with traditional statistical analyses, the power of a test increases with sample size.

Similarly, as the reliability of indicators increases (i.e., the greater proportion of variance in the indicators that is explained by latent variables) the more power the model will tend to have (Tomarken & Waller, 2003). This means that research that utilises multiple indicators (as is the case in the present investigation) will have more power than research that uses less reliable scales.

Naturally, sample size is related to the issue of power. Although there are no well-established guidelines about acceptable minimum levels of sample size (MacCallum & Austin, 2000; Marsh & Hau, 2007), some broad rules of thumb have been advanced. According to various researchers, a small sample size is considered less than 100 participants, between 100 and 200 participants are considered medium (the recommended minimum sample size for SEM) and sample sizes which exceed 200 are considered large and the more ideal (see Kline, 1998; Marsh & Hau, 2007; Schumaker & Lomaz, 1996). According to MacCallum et al. (1996), more complex models ($df = 75$) require sample
sizes of 200 participants or more to achieve a power level of .80. Put simply, the more parameters in a model, the larger the sample size needs to be to establish power.

The issue of sample size is also relevant in the context of model evaluation (see Hu & Bentler, 1998 for a detailed overview). Interestingly, in SEM the assessment of model fit is confounded with sample size and power. Hence, as power increases, the researcher will be more likely to reject the null hypothesis (i.e., that the observed covariance matrix and the hypothesised covariance matrix are equal; McCoach et al., 2007). Put simply, SEM models with highly reliable indicators tend to manifest worse fit than models with small sample size and less reliable indicators (Browne et al., 2002). In SEM, model fit is essentially concerned with the degree to which a model can reproduce the pattern of observed covariances, not whether the covariances among the variables are large or small. Thus, statistical power is especially critical in SEM because researchers hope to accept the null hypothesis about a model's overall fit. When this happens, it is crucial to ensure that the acceptance is not due to inadequate sample size.

To rely solely on the value of chi-square would be unwise, because sample sizes need to be small in order to reflect a good fit. Ultimately, this would result in reduced statistical power and questionable results (Satorra & Saris, 1985; Quintana & Maxwell, 1999). Numerous researchers have demonstrated and highlighted the sensitivity of the chi-square ($\chi^2$) goodness-of-fit statistic to sample size (see Bentler & Bonnet, 1980; Loehlin, 1998; Marsh, Balla et al., 1988; Browne et al., 2002), thus the larger the sample size the more difficult it is to fail to reject the null hypothesis. Hence, due to the unsatisfactory nature of the $\chi^2$ statistic for model fit assessment, a variety of alternative indices have been recommended. Accordingly, in the present investigation, the CFI, the NNFI, the RMSEA,
the $\chi^2$ test statistic, and an evaluation of parameter estimates are presented to assess model fit (Bentler & Bonnet, 1980). These indices were selected as per recommendations by various researchers (Hoyle & Panter, 1995; Hu & Bentler, 1995, 1998; Marsh, Balla et al., 1988; Marsh, Hau et al., 2004; MacCallum & Austin, 2000; MacCallum et al., 1996).

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Statistical Considerations

Sample Size and Power

As with traditional statistical analyses, making an effort to sustain adequate statistical power (i.e., the ability to detect and reject a poor fitting model) in SEM is a critical issue. However, in contrast to traditional hypothesis testing (which aims to reject the null hypothesis of no difference), the objective in SEM is to produce a non-significant result – that is, the covariance matrix implied by a model is equal to the population covariance of the observed variables (Chin, 1998; McCoach et al., 2007). As is the case with traditional statistical analyses, the power of a test increases with sample size.

Similarly, as the reliability of indicators increases (i.e., the greater proportion of variance in the indicators that is explained by latent variables) the more power the model will tend to have (Tomarken & Waller, 2003). This means that research that utilises multiple indicators (as is the case in the present investigation) will have more power than research that uses less reliable scales.

Naturally, sample size is related to the issue of power. Although there are no well-established guidelines about acceptable minimum levels of sample size (MacCallum & Austin, 2000; Marsh & Hau, 2007), some broad rules of thumb have been advanced. According to various researchers, a small sample size is considered less than 100 participants, between 100 and 200 participants are considered medium (the recommended minimum sample size for SEM) and sample sizes which exceed 200 are considered large and the more ideal (see Kline, 1998; Marsh & Hau, 2007; Schumaker & Lomaz, 1996). According to MacCallum et al. (1996), more complex models (df = 75) require sample
scales of 200 participants or more to achieve a power level of .80. Put simply, the more parameters in a model, the larger the sample size needs to be to establish power.

The issue of sample size is also relevant in the context of model evaluation (see Hu & Bentler, 1998 for a detailed overview). Interestingly, in SEM the assessment of model fit is confounded with sample size and power. Hence, as power increases, the researcher will be more likely to reject the null hypothesis (i.e., that the observed covariance matrix and the hypothesised covariance matrix are equal; McCoach et al., 2007). Put simply, SEM models with highly reliable indicators tend to manifest worse fit than models with small sample size and less reliable indicators (Browne et al., 2002). In SEM, model fit is essentially concerned with the degree to which a model can reproduce the pattern of observed covariances, not whether the covariances among the variables are large or small. Thus, statistical power is especially critical in SEM because researchers hope to accept the null hypothesis about a model's overall fit. When this happens, it is crucial to ensure that the acceptance is not due to inadequate sample size.

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for missing data as operationalised using missing value analysis in LISREL (Allison, 2003; Brown, 1994; Peugh & Enders, 2004; Tomarken & Waller, 2005. The percentage of missing data for this study was 4.88% at Time 1 and 4.82% at Time 2. The matched sample had no missing data as it was derived from the complete T1 and T2 datasets. Hence, the EM algorithm was considered an appropriate approach to handling missing data in the present investigation.

**Sample attrition.**

Missing data are also a particular problem for longitudinal research (Goldstein, 1979; Robinson et al., 2005). The unscheduled loss of sample over time can influence the power and ultimately the findings of longitudinal analyses. Through careful selection, large sampling, and purposeful tracking of participants, researchers are able to partially protect against sample attrition across time waves (Goldstein, 1979; Robinson et al., 2005; Van Der Kamp & Bijleveld, 1998). The present study was conducted over two time waves (one year apart) and therefore it was expected that at Time 2 there would not only be the inclusion of a new year 7 cohort but also the loss of the year 12 cohort measured at Time 1.

In an attempt to prepare for this scheduled sample attrition, the present investigation: (a) ensured that a large sample was obtained from the outset (at Time 1 and Time 2); and (b) tracked participants via unique identification numbers.

**Modification Indices.**

As indicated earlier, SEM allows for model evaluation via assessment of goodness-of-fit indices and parameter estimates. This process of ‘testing’ a proposed model is commonly referred to as the confirmatory aspect of SEM (Kline, 1998; Raykov &
Marcoulides, 2000; Schumaker & Lomax, 1996). However, it is a well-known limitation of SEM that several alternate models can fit the data equally well (or better) and that alternate theoretical models can also be feasible (Kaplan, 1989; Kline, 1998; Martens & Haase, 2006; Quintana & Maxwell, 1999; Tomarken & Waller, 2005). Therefore, another unique aspect of SEM is that it also allows for the purported 'exploratory' mode which allows for model refinement aimed at improving the fit between the data and the model (Kaplan, 1990a) as well as the further development of theory (Pugesek, Tomer, & Von Eye, 2003). Thus it is important that plausible alternate models are tested to determine which one is optimal from both an empirical and theoretical perspective. As a result, researchers rarely test a single model in isolation, but often make post hoc decisions to improve the fit between a model and the data, informed by a conceptual rationale (Byrne, 1998; Kline, 1998; MacCallum & Austin, 2000; Quintana & Maxwell, 1999).

One relatively common method for exploring possible additional parameters (i.e., modifying covariance structure) involves inspection of modification indices (MI; see Jöreskog & Sörbom, 1984, 1988) and the expected parameter change statistic (EPC) proposed by Saris, Satorra, and Sörbom (1987). Essentially, the MI provide an indication of the expected reduction in the overall value of the test statistic when a fixed parameter implied by the existing model is freed and the model re-estimated (Kaplan, 1990a; Olsson, Troye, & Howell, 1999). The EPC yields an estimated value or approximates the size of a fixed parameter if that parameter were to be freely estimated in the new model (Chou & Bentler, 1993; Kaplan, 1990a). Overall, these indices are designed to identify a statistically significant improvement in the fit of a model. Although the limitations of the model modification process have been well documented and debated in statistical literature (see
Bollen, 1990; Hayduk, 1990; Kaplan, 1990b; Stieger, 1990), there is agreement that there can be yields from indices such as the MI and EPC in that they can provide valuable information in the re-specification process if used with caution and based on sound substantive and statistical judgement (Olsson et al., 1999).

As theory building involves the progressive elaboration of existing models, it is crucial that model modification is based on theoretical rationale, as well as on empirical grounds (Bollen, 1990; Kaplan, 1989, 1990a, 1990b). Therefore, based on the above recommendations, the model modification process adopted in the present study is a forward search (see Chou & Bentler, 1993) in which both the MI and EPC are inspected and fixed parameters in the existing model are freed and successively re-estimated. Under this approach, parameters with large modification indices and large expected change values were freed, but only provided it made substantive sense to do so. Additionally, this process of model modification is based on univariate procedures in which each parameter is systematically considered in isolation (Kelloway, 1998). As a result, additional parameters were only freed if: (a) modification indices indicated a large estimated change; and (b) these parameters were conceptually defensible. In line with Marsh and Hau (2007), an audit trail of analyses and respecifications to models (starting with an a priori model) will be provided throughout the results chapters (Chapter 7 through to Chapter 10).

Multicollinearity and the Use of Higher-Order Factor Analysis

The finding that a model is a good fit to the data is not the only criterion for an acceptable model; a researcher must also examine parameter estimates (MacCallum & Austin, 2000). In the case of the current investigation, it is evident that there are numerous
factors which have the potential to be highly correlated. For example, in relation to the motivation instrument (MES-HS), it has been shown that a number of the first-order factors are highly correlated and this has led to recommendations that when using MES-HS factors as predictors (such as in the present investigation), researchers should incorporate the higher-order structure to circumvent problems of multicollinearity (Martin, 2007). Highly correlated factors raise the potential for the problem of multicollinearity in SEM analyses (Grewal, Cote, & Baumgartner, 2004; Marsh, Dowson, Pietsch, & Walker, 2004).

Multicollinearity can produce suppression effects in which identified beta parameters do not reflect the ‘true’ nature of a given relationship (Cohen, 1978; Grapentine, 2000; Kim, Kaye, & Wright, 2001; Martin, Marsh et al., 2001a, 2001b, 2003; Maassen & Bakker, 2001; Tzelgov & Henik, 1991). For example, a significant and positive association between two factors can be incorrectly represented as a negative association, as a non-significant beta path, or as a derived beta coefficient that is larger than the correlation implied by the product of the two factors (Grewal et al., 2004; MacKinnon et al., 2000; Maassen & Bakker, 2001). The suppression effects encountered in MES-HS research are essentially inflated errors of the beta estimate (or inflated regression coefficients) due to multicollinearity.

A variety of post hoc methods have been advanced as possible ways to deal with multicollinearity without jeopardising the theoretical underpinnings of hypothesised models. Some of these suggestions include: higher-order modelling, model respecification, the collection of additional data, replicating the analyses with a different sample, splitting the analysis into separate blocks whereby the highly correlated predictors are assessed separately as to their predictive power, principal components regressions, forming
composite indicators, and deletion of the predictor of least interest (see Billings & Wroten, 1978; Cohen, West, Aiken, & Cohen, 2003; Grewal et al., 2004).

To avoid possible suppression effects in the present study, and consistent with prior research using the MES-HS, it was considered appropriate to utilise the higher-order factors as predictors rather than the collinear first-order factors. Accordingly, in the following results chapters, the emphasis in the structural hypothesised models is on the four higher-order MES-HS factors (adaptive cognition, adaptive behaviour, impeding/maladaptive cognition, and maladaptive behaviour) rather than the eleven first-order components. In higher-order CFA models, correlations between the first-order factors are constrained to be zero and relations among these first-order factors are explained in terms of higher-order factors (Chin, 1998; Marsh & Hocevar, 1985). Therefore, an additional benefit to a higher-order approach to the modelling is that the number of higher-order factor loadings is typically much smaller than the number of correlations among the first-order factors. In CFA and SEM, parsimony refers to the number of estimated coefficients required to achieve a specific level of fit (Schumaker & Lomax, 1996). Thus, an added advantage of higher-order modelling is that it involves more parsimonious models (Marsh & Hocevar, 1985). An example of a higher-order model can be seen in Figure 6.3.
Chapter Summary

The purpose of this chapter has been to detail the methods used to address and answer the hypotheses and research questions relevant to academic processes in the present study. A description of participants at each time wave as well as an outline of the data collection procedures (and testing administration) were presented. Instrumentation was outlined along with the statistical processes used to examine their validity. CFAs examining the psychometric properties of the constructs, gender and year-level factor invariance, SEM, and MIMIC models were explained and their application to the current research presented. Finally, statistical considerations – such as missing data, modification
indices, correlated uniquenesses, and suppression effects – surrounding these advanced statistical techniques were discussed. The findings emanating from these statistical procedures are now the focus of the following chapters.
CHAPTER 7

ASSESSING THE PSYCHOMETRIC PROPERTIES OF TIME 1 INSTRUMENTATION

Introduction

Prior to evaluating the hypothesised academic self-system process model, it is important to demonstrate the psychometric properties of the measures under focus as well as preliminary analyses involving the roles of demographic characteristics such as gender and year-level. The present chapter assesses the psychometric properties of academic motivation (as measured by the MES-HS), academic self-concept (as measured by the SDQII-S subscale), cognitive action (i.e., positive school appraisal and positive academic plans), behavioural action (i.e., homework completion, class participation, and absenteeism), as well as academic outcomes (i.e., test performance and test effort).

Findings presented in this chapter are based on Time 1 data (N=3,450 students from six Australian high schools, years 7 to 12) and are broadly organised around the hypotheses and research questions outlined in Chapter 5.

Consistent with the construct validity approach detailed in the review of literature and also in the Methodology chapter, the hypotheses are centrally concerned with the descriptive and reliability properties associated with each construct, the factor structure underpinning the central measures, the invariance (or lack of) in factor structure on the basis of gender and year-level, and the predictive roles of gender, year-level, and their interaction. Taken together, this chapter is aimed at demonstrating the reliability and
validity of the measures under focus, thereby providing a sound and robust basis for examining the hypothesised academic self-system process model that is the central focus of this thesis.

**Time 1 Descriptive and Reliability Statistics**

It was predicted that distribution and reliability tests will demonstrate normality and internal consistency for all instrumentation. In order to test this prediction, descriptive and Cronbach’s alpha (reliability) statistics were examined for the total Time 1 sample. Recapping from Chapter 6, reliability coefficients range from 0 – 1, with values closer to 1 representing relatively greater reliability. Values over .70 are generally considered acceptable (Anastasi & Urbina, 1997; Hills, 2003; Sattler, 2001). Reliability coefficients were calculated for all psychometric scales (i.e., academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes) utilised at Time 1. Coefficient alphas (presented in Table 7.1) indicate acceptable reliability for all hypothesised factors, providing support for the hypotheses specified in Chapter 5. Having demonstrated the reliability of each factor, it is also important to assess the distributional properties of each factor. Factor subscales were formed by generating the mean of the set of items for each facet of the MES-HS, academic self-concept, cognitive action, behavioural action and academic outcomes. Descriptive statistics for each subscale are presented in Table 7.1. Distributional data indicate that each first-order motivation facet, academic self-concept, cognitive action, behavioural action, and academic outcomes is approximately normally distributed. The exception is found for test effort where students were required to attempt the bulk of the spelling and mathematic items, thus leading to
skewness and kurtosis. Overall, these findings provide support for the hypothesis that the factors will be approximately normally distributed.

Table 7.1

| Time 1 Descriptive Statistics and Cronbach’s Alphas for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes |
|---------------------------------|----------------|----------------|----------------|----------------|----------------|
|                                  | Mean           | Standard Deviation | Skewness | Kurtosis | Cronbach’s α |
| ADAPTIVE MOTIVATION - COGNITION |                |                  |          |          |               |
| Self-efficacy                   | 5.74           | .99              | -.98     | 1.12     | .79           |
| Mastery Orientation             | 5.80           | .97              | -1.03    | 1.40     | .82           |
| Valuing of School               | 5.73           | 1.00             | -1.03    | 1.24     | .79           |
| ADAPTIVE MOTIVATION - BEHAVIOUR |                |                  |          |          |               |
| Planning                        | 4.33           | 1.25             | -.17     | -.33     | .78           |
| Task Management                 | 4.97           | 1.29             | -.54     | -.12     | .83           |
| Persistence                     | 4.93           | 1.13             | -.47     | .10      | .81           |
| IMPEDING/MALADAPTIVE MOTIVATION |                |                  |          |          |               |
| Anxiety                         | 4.19           | 1.37             | -.11     | -.04     | .78           |
| Failure Avoidance               | 3.13           | 1.34             | -.38     | -.46     | .78           |
| Uncertain Control               | 3.35           | 1.29             | .20      | -.52     | .78           |
| MALADAPTIVE MOTIVATION          |                |                  |          |          |               |
| Self-handicapping               | 2.84           | 1.30             | .47      | -.47     | .80           |
| Disengagement                   | 2.42           | 1.23             | .95      | .49      | .80           |
| SDQII-S SUBSCALE                |                |                  |          |          |               |
| Academic Self-concept           | 4.58           | 1.04             | -.77     | .44      | .87           |
| COGNITIVE AND BEHAVIOURAL ACTION|                |                  |          |          |               |
| Positive School Appraisal       | 5.02           | 1.39             | -.74     | .10      | .91           |
| Positive Academic Plans         | 5.74           | 1.12             | -1.23    | 1.56     | .82           |
| Class Participation             | 5.19           | 1.22             | -.67     | .31      | .90           |
| Homework Completion             | 4.28           | .79              | -1.15    | 1.53     | .68           |
| Absenteeism                     | 2.23           | .92              | 1.60     | 3.92     | .68           |
| ACADEMIC OUTCOMES               |                |                  |          |          |               |
| Test Performance                | 106.95         | 12.55            | -.51     | .68      | .68           |
| Test Effort                     | 35.09          | 4.07             | -2.07    | 9.93     | .31           |

Note. Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort)
Time 1 First-order Factor Analysis of the Instrumentation

It was hypothesised in Chapter 5 that data will support a sound first-order factor structure underpinning academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes. To test this prediction, CFA was conducted using maximum likelihood estimation. In this CFA, all first-order factors were assessed, yielding a 19-factor model. Items were freed to load on their respective factors and all other factor loadings were constrained to be zero. As discussed in the methodology chapter, $\chi^2$ tests are sensitive to sample size and so models with large sample size will often be rejected (Bentler & Bonnett, 1980; Browne et al., 2002; Loehlin, 1998; Marsh, Balla et al., 1988). Hence, in addition to $\chi^2$ tests, the RMSEA, CFI, and NNFI are also included (see Methodology chapter for more details).

Results of the CFA testing the first-order factors of academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes are presented in Table 7.2. The first-order factor model provided an excellent fit to the data ($\chi^2 = 10,456.87$, $df = 1,910$, RMSEA = .04, CFI = .98, NNFI = .98). The factor loadings indicate that the factors are well defined and factor loadings are robust (with the exception of effort with a loading of .26). Essentially, all items are loading highly on the factors they are intended to measure (average absolute factor loading = .69).

Correlations amongst all first-order factors are presented in Table 7.3. The correlations amongst MES-HS factors are in line with previous research (Martin, 2001, 2003b, 2007) and the hypotheses presented in Chapter 5. As seen in Table 7.3, the adaptive motivation factors are highly correlated with each other, correlated at zero or slightly
negatively with impeding/maladaptive motivation factors, and markedly negatively correlated with maladaptive motivation factors. There are high correlations amongst impeding/maladaptive motivation factors and amongst maladaptive motivation factors with the latter two clusters modestly positively correlated. With the exception of absenteeism (in which higher scores reflect a maladaptive outcome), correlations also demonstrate that the adaptive motivation factors are positively correlated with cognitive action, behavioural action, and academic outcomes, the impeding/maladaptive motivation factors are correlated around zero or modestly negative with these constructs, and the maladaptive motivation factors are correlated more markedly negatively. In terms of academic self-concept, the factor correlations show that academic self-concept is strongly positively correlated with the adaptive motivation factors, and moderately negatively correlated with the impeding/maladaptive motivation factors and correlated more distinctly negatively with the maladaptive motivation factors. Similarly, academic self-concept appears to be significantly correlated with cognitive action, behavioural action (with the exception of absenteeism to which it is negatively related), and academic outcomes.
Table 7.2

*Time 1 First-order Factor Loadings for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes*

<table>
<thead>
<tr>
<th>Item</th>
<th>Item 1</th>
<th>Item 2</th>
<th>Item 3</th>
<th>Item 4</th>
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<tbody>
<tr>
<td>Self-efficacy</td>
<td>.72</td>
<td>.67</td>
<td>.63</td>
<td>.76</td>
</tr>
<tr>
<td>Mastery Orientation</td>
<td>.66</td>
<td>.71</td>
<td>.78</td>
<td>.80</td>
</tr>
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<td>Test Effort</td>
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</tbody>
</table>

*Note.* Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort).
Table 7.3

Time I CFA Factor Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

<table>
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<th>TM</th>
<th>P</th>
<th>A</th>
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<th>UC</th>
<th>SH</th>
<th>D</th>
<th>AS</th>
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</table>

Note. SE= Self-efficacy, MO= Mastery orientation, VS= Valuing of school, PL= Planning, TM= Task management, P= Persistence, A= Anxiety, FA= Failure avoidance, UC= Uncertain control, SH= Self-handicapping, D= Disengagement, AS= Academic self-concept, PS= Positive school appraisal, PA= Positive academic plans, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. All r-values > .07 are significant at p<.05.
Time 1 Higher-order Factor Analysis of the Instrumentation

In addition to the first-order factor structure constituting the eleven facets of the MES-HS, there is also hypothesised a higher-order structure defined by four primary dimensions: adaptive cognitive motivation dimension, adaptive behavioural motivation dimension, impeding/maladaptive motivation dimension, and maladaptive motivation dimension. As discussed in Chapter 6, it is recommended that the higher-order structure of the MES-HS be utilised when using it as a predictive instrument (Martin, 2007) such as in the case when testing the hypothesised academic self-system process model (see Figure 3.5). Higher-order CFA models essentially aim to determine whether various combinations of first-order factors adequately represent the higher-order factor structure. In higher-order CFA models, the number of higher-order factor loadings is typically much smaller than the number of correlations among the first-order factors, therefore making the higher-order models more parsimonious (Marsh & Hocevar, 1985).

The higher-order CFA included all factors from the first-order analysis, but represented the MES-HS in terms of four higher-order factors. This higher-order CFA provided an excellent fit to the data ($\chi^2 = 12,647.95$, $df = 2,005$, RMSEA = .04, CFI = .98, NNFI = .98). As expected, the factor loadings for the higher-order factors of the MES-HS are well defined, and statistically significant, and acceptable in strength (range = .54 to .90). Essentially, all first-order factors load highly on the higher-order factors they are intended to account for (see Table 7.4).

Not surprisingly, factor correlations within the higher-order factor structure of the MES-HS (see Table 7.4) demonstrate that adaptive motivation (i.e., adaptive cognitive
motivation and adaptive behavioural motivation) higher-order factors are strongly positively correlated, but that these adaptive motivation dimensions are negatively correlated with impeding/maladaptive motivation and more markedly negatively correlated with maladaptive motivation. These analyses also show that, notwithstanding absenteeism (in which higher scores reflect a more maladaptive outcome), the adaptive motivation dimension is positively correlated with cognitive action, behavioural action, and academic outcomes, the impeding/maladaptive motivation dimension is correlated somewhat negatively with these constructs, and the maladaptive motivation dimension is correlated more markedly negatively.

In summary, the results assessing the first-order and higher factor solutions demonstrate support for the factor structure of the central constructs. More specifically, the goodness-of-fit indices, the factor loadings, and the factor correlations supported the use of these factors for testing the hypothesised academic self-system process model. Although the structure and relations among the first-order factors are well defined, there is also support for the hypothesised higher-order solution.
Table 7.4

**Time 1 Higher-order Factor Loadings (range and means in diagonal) and Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes**

<table>
<thead>
<tr>
<th></th>
<th>AC</th>
<th>AB</th>
<th>IM</th>
<th>MM</th>
</tr>
</thead>
<tbody>
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<td>(.86)</td>
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<td>-.85</td>
<td>(.84)</td>
</tr>
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<td>Impeding/Maladaptive Motivation (IM)</td>
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<td>-.25</td>
<td>.54</td>
<td>-.89</td>
</tr>
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<td>Maladaptive Motivation (MM)</td>
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<td>-.75</td>
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<td>.66</td>
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<td>Academic Self-concept</td>
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<td>-.55</td>
<td>-.59</td>
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<td>Positive School Appraisal</td>
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<td>-.24</td>
<td>-.70</td>
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<tr>
<td>Positive Academic Plans</td>
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<td>-.71</td>
</tr>
<tr>
<td>Class Participation</td>
<td>.53</td>
<td>.49</td>
<td>-.25</td>
<td>-.50</td>
</tr>
<tr>
<td>Homework Completion</td>
<td>.46</td>
<td>.56</td>
<td>-.24</td>
<td>-.61</td>
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<tr>
<td>Absenteeism</td>
<td>-.16</td>
<td>-.17</td>
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<tr>
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<td>Test Effort</td>
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<td>.17</td>
<td>-.14</td>
<td>-.26</td>
</tr>
</tbody>
</table>

Note. Range and mean of higher-order CFA loadings are in the diagonal of the upper part of table. All correlations are significant at $p < .05$.

**Factor Invariance Across Gender and Year-level: First-order and Higher-order Solutions for Time 1 Data**

The focus of a vast majority of studies exploring the effects of gender and year-level on multiple dimensions of motivation, self-concept, engagement, and academic outcomes has been on whether there are mean-level differences between males and females or between different year levels at school. Inadequate attention, however, has been given to gender and year-level differences in factor structure of key constructs (in particular...
motivation and self-concept). Such concerns about factor structure invariance are valid and worthy of investigation, because unless there is adequate support for the invariance of factor structure across gender and year-level, it may not be justifiable to pool data across these groups (Marsh, 1993b).

Invariance in factor structure is most appropriately evaluated using CFA to determine whether—and how—the structure of constructs varies according to gender and year-level (see Byrne & Shavelson, 1987; Hattie, 1992a; Marsh, 1993b). Using CFA, testing for factor invariance essentially involves comparing a number of estimated models in which aspects of the factor structure are systematically held invariant across groups and assessing fit indices when elements of these structures are constrained. It was hypothesised (see Chapter 5) that the first-order and higher-order factor structure of academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes will be invariant across males and females and across year-levels.

**Testing Invariance as a Function of Gender for the Time 1 Sample**

The first set of analyses involved multi-group CFAs as a function of gender. The first multi-group CFA examined the first-order factor structure for males and females and allowed all factor loadings, uniquenesses, and correlations/variances to be freely estimated (this is considered to be the baseline or control model). This model yielded an excellent fit to the data ($\chi^2 = 15,024.86$, $df = 3,824$, RMSEA = .04, CFI = .98, NNFI = .97). Factor loadings are presented in Table 7.5. Although the factor loadings and fit indices suggest that this model is a good fit to the data, it is important to formally test for invariance between males and females. It was therefore necessary to examine the comparative fit
indices for four additional models across males and females. As discussed in Chapter 6, the first model holds the factor loadings invariant across males and females; the second holds both factor loadings and correlations/variances invariant; the third holds factor loadings and uniquenesses invariant; and the fourth holds the factor loadings, uniquenesses, and the correlations/variances invariant (See Table 7.6).

Results indicate that when successive elements of the factor structure are held invariant across gender, the fit indices are predominately comparable. Indeed, the application of recommended criteria for evidence of lack of invariance (i.e., a change in 0.01 in fit indices – see Cheung & Rensvold, 2002) indicates that there is relative invariance across all models. This suggests that the factor structure, factor loadings, uniquenesses, and factor correlations/variances are relatively invariant for males and females.
Table 7.5

Time I Gender and Year-level Factor Loading Ranges for the First-order Factor Structure

of Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action,

and Academic Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
<th>Junior</th>
<th>Middle</th>
<th>Senior</th>
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<td>56 - 79</td>
<td>62 - 72</td>
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<td>66 - 84</td>
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<td>66 - 78</td>
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<tr>
<td><strong>Valuing of School</strong></td>
<td>57 - 79</td>
<td>57 - 75</td>
<td>57 - 83</td>
<td>57 - 73</td>
<td>57 - 75</td>
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<tr>
<td><strong>Planning</strong></td>
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<td>61 - 77</td>
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<td>50 - 78</td>
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<tr>
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<td>61 - 75</td>
<td>63 - 76</td>
<td>57 - 76</td>
<td>64 - 76</td>
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<td>74 - 90</td>
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<td>75 - 88</td>
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<tr>
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<td>71 - 82</td>
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<tr>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Absenteism</strong></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Test Performance</strong></td>
<td>63 - 76</td>
<td>63 - 76</td>
<td>62 - 75</td>
<td>62 - 75</td>
<td>62 - 75</td>
</tr>
<tr>
<td><strong>Test Effort</strong></td>
<td>16 - 29</td>
<td>16 - 29</td>
<td>14 - 25</td>
<td>14 - 25</td>
<td>14 - 25</td>
</tr>
</tbody>
</table>

*Note. Decimals omitted. Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort)*
Table 7.6

**Time 1 Gender and Year-level Invariance for the First- and Higher-order Factor Structure of the Academic Motivation, Academic Self-concept, and Cognitive Action, Behavioural Action and Academic Outcomes**

<table>
<thead>
<tr>
<th>Invariance across Males and Females</th>
<th>Chi Square</th>
<th>df</th>
<th>CFI</th>
<th>NNFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>All parameters are free: No invariance (Model 1)</td>
<td>15,024.86</td>
<td>3,824</td>
<td>.98</td>
<td>.97</td>
<td>.041</td>
</tr>
<tr>
<td>FIRST-ORDER FACTOR LOADINGS invariant (Model 2)</td>
<td>15,107.90</td>
<td>3,869</td>
<td>.98</td>
<td>.97</td>
<td>.041</td>
</tr>
<tr>
<td>Model 2 + CORRELATIONS/VARIANCES invariant (Model 3)</td>
<td>16,567.96</td>
<td>4,059</td>
<td>.97</td>
<td>.97</td>
<td>.042</td>
</tr>
<tr>
<td>Model 2 + UNIQUENESSES invariant (Model 4)</td>
<td>15,951.68</td>
<td>3,933</td>
<td>.97</td>
<td>.97</td>
<td>.042</td>
</tr>
<tr>
<td>Model 2 + CORRELATIONS/VARIANCES, UNIQUENESSES invariant (Model 5)</td>
<td>17,480.83</td>
<td>4,123</td>
<td>.97</td>
<td>.97</td>
<td>.043</td>
</tr>
<tr>
<td>Model 5 + HIGHER-ORDER LOADINGS free (Model 6)</td>
<td>19,649.39</td>
<td>4,212</td>
<td>.97</td>
<td>.97</td>
<td>.046</td>
</tr>
<tr>
<td>Model 5 + HIGHER-ORDER LOADINGS invariant (Model 7)</td>
<td>19,700.23</td>
<td>4,218</td>
<td>.97</td>
<td>.97</td>
<td>.046</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Invariance across Year-Level (Junior, Middle, and Senior)</th>
<th>Chi Square</th>
<th>df</th>
<th>CFI</th>
<th>NNFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>All parameters are free: No invariance (Model 1)</td>
<td>17,891.21</td>
<td>5,736</td>
<td>.97</td>
<td>.97</td>
<td>.043</td>
</tr>
<tr>
<td>FIRST-ORDER FACTOR LOADINGS invariant (Model 2)</td>
<td>18,813.64</td>
<td>5,826</td>
<td>.97</td>
<td>.97</td>
<td>.043</td>
</tr>
<tr>
<td>Model 2 + CORRELATIONS/VARIANCES invariant (Model 3)</td>
<td>19,968.08</td>
<td>6,206</td>
<td>.97</td>
<td>.97</td>
<td>.043</td>
</tr>
<tr>
<td>Model 2 + UNIQUENESSES invariant (Model 4)</td>
<td>18,916.84</td>
<td>5,954</td>
<td>.97</td>
<td>.97</td>
<td>.044</td>
</tr>
<tr>
<td>Model 2 + CORRELATIONS/VARIANCES, UNIQUENESSES invariant (Model 5)</td>
<td>20,468.50</td>
<td>6,334</td>
<td>.97</td>
<td>.97</td>
<td>.044</td>
</tr>
<tr>
<td>Model 5 + HIGHER-ORDER LOADINGS free (Model 6)</td>
<td>22,627.81</td>
<td>6,417</td>
<td>.97</td>
<td>.97</td>
<td>.047</td>
</tr>
<tr>
<td>Model 5 + HIGHER-ORDER LOADINGS invariant (Model 7)</td>
<td>23,994.52</td>
<td>6,429</td>
<td>.96</td>
<td>.96</td>
<td>.050</td>
</tr>
</tbody>
</table>
In addition to the first-order factor structure of motivation (constituting the eleven facets of the MES-HS), there is also a hypothesised higher-order structure defined by four dimensions: adaptive cognitive motivation dimension, adaptive behavioural motivation dimension, impeding/maladaptive motivation dimension, and maladaptive motivation dimension. Hence, the second multi-group CFA examined the higher-order factor structure of the MES-HS along with first-order academic self-concept, cognitive action, behavioural action, and academic outcomes for males and females. Factor loadings are presented in Table 7.7. These higher-order invariance tests examined the comparative fit indices for two additional models where the first-order model and parameters are held invariant but the beta coefficients (higher-order loadings) are freely estimated (the first additional model) and then subsequently held invariant (the second additional model). Using Cheung and Rensvold’s (2002) criteria (a change of 0.01 in fit indices), the results presented in the lower half of Table 7.6, show that there is gender invariance in the higher-order model. This gender invariance data suggest that in terms of the central constructs (both first-order and higher-order) and the composition of and relationships amongst these constructs, males and females are not substantially different.
Table 7.7

*Time 1 Gender and Year-level Factor Loading Ranges for the Higher-order Factor Structure of Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes*

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
<th>Junior</th>
<th>Middle</th>
<th>Senior</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adaptive Motivation - Cognition</strong></td>
<td>73 - 87</td>
<td>85 - 94</td>
<td>82 - 86</td>
<td>86 - 95</td>
<td>86 - 96</td>
</tr>
<tr>
<td><strong>Adaptive Motivation - Behaviour</strong></td>
<td>84 - 86</td>
<td>81 - 86</td>
<td>84 - 87</td>
<td>80 - 86</td>
<td>76 - 85</td>
</tr>
<tr>
<td><strong>Impeding/Maladaptive Motivation</strong></td>
<td>54 - 86</td>
<td>54 - 90</td>
<td>54 - 95</td>
<td>54 - 86</td>
<td>54 - 87</td>
</tr>
<tr>
<td><strong>Maladaptive Motivation</strong></td>
<td>66 - 85</td>
<td>66 - 85</td>
<td>65 - 85</td>
<td>65 - 85</td>
<td>65 - 85</td>
</tr>
<tr>
<td><strong>Academic Self-concept</strong></td>
<td>71 - 88</td>
<td>71 - 87</td>
<td>60 - 83</td>
<td>60 - 83</td>
<td>60 - 83</td>
</tr>
<tr>
<td><strong>Cognitive Action</strong></td>
<td>67 - 88</td>
<td>67 - 88</td>
<td>68 - 88</td>
<td>68 - 88</td>
<td>68 - 88</td>
</tr>
<tr>
<td><strong>Class Participation</strong></td>
<td>78 - 89</td>
<td>78 - 85</td>
<td>78 - 89</td>
<td>78 - 89</td>
<td>78 - 89</td>
</tr>
<tr>
<td><strong>Homework Completion</strong></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Absence</strong></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Test Performance</strong></td>
<td>63 - 76</td>
<td>63 - 76</td>
<td>62 - 75</td>
<td>62 - 75</td>
<td>62 - 75</td>
</tr>
<tr>
<td><strong>Test Effort</strong></td>
<td>14 - 26</td>
<td>14 - 26</td>
<td>13 - 22</td>
<td>13 - 22</td>
<td>13 - 22</td>
</tr>
</tbody>
</table>

*Note.* Decimals omitted. Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort).

*Testing Invariance as a Function of Year-level for the Time 1 Sample*

The next set of multi-group CFAs examined the first-order factor structure for the three year-levels (junior high school = years 7 and 8, middle high school = years 9 and 10, senior high school = years 11 and 12) and allowed all factor loadings, uniquenesses, and correlations/variances to be freely estimated. This model yielded an excellent fit to the data ($\chi^2 = 17,891.21$, $df = 5,736$, RMSEA = .04, CFI = .97, NNFI = .97). Factor loadings are presented in Table 7.5. Again, although this model fit the data well, it is important to formally test for invariance between the three year-level groupings. As described above, this involved assessing the comparative fit indices for four additional first-order models across junior high, middle high, and senior high in which successive elements of the factor
structure were held invariant. Results in Table 7.6, indicate that in each successive and more restrictive model, the fit indices are quite comparable using Cheung and Rensvold's (2002) recommended criteria. These findings demonstrate that the first-order factor structure is much the same across the three year groupings.

It was also of interest to investigate the higher-order factor structure for the three year groupings. Hence, the final multi-group CFAs examined the comparative fit indices for two additional models where the first-order model and parameters are held invariant but the higher-order loadings are freely estimated (the first additional model) and then held invariant (the second additional model). Factor loadings are presented in Table 7.7 and the findings presented in Table 7.6 show that when successive elements of the higher-order factor structure are held invariant across year-levels, there are comparable fit indices. In sum, these data suggest that in terms of the hypothesised higher-order factors, junior high, middle high, and senior high school students are not substantially different.

Taken together, fit indices provide support for the prediction that first-order and higher-order factor solutions are comparable for both males and females and across different year-levels of high school. Following on from this, in terms of first- and higher-order factor structure, the data show that it is justifiable to pool data for males and females and also across year-levels in subsequent analyses.

*The Effect of Gender and Year-level on Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes*

In order to investigate the effects of gender and year-level on academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes,
MIMIC modelling was conducted. It will be recalled from the methodology chapter that the MIMIC approach is one where latent variables (e.g., multiple dimensions of academic motivation) are ‘caused’ by discrete grouping variables (e.g., gender, year-level, gender x year-level) that are represented by single indicators. Therefore in this chapter, the MIMIC model to be tested included the effects of gender, year-level, and the gender x year-level interaction on each first-order and higher-order factor underpinning the instrumentation (measuring academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes).

Consistent with recommendations by Aiken and West (1991), year-level was zero-centred (put in deviation score form so that the mean equals zero and standard deviation equals 1) so as to reduce the multi-collinearity between year-level and the corresponding interaction term. Very high levels of multi-collinearity can introduce technical problems in estimating regression coefficients and centering variables often minimises these potential problems. The interaction term was calculated by multiplying gender and the zero-centered year-level variable.

**MIMIC Modelling and the First-order Model**

The first MIMIC analysis assessed the effects of gender, year-level, and their interaction on the first-order constructs. Because the first-order factor loadings of the latent variables are the same for these MIMIC models as they were for the CFA analyses presented earlier, greater emphasis is placed on the beta coefficients (i.e., path coefficients) that represent the effects of gender, year-level, and gender x year-level interactions. The results for the MIMIC model (gender, year-level, and gender x year-level effects) yielded
an excellent fit to the data ($\chi^2 = 14,070.41, df = 2,167, CFI = .98, NNFI = .98, RMSEA = .04$). Derived beta coefficients are presented in Table 7.7 and significance levels for gender, year-level, and their interaction are also indicated.

Findings in Table 7.8 are broadly consistent with predictions that females are significantly higher in mastery orientation ($\beta = -.10, p < .001$), valuing of school ($\beta = -.09, p < .001$), planning ($\beta = -.10, p < .001$), persistence ($\beta = -.11, p < .001$), positive school appraisal ($\beta = -.08, p < .001$), positive academic plans ($\beta = -.09, p < .001$), absenteeism ($\beta = -.08, p < .001$), test performance ($\beta = -.17, p < .001$), and test effort ($\beta = -.17, p < .001$). However, they are also significantly higher in anxiety ($\beta = -.24, p < .001$), uncertain control ($\beta = -.07, p < .001$), and self-handicapping ($\beta = -.06, p < .001$), and lower in academic self-concept ($\beta = .15, p < .001$). It is important to recognise, however, that the main effects for mastery orientation, valuing of school, anxiety, absenteeism, and test performance were qualified by an interaction effect. That is gender differences on these dimensions change as a function of year-level.

In terms of year-level, findings which are generally consistent with predictions, such that lower year-levels tend to be higher in self-efficacy ($\beta = -.09, p < .001$), mastery orientation ($\beta = -.08, p < .001$), valuing of school ($\beta = -.21, p < .001$), planning ($\beta = -.16, p < .001$), task management ($\beta = -.05, p < .01$), persistence ($\beta = -.13, p < .001$), positive academic plans ($\beta = -.04, p < .05$), class participation ($\beta = -.11, p < .001$), homework completion ($\beta = -.23, p < .001$), absenteeism ($\beta = -.10, p < .001$), and test performance ($\beta = -.36, p < .001$). Lower year-levels are also significantly lower in failure avoidance ($\beta = .08, p < .001$), uncertain control ($\beta = .06, p < .01$), self-handicapping ($\beta = .13, p < .001$), and
disengagement ($\beta = .22, p< .001$). Once again, it is important to recognise, however, that

the main effects for mastery orientation, valuing of school, disengagement, class

participation, absenteeism, and test performance were qualified by an interaction effect.
Table 7.8

**Beta Coefficients for Gender, Year-level, and Gender x Year-level Interactions for First-order Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes**

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Year-level</th>
<th>Gender x Year-level Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>.01</td>
<td>-.09***</td>
<td>-.02</td>
</tr>
<tr>
<td>Mastery Orientation</td>
<td>-.10***</td>
<td>-.08***</td>
<td>-.05**</td>
</tr>
<tr>
<td>Valuing of School</td>
<td>-.09***</td>
<td>-.21***</td>
<td>-.04*</td>
</tr>
<tr>
<td>Planning</td>
<td>-.10***</td>
<td>-.16***</td>
<td>-.03</td>
</tr>
<tr>
<td>Task Management</td>
<td>-.01</td>
<td>-.05**</td>
<td>-.03</td>
</tr>
<tr>
<td>Persistence</td>
<td>-.11***</td>
<td>-.13***</td>
<td>-.03</td>
</tr>
<tr>
<td>Anxiety</td>
<td>-.24***</td>
<td>.04</td>
<td>-.05**</td>
</tr>
<tr>
<td>Failure Avoidance</td>
<td>.04*</td>
<td>.08***</td>
<td>-.01</td>
</tr>
<tr>
<td>Uncertain Control</td>
<td>-.07***</td>
<td>.06**</td>
<td>.01</td>
</tr>
<tr>
<td>Self-handicapping</td>
<td>-.06***</td>
<td>.13***</td>
<td>.02</td>
</tr>
<tr>
<td>Disengagement</td>
<td>.02</td>
<td>.22***</td>
<td>.04*</td>
</tr>
<tr>
<td>Academic Self-concept</td>
<td>.15***</td>
<td>-.11***</td>
<td>.01</td>
</tr>
<tr>
<td>Positive School Appraisal</td>
<td>-.08***</td>
<td>-.02</td>
<td>.03</td>
</tr>
<tr>
<td>Positive Academic Plans</td>
<td>-.09***</td>
<td>-.04*</td>
<td>.03</td>
</tr>
<tr>
<td>Class Participation</td>
<td>.01</td>
<td>-.11***</td>
<td>-.04*</td>
</tr>
<tr>
<td>Homework Completion</td>
<td>-.03</td>
<td>-.23***</td>
<td>-.02</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>-.08***</td>
<td>-.10***</td>
<td>-.07***</td>
</tr>
<tr>
<td>Test Performance</td>
<td>-.17***</td>
<td>-.36***</td>
<td>.09***</td>
</tr>
<tr>
<td>Test Effort</td>
<td>-.17***</td>
<td>-.01</td>
<td>.03</td>
</tr>
</tbody>
</table>

*Note. Females = 1, Males = 2. All path coefficients are standardised. * p < .05, ** p < .01, *** p < .001.*
The MIMIC model also allowed for the investigation of the possible gender x year-level interaction effects. The MIMIC model revealed seven significant interaction effects for mastery orientation, valuing of school, anxiety, disengagement, class participation, absenteeism, and test performance (see Figure 7.1a through to Figure 7.1g).

In terms of valuing school, both males and females decline between junior high and middle high school, however, males’ decline is sharper and the trajectory for males continues into senior high school. The interaction effect for anxiety shows that relative to males, females tend to experience a larger increase in anxiety across high school. The disengagement interaction indicates that there is a steady increase in disengagement for both males and females but by middle high school males report higher ratings of disengagement than females and this pattern continues through to senior high school. For class participation, there is a decline between junior high and middle high school for males and females, however, there continues to be a decline for males in senior high school but not so much for females.

Interestingly, the interaction effect for mastery orientation shows that by middle high school, females experience an increase in mastery orientation and males experience a decline in mastery orientation. However, by senior high school both males and females experience a decline in mastery orientation. In terms of the absenteeism interaction effect, males and females appear to have almost identical absenteeism ratings in junior and middle high school, however, by senior high absenteeism ratings are higher for females than males. Finally, the interaction effect for test performance shows that females have higher levels of test performance than males during both junior and middle high school, however,
females in senior high school experience a sharper decline in test performance than male senior high school students.

Figure 7.1a. Gender x year-level interaction for valuing of school.

Figure 7.1b. Gender x year-level interaction for mastery orientation.
Figure 7.1c. Gender x year-level interaction for anxiety.

Figure 7.1d. Gender x year-level interaction for disengagement.
Figure 7.1e. Gender x year-level interaction for class participation.

Figure 7.1f. Gender x year-level interaction for absenteeism.
The second MIMIC analysis assessed the effects of gender, year-level, and their interaction on the higher-order motivation constructs. Because the higher-order factor loadings of the latent variables and the MIMIC effects on academic self-concept, cognitive action, behavioural action, and academic outcomes are the same for CFA models presented earlier, greater emphasis is placed on the beta coefficients (i.e., path coefficients) that represent the effects of gender, year-level, and gender x year-level interactions on the four higher-order factors. The results for the higher-order MIMIC model (gender, year-level, and gender x year-level effects) yielded an excellent fit to the data ($\chi^2 = 14,070.41$, $df = 2,167$, CFI = 0.98, NNFI = 0.98, RMSEA = 0.04). Derived beta coefficients are presented in Table 7.9 and significance levels for gender, year-level, and their interaction are also
indicated. These results indicate, broadly consistent with hypotheses (see Chapter 5), that females are significantly higher in adaptive cognitive motivation \( (\beta = -0.07, p < 0.001) \), adaptive behavioural motivation \( (\beta = -0.09, p < 0.001) \), and impeding/maladaptive motivation \( (\beta = -0.10, p < 0.001) \). In terms of year-level, and consistent with predictions, lower year-levels tend to be higher in adaptive cognitive motivation \( (\beta = -0.16, p < 0.001) \), adaptive behavioural motivation \( (\beta = -0.14, p < 0.001) \), and significantly lower in impeding/maladaptive motivation \( (\beta = 0.08, p < 0.001) \), and maladaptive motivation \( (\beta = 0.24, p < 0.001) \).

As with the first-order model, it is important to recognise, that the gender and year-level main effects for the adaptive cognitive motivation and maladaptive motivation were qualified by an interaction effect. Figure 7.2a demonstrates, in terms of adaptive cognitive motivation, both males and females decline between junior high and middle high school, however, males’ decline is sharper and this trajectory for males continues into senior high school. For maladaptive motivation, both males and females experience an increase throughout their high school years but between junior high and middle high school, males’ increase tends to be sharper (see Figure 7.2b).
Table 7.9

Beta Coefficients for Gender, Year-level, and Gender x Year-level Interactions for the Higher-order Academic Motivation Factors, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Year-level</th>
<th>Gender x Year-level Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive Motivation - Cognition</td>
<td>-.07***</td>
<td>-.16***</td>
<td>-.04*</td>
</tr>
<tr>
<td>Adaptive Motivation - Behaviour</td>
<td>-.09***</td>
<td>-.14***</td>
<td>-.04</td>
</tr>
<tr>
<td>Impeding/Maladaptive Motivation</td>
<td>-.10***</td>
<td>.08***</td>
<td>-.01</td>
</tr>
<tr>
<td>Maladaptive Motivation</td>
<td>-.01</td>
<td>.24***</td>
<td>.04*</td>
</tr>
<tr>
<td>Academic Self-concept</td>
<td>.15***</td>
<td>-.11***</td>
<td>.01</td>
</tr>
<tr>
<td>Positive School Appraisal</td>
<td>-.08***</td>
<td>-.02</td>
<td>.03</td>
</tr>
<tr>
<td>Positive Academic Plans</td>
<td>-.09***</td>
<td>-.04*</td>
<td>.03</td>
</tr>
<tr>
<td>Class Participation</td>
<td>.01</td>
<td>-.11***</td>
<td>-.04*</td>
</tr>
<tr>
<td>Homework Completion</td>
<td>-.03</td>
<td>-.23***</td>
<td>-.02</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>-.08***</td>
<td>.10***</td>
<td>-.07***</td>
</tr>
<tr>
<td>Test Performance</td>
<td>-.17***</td>
<td>-.37***</td>
<td>.09***</td>
</tr>
<tr>
<td>Test Effort</td>
<td>-.16***</td>
<td>-.01</td>
<td>.03</td>
</tr>
</tbody>
</table>

Note. Females = 1, Males = 2. All path coefficients are standardised. * p < .05, ** p < .01, *** p < .001.
Figure 7.2a. Gender x year-level interaction for adaptive cognitive motivation.

Figure 7.2b. Gender x year-level interaction for maladaptive motivation.
Chapter Summary

The results presented in this chapter show that the central constructs and instrumentation are approximately normally distributed, have sound structural validity, and demonstrate strong internal consistency. Multi-group CFA tests show that there is gender and year-level invariance in factor structure for the first-order model and the higher-order model. That is, in terms of the factor structure of motivation (both first-order and higher-order), academic self-concept, cognitive action, behavioural action, and academic outcomes, males and females across different year-levels are not substantially different. Mean-level differences as a function of gender, year-level, and their interaction were explored for first and higher-order models using the MIMIC approach and findings were broadly consistent with predictions. Taken together, Time 1 data are robust and provide a sound basis for the SEMs to be conducted in the next chapter that assesses the hypothesised process model of academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes.
CHAPTER 8

ASSESSING THE HYPOTHESISED ACADEMIC SELF-SYSTEM PROCESS MODEL AT TIME 1

Introduction

The strong psychometric results presented in Chapter 7 demonstrated that the central measures are suitable for the assessment of the hypothesised Time 1 academic self-system process model using SEM. Findings presented in the current chapter are once again based on Time 1 data (N=3,450 students from six Australian high schools, years 7 to 12) and are broadly organised around the hypotheses and research questions outlined in Chapter 5. To recap, the central issues explored in the present chapter concern the academic self-concept and academic motivation factors that predict cognitive action (i.e., positive school appraisal and positive academic plans), the impact cognitive action has on behavioural action (i.e., class participation, homework completion, and absenteeism), followed by an assessment of the impact these three behavioural actions have on academic outcomes (test performance and test effort). SEM is ideal for assessing the theoretically posited relations in the academic self-system process model.

Preliminary Assessment of the Hypothesised Time 1 Academic Self-system Process Model

The first SEM model comprised four higher-order motivation factors, one academic self-concept factor, two cognitive action factors (positive school appraisal and positive academic plans), three behavioural action factors (class participation, homework...
completion and absenteeism), and two academic outcomes (test performance and test effort).

Although this model demonstrated acceptable fit with the data as indicated by adequate goodness-of-fit indices ($\chi^2 = 14,253.47$, $df = 2,034$, RMSEA = .04, CFI = .98, NNFI = .98), inspection of beta coefficients indicated that there were numerous suppression effects (see Chapter 6; see Cohen, 1978; Grapentine, 2000; Kim et al., 2001; Martin, Marsh et al., 2001a, 2001b, 2003; Tzelgov & Henik, 1991 for further information about suppression effects). Essentially, suppression effects are inflated errors of the beta estimate or inflated regression coefficients, usually the result of multicollinearity (Grewal et al., 2004; MacKinnon et al., 2000). Suppression effects are problematic because the derived beta coefficients are not well estimated. For example, the direction of the beta terms can shift from a previously positive relationship to a negative relationship or vice versa. Another indicator of a suppression effect is when the observed beta coefficient is larger than the correlation implied by the product of the two corresponding variables (Cohen, 1987; Grewal et al., 2004; Maassen & Bakker, 2001; MacKinnon et al., 2000).

As a result of the potential problems of suppression effects, all findings in the present investigation were checked for suppression effects. After thorough examination of the SEM results, suppression effects appeared to exist for the paths between adaptive behavioural motivation and cognitive action factors: positive school appraisal ($\beta = -.14$, compared with $r = .56$) and positive academic plans ($\beta = -.09$, compared with $r = .67$). Suppression effects were also evident between impeding/maladaptive motivation and cognitive action factors: positive school appraisal ($\beta = .28$, compared with $r = -.24$) and
positive academic plans ($\beta = .28$, compared with $r = -.31$). Furthermore, a minor inflated beta coefficient was found between positive academic plans and homework completion ($\beta = .69$, compared with $r = .52$). These suppression effects are most likely the result of the substantially high correlations between adaptive cognitive motivation and adaptive behavioural motivation ($r = .79$) and the high correlation between positive school appraisal and positive academic plans ($r = .84$).

As a result of these high correlations, it was deemed appropriate to combine the adaptive cognitive motivation factors and the adaptive behavioural motivation factors into one higher-order adaptive motivation dimension. Similarly, high correlations between the two cognitive action factors (positive school appraisal and positive academic plans) led to the creation of a higher-order cognitive action factor. One final refinement to remove suppression effects between motivation and cognitive action involved constraining the correlation between impeding/maladaptive motivation and maladaptive motivation. As these two are relatively more distinct dimensions than the adaptive motivation dimensions it did not make substantive sense to combine them into a higher-order factor. As a result, only the correlation between impeding/maladaptive motivation and maladaptive motivation dimensions was constrained. A second model was estimated that reflected these adjustments. This adjusted model is examined in more detail below and reflected no evidence of suppression effects.

---

3 This result led to the creation of a higher-order cognitive action factor. This finding demonstrates that these two constructs (positive academic plans and positive academic appraisals) predominately represent cognitive constructs as opposed to cognitive-affective constructs; therefore, the utilisation of the term cognitive action throughout this thesis is supported.
Further Assessment of the Hypothesised Time 1 Academic Self-system Process Model

As detailed above, the original structure of the hypothesised Time 1 academic self-system process model was adjusted to resolve a number of suppression effects. The adjusted SEM model comprised three higher-order motivation factors (adaptive cognition and behaviour, impeding/maladaptive motivation, and maladaptive motivation) and academic self-concept predicting higher-order cognitive action (positive school appraisal and positive academic plans). This higher-order cognitive action factor then predicted the behavioural action factors (class participation, homework completion, and absenteeism) which in turn predicted the academic outcomes (test performance and test effort scores; see Figure 8.1).

This model provided an excellent fit to the data ($\chi^2 = 15,564.53, df = 2,048$, RMSEA = .04, CFI = .98, NNFI = .98). The beta coefficients and path diagram are shown in Figure 8.1 and Table 8.1. These path coefficients show that cognitive action is positively predicted by adaptive motivation ($\beta = .35$, $p < .001$) and academic self-concept ($\beta = .25$, $p < .001$), weakly by impeding/maladaptive motivation ($\beta = .07$, $p < .001$), and negatively by maladaptive motivation ($\beta = -.44$, $p < .001$). In turn, cognitive action positively predicts behavioural action in the form of class participation ($\beta = .61$, $p < .001$) and homework completion ($\beta = .56$, $p < .001$) and negatively predicts absenteeism ($\beta = -.23$, $p < .001$). In terms of behavioural action, class participation positively predicts test performance ($\beta = .09$, $p < .001$) and test effort ($\beta = .11$, $p < .001$) as does homework completion ($\beta = .24$, $p < .001$ for test performance; $\beta = .19$, $p < .001$ for test effort). Not surprisingly, the number of
weeks absent from school negatively predicts test performance ($\beta = -.22, p < .001$) and test effort ($\beta = -.09, p < .001$) outcomes.
Figure 8.1. Derived academic self-system process model for Time 1.

$\chi^2 = 15,564.53, df = 2,048, \text{RMSEA} = .04, \text{CFI} = .98, \text{NNFI} = .98$. All path coefficients are completely standardised. All paths are significant at $p < .001$. 
### Table 8.1


<table>
<thead>
<tr>
<th>Cognitive Action</th>
<th>Behavioural Action</th>
<th>Academic Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive School Appraisal and Positive Academic Plans</td>
<td>Class Participation</td>
<td>Homework Completion</td>
</tr>
<tr>
<td><strong>Academic Motivation and Academic Self-concept</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptive Motivation</td>
<td>.35 ***</td>
<td>-</td>
</tr>
<tr>
<td>Impeding/Maladaptive Motivation</td>
<td>.07 ***</td>
<td>-</td>
</tr>
<tr>
<td>Maladaptive Motivation</td>
<td>-.44 ***</td>
<td>-</td>
</tr>
<tr>
<td>Academic Self-concept</td>
<td>.25 ***</td>
<td>-</td>
</tr>
<tr>
<td><strong>Cognitive Action</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive School Appraisal and Positive Academic Plans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class Participation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homework Completion</td>
<td>.61 ***</td>
<td>.56 ***</td>
</tr>
<tr>
<td>Absenteeism</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Behavioural Action</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class Participation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Homework Completion</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note.* All coefficients completely standardised. *** p< .001
Post Hoc Analysis of the Time 1 Academic Self-system Process Model Using Modification Indices

In addition to model evaluation, SEM also allows for model modification (viz freeing model parameters) aimed at improving the fit between the data and the model (Kaplan, 1990a). As detailed in Chapter 6, model evaluation and model modification can be described as the link between ‘theory’ and ‘empiricism’ (Byrne, 1998; Kline, 1998). Under this approach, parameters with large modification indices and large expected change values can be freed to be estimated in a subsequent model – provided it makes substantive sense to do so (Chou & Bentler, 1993; Kaplan, 1989, 1990a; Olsson et al., 1999).

Accordingly, subsequent post hoc analyses were conducted that sought to assess what parameters could be freed on empirical and substantive grounds. Specifically, a series of subsequent models were examined that freed additional beta (i.e., predictor) parameters (one parameter was freed in each successive model) if (a) modification indices indicated a large estimated change and (b) these parameters were conceptually defensible.

This model modification process resulted in a good fitting model \( \chi^2 = 15,075.59, \quad df = 2,043, \quad \text{RMSEA} = .04, \quad \text{CFI} = .98, \quad \text{NNFI} = .98 \) and the inclusion of four additional beta paths. The resulting model is presented in Table 8.2. According to this modified model, the adaptive motivation now also predicts class participation \( (\beta = .26, p < .001) \), and homework completion \( (\beta = .50, p < .001) \); the maladaptive motivation now also negatively predicts test performance \( (\beta = -.11, p < .001) \); and academic self-concept now also positively predicts class participation \( (\beta = .11, p < .001) \).
Table 8.2


<table>
<thead>
<tr>
<th>Cognitive Action</th>
<th>Behavioural Action</th>
<th>Academic Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive School Appraisal and Positive Academic Plans</td>
<td>Class Participation</td>
<td>Homework Completion</td>
</tr>
<tr>
<td>Academic Motivation and Academic Self-concept</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptive Motivation</td>
<td>.25 ***</td>
<td>.26***</td>
</tr>
<tr>
<td>Impeding/Maladaptive Motivation</td>
<td>-.47***</td>
<td>-</td>
</tr>
<tr>
<td>Maladaptive Motivation</td>
<td>.23***</td>
<td>.11***</td>
</tr>
<tr>
<td>Academic Self-concept</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive School Appraisal and Positive Academic Plans</td>
<td>-</td>
<td>.30***</td>
</tr>
<tr>
<td>Behavioural Action</td>
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<td></td>
</tr>
<tr>
<td>Class Participation</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Homework Completion</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. Post hoc parameters in bold. All path coefficients are completely standardised. * p < .05, ** p < .01, *** p < .001.
The purpose of this chapter has been to examine the hypothesised academic self-system process model in the context of Time 1 data. A series of SEMs examined the relations between motivation and self-concept predictors and cognitive (positive school appraisal and positive academic plans) and behavioural (class participation, homework completion, and absenteeism) action and academic outcomes (test performance and test effort). Initial analyses involved a model comprising four higher-order motivation factors as well as two cognitive action factors. Due to suppression effects in these initial analyses, there was a need for a three-factor higher-order model of motivation (combining adaptive cognition and behaviour into one higher-order factor) as well as a higher-order factor for cognitive action (combining positive school appraisal and positive academic plans into one higher-order factor). This adjusted model resolved the problematic suppression effects observed at the initial assessment of the academic self-system process model.

Consistent with predictions, findings of the adjusted academic self-system process model demonstrated that: (a) motivation and academic self-concept predict cognitive action; (b) cognitive action positively predicts class participation and homework completion and negatively predict absenteeism; and (c) class participation and homework completion positively predict academic outcomes whilst absenteeism negatively predicts academic outcomes. Follow-up analyses that freed parameters (as suggested by modification indices) indicated four additional parameters that could be freed: adaptive motivation to class participation; homework completion to test performance; maladaptive motivation to test performance; and academic self-concept to class participation.
Taken together, these findings offer a detailed insight into the academic related factors that are predictive of educational processes and outcomes and are largely consistent with the hypotheses derived from the empirical and theoretical literature reviewed at the outset of this thesis. Therefore, Time 1 data demonstrates that the hypothesised academic self-system process model is theoretically sound and a parsimonious representation of the processes underlying students’ educational outcomes. Having demonstrated the validity and utility of the hypothesised academic self-system process model at Time 1, the aim now is to examine this model at Time 2 and then longitudinally. This is the focus of the following two chapters.
CHAPTER 9

ASSESSING THE PSYCHOMETRIC PROPERTIES AND THE HYPOTHESISED ACADEMIC SELF-SYSTEM PROCESS MODEL AT TIME 2

Introduction

Having estimated and confirmed the validity of the hypothesised academic self-system process model for Time 1 data, it is important now to assess the stability of this model in a subsequent phase of testing. Accordingly, the present chapter examines the psychometric properties as well as the stability of the hypothesised process model one year later (Time 2) with the same cohort of high school students (a full longitudinal SEM is tested in Chapter 10).

Using Time 2 data and consistent with analyses at Time 1, the present chapter utilises CFA to assesses the factor structure of and relations between (using SEM) academic motivation, academic self-concept, cognitive action (positive school appraisal and positive academic plans), behavioural action (class participation, homework completion, and absenteeism), and academic outcomes (test performance and test effort). Findings presented in this chapter are based on Time 2 data (N=3,261 students from six Australian high schools, years 7 to 12) and are broadly structured around the hypotheses outlined in Chapter 5. Consistent with Time 1 predictions, it is hypothesised that the constructs will evince sound reliability, a distinct factor structure, and factor invariance across gender and year-level. Once these psychometric properties are established, the chapter will also determine the degree of correspondence between the hypothesised self-system process model and the data-estimated model using Time 2 responses. Consistent with Time 1, it is broadly hypothesised that the theoretically
driven academic self-system process model (see Figure 3.5) will fit the Time 2 data well.

**Time 2 Descriptive and Reliability Statistics**

It was predicted (see Chapter 5) that distribution and reliability tests will demonstrate approximate normality and internal consistency for each of the 11 motivation scales (MES-HS), academic self-concept (SDQ II-S subscale), cognitive action, behavioural action, and academic outcomes. In order to test this prediction, descriptive and Cronbach's alpha (reliability) statistics were derived for all scales used at Time 2. Coefficient alphas (presented in Table 9.1) indicate acceptable reliability for all hypothesised factors, providing support for the hypotheses presented in Chapter 5. Descriptive statistics for each subscale are presented in Table 9.1. Distributional data indicate that each factor is approximately normally distributed. As with Time 1 distributional data, the exception at Time 2 is test effort, probably due to the fact that all students were required by teachers to attempt the bulk of the spelling and mathematic items during administration (even if their attempts were unsuccessful) thus leading to skewness and kurtosis. It must also be noted that there is greater kurtosis for the number of weeks students were absent, explained by the fact that students tend to cluster around a relatively narrow range of weeks absent from school.
Table 9.1

Time 2 Descriptive Statistics and Cronbach’s Alphas for Academic Motivation,

Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Cronbach’s α</th>
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</thead>
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<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>5.79</td>
<td>1.03</td>
<td>-1.07</td>
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<td>.81</td>
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<td>Mastery Orientation</td>
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<td>.80</td>
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<tr>
<td>Valuing of School</td>
<td>5.71</td>
<td>1.06</td>
<td>-1.10</td>
<td>1.38</td>
<td>.83</td>
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<td></td>
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<tr>
<td>Planning</td>
<td>4.36</td>
<td>1.27</td>
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<td>-.23</td>
<td>.78</td>
</tr>
<tr>
<td>Task Management</td>
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<td>-.53</td>
<td>-.18</td>
<td>.84</td>
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<td>Persistence</td>
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<td>.25</td>
<td>.82</td>
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<td><strong>IMPEDING/MALADAPTIVE MOTIVATION</strong></td>
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<tr>
<td>Anxiety</td>
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<td>1.41</td>
<td>-.13</td>
<td>-.61</td>
<td>.78</td>
</tr>
<tr>
<td>Failure Avoidance</td>
<td>3.08</td>
<td>1.37</td>
<td>.50</td>
<td>-.23</td>
<td>.78</td>
</tr>
<tr>
<td>Uncertain Control</td>
<td>3.22</td>
<td>1.35</td>
<td>.33</td>
<td>-.49</td>
<td>.81</td>
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<td><strong>MALADAPTIVE MOTIVATION</strong></td>
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<tr>
<td>Self-handicapping</td>
<td>2.70</td>
<td>1.31</td>
<td>.63</td>
<td>-.20</td>
<td>.81</td>
</tr>
<tr>
<td>Disengagement</td>
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<td>1.08</td>
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<td>.81</td>
</tr>
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<tr>
<td>Academic Self-concept</td>
<td>4.62</td>
<td>1.08</td>
<td>-.92</td>
<td>.88</td>
<td>.87</td>
</tr>
<tr>
<td><strong>COGNITIVE AND BEHAVIOURAL ACTION</strong></td>
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<td></td>
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<tr>
<td>Positive School Appraisal</td>
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<td>1.39</td>
<td>-.82</td>
<td>.25</td>
<td>.90</td>
</tr>
<tr>
<td>Positive Academic Plans</td>
<td>5.78</td>
<td>1.18</td>
<td>-1.35</td>
<td>1.80</td>
<td>.83</td>
</tr>
<tr>
<td>Class Participation</td>
<td>5.23</td>
<td>1.26</td>
<td>-.66</td>
<td>.16</td>
<td>.90</td>
</tr>
<tr>
<td>Homework Completion</td>
<td>4.32</td>
<td>.79</td>
<td>-1.35</td>
<td>2.40</td>
<td>-</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>4.54</td>
<td>6.48</td>
<td>6.36</td>
<td>72.23</td>
<td>-</td>
</tr>
<tr>
<td><strong>ACADEMIC OUTCOMES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Performance</td>
<td>102.91</td>
<td>12.82</td>
<td>-.70</td>
<td>1.06</td>
<td>.69</td>
</tr>
<tr>
<td>Test Effort</td>
<td>34.6</td>
<td>5.00</td>
<td>-2.36</td>
<td>9.90</td>
<td>.35</td>
</tr>
</tbody>
</table>

*Note. Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort)*
Time 2 First-order Factor Analysis of the Instrumentation

In order to confirm comparability and consistency across time, a CFA using the same instrumentation at Time 1 was conducted using Time 2 data. All first-order factors were assessed in the first instance, yielding a 19-factor model comprising the first-order factor structure of academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes. Results of the CFA are presented in Table 9.2. The first-order factor model provided an excellent fit to the data ($\chi^2 = 10,938.49$, $df = 1,910$, RMSEA = .04, CFI = .98, NNFI = .98). The factor loadings indicate that all factors are well defined and that each factor loading is statistically significant and substantial in size (with the partial exception of effort with a loading of .36). In essence, all items load highly on the factors they are designed to measure (average absolute factor loading = .69).

Correlations between the first-order factors are presented in Table 9.3. Once again, the inter- and intra-correlations amongst motivation factors are in line with previous research (Martin, 2001, 2003b, 2007) and the hypotheses presented in Chapter 5. As seen in Table 9.3, the adaptive motivation factors are highly correlated with each other, correlated at zero or slightly negatively with impeding/maladaptive motivation factors, and markedly negatively correlated with maladaptive motivation factors. As expected, there are high correlations amongst impeding/maladaptive motivation factors and amongst the maladaptive motivation factors. The factor correlations also demonstrate that the adaptive motivation factors are positively correlated with the cognitive and behavioural action (with the exception of absenteeism to which it is negatively correlated) and academic outcomes, the impeding/maladaptive motivation factors are correlated around zero or modestly negative with these constructs, and the
maladaptive motivation factors are correlated more markedly negatively. Additionally, factor correlations show that academic self-concept is strongly positively correlated with the adaptive motivation factors, and moderately negatively correlated with the impeding/maladaptive motivation factors and correlated more distinctly negatively with the maladaptive motivation factors. Similarly, academic self-concept appears to be significantly positively correlated with cognitive action, behavioural action (with the exception of absenteeism to which it is negatively related) and academic outcomes.
Table 9.2

*Time 2 First-order Factor Loadings for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes*

<table>
<thead>
<tr>
<th>Item 1</th>
<th>Item 2</th>
<th>Item 3</th>
<th>Item 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>.70</td>
<td>.73</td>
<td>.68</td>
</tr>
<tr>
<td>Mastery Orientation</td>
<td>.67</td>
<td>.73</td>
<td>.78</td>
</tr>
<tr>
<td>Valuing of School</td>
<td>.59</td>
<td>.76</td>
<td>.68</td>
</tr>
<tr>
<td>Planning</td>
<td>.66</td>
<td>.76</td>
<td>.82</td>
</tr>
<tr>
<td>Task Management</td>
<td>.74</td>
<td>.74</td>
<td>.85</td>
</tr>
<tr>
<td>Persistence</td>
<td>.62</td>
<td>.74</td>
<td>.74</td>
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<td>Anxiety</td>
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</tr>
<tr>
<td>Failure Avoidance</td>
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<td>.83</td>
<td>.52</td>
</tr>
<tr>
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<td>Self-handicapping</td>
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<tr>
<td>Disengagement</td>
<td>.62</td>
<td>.80</td>
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</tr>
<tr>
<td>Academic Self-concept</td>
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<td>Positive Academic plans</td>
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<td>Class Participation</td>
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<tr>
<td>Homework Completion</td>
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<tr>
<td>Absenteeism</td>
<td>1.00</td>
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<td>-</td>
</tr>
<tr>
<td>Test Performance</td>
<td>.81</td>
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</tr>
<tr>
<td>Test Effort</td>
<td>.63</td>
<td>.36</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note.* Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort).
### Table 9.3

**Time 2 CFA Factor Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes**

<table>
<thead>
<tr>
<th></th>
<th>SE</th>
<th>MO</th>
<th>VS</th>
<th>PL</th>
<th>TM</th>
<th>P</th>
<th>A</th>
<th>FA</th>
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<th>AS</th>
<th>PS</th>
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</thead>
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</table>

**Note.** SE= Self-efficacy, MO= Mastery orientation, VS= Valuing of school, PL= Planning, TM= Task management, P= Persistence, A= Anxiety, FA= Failure avoidance, UC= Uncertain control, SH= Self-handicapping, D= Disengagement, AS= Academic self-concept, PS= Positive school appraisal, PA= Positive academic plans, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. All r-values > .04 are significant at p < .05.
Time 2 Higher-order Factor Analysis of the Instrumentation

As explained in Chapter 6 and demonstrated in Chapter 7 and Chapter 8, higher-order factors can be generated using CFA techniques so that underlying first-order factors are represented by higher-order factors. As detailed in the previous chapter, due to suppression effects that were a result of the high correlation between the adaptive cognitive motivation dimension and the adaptive behavioural motivation dimension and the high correlation between positive school appraisal and positive academic plans, some post hoc adjustments were required. These adjustments subsequently represented motivation in terms of three higher-order factors (comprising adaptive motivation, impeding/maladaptive motivation, and maladaptive motivation) and one higher-order cognitive action factor (comprising positive school appraisal and positive academic plans). To maintain consistency with analyses at Time 1, this higher-order factor structure was retained for Time 2 analyses.

The results of this higher-order model provided an excellent fit to the data ($\chi^2 = 14,075.28$, $df = 2,025$, RMSEA = .04, CFI = .98, NNFI = .98). As expected and consistent with Time 1, all higher-order factors are well defined and each factor loading is statistically significant and substantial in size (range = .54 to .95; see Table 9.4). Factor correlations within the higher-order factor structure of the MES-HS (see Table 9.4) demonstrate that the adaptive motivation is negatively correlated with the impeding/maladaptive motivation and more markedly negatively correlated with the maladaptive motivation. These higher-order analyses also show that, notwithstanding absenteeism (in which higher scores reflect higher absenteeism), adaptive motivation is positively correlated with cognitive action, behavioural action, and academic outcomes,
impeding/maladaptive motivation is correlated somewhat negatively with these constructs, and the maladaptive motivation is correlated more markedly negatively.

Table 9.4

**Time 2 Higher-order Factor Loadings (range and means in diagonal) and Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes**

<table>
<thead>
<tr>
<th>AM</th>
<th>IM</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM</td>
<td>.71 -.87 (.80)</td>
<td></td>
</tr>
<tr>
<td>Impeding/Maladaptive Motivation (IM)</td>
<td>-.29 .54 -.87 (.67)</td>
<td></td>
</tr>
<tr>
<td>Maladaptive Motivation (MM)</td>
<td>-.80 .61 .69 -.88 (.78)</td>
<td></td>
</tr>
<tr>
<td>Academic Self-concept</td>
<td>.55 -.52 -.60</td>
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<tr>
<td>Cognitive Action</td>
<td>.78 -.28 -.76</td>
<td></td>
</tr>
<tr>
<td>Class Participation</td>
<td>.60 -.26 -.53</td>
<td></td>
</tr>
<tr>
<td>Homework Completion</td>
<td>.46 -.21 -.51</td>
<td></td>
</tr>
<tr>
<td>Absenteeism</td>
<td>-.20 .09 .22</td>
<td></td>
</tr>
<tr>
<td>Test Performance</td>
<td>.31 -.21 -.36</td>
<td></td>
</tr>
<tr>
<td>Test Effort</td>
<td>.34 -.14 -.33</td>
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</tbody>
</table>

*Note. Range and mean of higher-order CFA loadings are in the diagonal of the upper part of table. All correlations are significant at p < .05.*

**Factor Invariance Across Gender and Year-level: First-order and Higher-order Solutions for Time 2 Data**

Testing for factor invariance of scales and instruments allows the researcher to test whether the *a priori* factor structure of the instrumentation under focus is stable across different sample groups. Invariance in factor structure is most appropriately evaluated using multi-group CFA to determine whether—and how—the structure of constructs varies according to gender and year-level (see Byrne & Shavelson, 1987;
Hattie, 1992a; Marsh, 1993b). As with Time 1 invariance analyses, the tests of invariance for this study comprised an investigation of the comparative fit for CFA models across males and females and across junior, middle, and senior high school year-levels. As described earlier, testing for factor invariance (using CFA) essentially involves comparing a number of estimated models in which aspects of the factor structure are systematically held invariant across groups and fit indices are assessed when elements of these structures are constrained. If the introduction of increasingly stringent invariance constraints results in no more than a change of .01 in goodness-of-fit indices, then the factor structure is considered to be invariant across the groups (Cheung & Rensvold, 2002). Consistent with Time 1, it was hypothesised (see Chapter 5) that the first-order and higher-order factor structure of academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes would be invariant across males and females and across year-levels for the Time 2 sample.

**Testing Invariance as a Function of Gender for the Time 2 Sample**

The first set of invariance analyses comprised multi-group CFAs as a function of gender. The initial multi-group CFA examined the first-order factor structure for males and females and was a completely free model in which no constraints were placed on the model between groups (i.e., all factor loadings, uniquenesses, and correlations/variances were freely estimated). This baseline model yielded an excellent fit to the data ($\chi^2 = 16,009.56, df = 3,824, \text{RMSEA} = .04, \text{CFI} = .98, \text{NNFI} = .97$). Factor loadings are presented in Table 9.5. Although the factor loadings and fit indices are suggestive of a good fit between the data and the *a priori* factor structure for both groups, it is important to formally test for invariance between males and females. It was
therefore necessary to examine the goodness-of-fit statistics generated for each additional model across males and females (see Table 9.6). Therefore, the second model tested holds the factor loadings invariant across males and females, the third holds both factor loadings and correlations/variances invariant, the fourth holds factor loadings and uniquenesses invariant, and the fifth holds the factor loadings, uniquenesses, and the correlations/variances invariant (See Table 9.6).

Results indicate that when successive elements of the factor structure are held invariant across gender, the fit indices are largely comparable. Indeed, the application of recommended criteria for evidence of lack of invariance (i.e., a change in 0.01 in fit indices – see Cheung & Rensvold, 2002) indicates that there is relative invariance across all models. These results illustrate that the factor structure, factor loadings, uniquenesses, and factor correlations/variances are relatively invariant for males and females.
**Table 9.5**

**Time 2 Gender and Year-level Factor Loading Ranges for the First-order Factor Structure of Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Females</th>
<th>Males</th>
<th>Junior</th>
<th>Middle</th>
<th>Senior</th>
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</thead>
<tbody>
<tr>
<td><strong>Self-efficacy</strong></td>
<td>67 – 76</td>
<td>69 – 79</td>
<td>66 – 77</td>
<td>70 – 80</td>
<td>66 – 75</td>
</tr>
<tr>
<td><strong>Mastery Orientation</strong></td>
<td>65 – 77</td>
<td>67 – 82</td>
<td>68 – 80</td>
<td>68 – 81</td>
<td>68 – 78</td>
</tr>
<tr>
<td><strong>Valuing of School</strong></td>
<td>59 – 82</td>
<td>59 – 75</td>
<td>57 – 80</td>
<td>57 – 71</td>
<td>57 – 86</td>
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<tr>
<td><strong>Planning</strong></td>
<td>56 – 82</td>
<td>55 – 81</td>
<td>56 – 79</td>
<td>59 – 81</td>
<td>49 – 85</td>
</tr>
<tr>
<td><strong>Task Management</strong></td>
<td>71 – 84</td>
<td>73 – 85</td>
<td>74 – 89</td>
<td>74 – 88</td>
<td>64 – 75</td>
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<tr>
<td><strong>Persistence</strong></td>
<td>62 – 82</td>
<td>62 – 77</td>
<td>63 – 89</td>
<td>63 – 80</td>
<td>63 – 70</td>
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<td><strong>Anxiety</strong></td>
<td>62 – 76</td>
<td>62 – 75</td>
<td>69 – 76</td>
<td>59 – 76</td>
<td>53 – 76</td>
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<td><strong>Failure Avoidance</strong></td>
<td>56 – 84</td>
<td>63 – 82</td>
<td>62 – 84</td>
<td>46 – 80</td>
<td>44 – 85</td>
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<td><strong>Uncertain Control</strong></td>
<td>64 – 78</td>
<td>64 – 79</td>
<td>64 – 83</td>
<td>64 – 76</td>
<td>64 – 79</td>
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<tr>
<td><strong>Disengagement</strong></td>
<td>62 – 89</td>
<td>62 – 81</td>
<td>61 – 72</td>
<td>59 – 82</td>
<td>61 – 87</td>
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<tr>
<td><strong>Positive School Appraisal</strong></td>
<td>72 – 90</td>
<td>75 – 87</td>
<td>87 – 90</td>
<td>73 – 87</td>
<td>74 – 92</td>
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<tr>
<td><strong>Class Participation</strong></td>
<td>71 – 85</td>
<td>78 – 92</td>
<td>78 – 92</td>
<td>72 – 83</td>
<td>78 – 97</td>
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<td><strong>Homework Completion</strong></td>
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<td><strong>Absenteism</strong></td>
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<tr>
<td><strong>Test Effort</strong></td>
<td>30 – 47</td>
<td>30 – 47</td>
<td>30 – 46</td>
<td>30 – 46</td>
<td>30 – 46</td>
</tr>
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</table>

*Note.* Decimals omitted. Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort).
Table 9.6

Time 2 Gender and Year-level Invariance for the First- and Higher-order Factor Structure of Academic Motivation, Cognitive Action, Behavioural Action, and Academic Outcomes

<table>
<thead>
<tr>
<th>Invariance across Males and Females</th>
<th>Chi Square</th>
<th>df</th>
<th>CFI</th>
<th>NNFI</th>
<th>RMSEA</th>
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</thead>
<tbody>
<tr>
<td>All parameters are free: No invariance (Model 1)</td>
<td>16,009.56</td>
<td>3,824</td>
<td>.98</td>
<td>.97</td>
<td>.04</td>
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<tr>
<td>FIRST-ORDER FACTOR LOADINGS invariant (Model 2)</td>
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<td>.98</td>
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<tr>
<td>Model 2 + CORRELATIONS/VARIANCES invariant (Model 3)</td>
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<td>4,059</td>
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<td>.98</td>
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<tr>
<td>Model 2 + UNIQUENESSES invariant (Model 4)</td>
<td>15,951.68</td>
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<td>.97</td>
<td>.04</td>
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<td>Model 2 + CORRELATIONS/VARIANCES, UNIQUENESSES invariant (Model 5)</td>
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<td>Model 5 + HIGHER-ORDER LOADINGS free (Model 6)</td>
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Invariance across Year-Level (Junior, Middle, and Senior)

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<th>Chi Square</th>
<th>df</th>
<th>CFI</th>
<th>NNFI</th>
<th>RMSEA</th>
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</thead>
<tbody>
<tr>
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The next multi-group CFA was designed to examine the higher-order factor structure of motivation along with first-order academic self-concept, cognitive action, behavioural action, and academic outcomes for males and females. Higher-order factor loadings are presented in Table 9.7. Consistent with SEM models at Time 1 and with those to be tested at Time 2, three (rather than four) higher-order motivation factors are estimated (adaptive motivation, impeding/maladaptive motivation, and maladaptive motivation) and one higher-order (rather than two first-order factors) cognitive action factor (comprising positive school appraisal and positive academic plans) is estimated. The higher-order invariance tests examined the comparative fit indices for two additional models where the first-order model and parameters are held invariant but the beta coefficients (higher-order loadings) are freely estimated and then subsequently held invariant (see Table 9.6). Using Cheung and Rensvold’s (2002) criteria (a change of greater than 0.01 in fit indices), the results show that there is gender invariance in the higher-order model. The gender invariance data suggest that in terms of the central constructs (both first-order and higher-order), and the composition of and relationships amongst these constructs, males and females are not substantially different (see Table 9.6).
Table 9.7

**Time 2 Gender and Year-level Factor Loading Ranges for the Higher-order Factor Structure of Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes**

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
<th>Junior</th>
<th>Middle</th>
<th>Senior</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adaptive Motivation</strong></td>
<td>72 - 87</td>
<td>71 - 87</td>
<td>77 - 87</td>
<td>70 - 89</td>
<td>65 - 88</td>
</tr>
<tr>
<td><strong>Impeding/Maladaptive Motivation</strong></td>
<td>53 - 83</td>
<td>53 - 89</td>
<td>53 - 92</td>
<td>53 - 88</td>
<td>53 - 83</td>
</tr>
<tr>
<td><strong>Maladaptive Motivation</strong></td>
<td>69 - 88</td>
<td>69 - 87</td>
<td>69 - 87</td>
<td>69 - 87</td>
<td>69 - 87</td>
</tr>
<tr>
<td><strong>Academic Self-concept</strong></td>
<td>71 - 87</td>
<td>71 - 87</td>
<td>71 - 87</td>
<td>71 - 87</td>
<td>71 - 87</td>
</tr>
<tr>
<td><strong>Cognitive Action</strong></td>
<td>67 - 88</td>
<td>67 - 88</td>
<td>68 - 87</td>
<td>68 - 87</td>
<td>68 - 87</td>
</tr>
<tr>
<td><strong>Class Participation</strong></td>
<td>78 - 89</td>
<td>78 - 85</td>
<td>78 - 89</td>
<td>78 - 89</td>
<td>78 - 89</td>
</tr>
<tr>
<td><strong>Homework Completion</strong></td>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Absenteeism</strong></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Test Performance</strong></td>
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<td>60 - 81</td>
<td>58 - 80</td>
<td>58 - 80</td>
<td>58 - 80</td>
</tr>
<tr>
<td><strong>Test Effort</strong></td>
<td>36 - 63</td>
<td>36 - 63</td>
<td>36 - 63</td>
<td>36 - 63</td>
<td>36 - 63</td>
</tr>
</tbody>
</table>

*Note.* Decimals omitted. Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort).

**Testing Invariance as a Function of Year-level for the Time 2 Sample**

Multi-group CFAs were also conducted for the three year-level groupings (junior high school = years 7 and 8; middle high school = years 9 and 10; senior high school = years 11 and 12). The initial multi-group CFA for year-level examined the first-order factor structure and allowed all factor loadings, uniquenesses, and correlations/variances to be freely estimated (this is considered to be the baseline or control model). This model yielded an excellent fit to the data ($\chi^2 = 18,673.38$, $df = 5,736$, RMSEA = .06, CFI = .98, NNFI = .97). Factor loadings are presented in Table 9.5. Again, although this model fit the data well, it is important to formally test for invariance between the three year-level groupings. This is performed by testing more restrictive models which systematically hold
specific parameters invariant across year-level. Results in Table 9.6, indicate that in each additional model, the fit indices are reasonably comparable using Cheung and Rensvold's (2002) recommended criteria. These findings demonstrate that the first-order factor structure is much the same across the three year-level groupings.

As with gender invariance, it was also of interest to investigate the higher-order factor structure for the three year groupings. Higher-order factor loadings are presented in Table 9.7. Hence, the final multi-group CFAs examined the comparative fit indices for two additional models (with the same higher-order structure described in gender invariance tests above), where the first-order model and parameters are held invariant but the higher-order loadings are freely estimated (the first additional model) and then held beta coefficients invariant (the second additional model). Findings presented in Table 9.6 show that when successive elements of the higher-order factor structure are held invariant across year-levels, there are comparable fit indices. In sum, these data suggest that in terms of the hypothesised higher-order factors, junior high, middle high, and senior high school students are not substantially different.

Taken together, the results of factor invariance (as indicated by goodness-of-fit indices) provide support for the prediction that first-order and higher-order factor solutions are comparable for both males and females and across different year-levels of high school (i.e., the factor structure of the instrumentation is equivalent for both males and females of different year-levels). Following on from this, in terms of first- and higher-order factor structure, the data show that it is justifiable to pool data for males and females and also across year-levels in subsequent analyses.
Assessment of the Hypothesised Time 2 Academic Self-system Process Model

Results of the hypothesised SEM at Time 2 provided an excellent fit to the data ($\chi^2 = 15,763.68$, $df = 2,048$, RMSEA = .05, CFI = .98, NNFI = .98). As in previous CFAs, the factors were well defined and factor loadings were robust. The path model for this analysis is depicted in Figure 9.1 and beta coefficients are shown in Table 9.8. Results show that cognitive action is positively predicted by the adaptive motivation ($\beta = .44, p < .001$) and academic self-concept ($\beta = .24, p < .001$), weakly by impeding/maladaptive motivation ($\beta = .08, p < .001$), and negatively by maladaptive motivation ($\beta = -.34, p < .001$). In turn, cognitive action positively predicts behavioural action in the form of class participation ($\beta = .67, p < .001$) and homework completion ($\beta = .47, p < .001$) and negatively predicts absenteeism ($\beta = -.23, p < .001$). In terms of behavioural action, class participation positively predicts test performance ($\beta = .13, p < .001$) and test effort ($\beta = .13, p < .001$) as does homework completion ($\beta = .21, p < .001$ for test performance; $\beta = .17, p < .001$ for test effort). Not surprisingly, the number of weeks absent from school negatively predicts test performance ($\beta = -.21, p < .001$) and test effort ($\beta = -.16, p < .001$). These beta coefficients are broadly parallel with the beta coefficients found at Time 1.
Figure 9.1. Derived academic self-system process model for Time 2.

\[ \chi^2 = 15,763.68, df = 2,048, \text{RMSEA} = .05, \text{CFI} = .98, \text{NNFI} = .98. \text{All path coefficients are completely standardised. All paths are significant at } p < .001. \]
Table 9.8


<table>
<thead>
<tr>
<th>Cognitive Action</th>
<th>Behavioural Action</th>
<th>Academic Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive School Appraisal and Positive Academic Plans</td>
<td>Class Participation</td>
<td>Test Performance</td>
</tr>
<tr>
<td></td>
<td>Homework Completion</td>
<td>Test Effort</td>
</tr>
<tr>
<td></td>
<td>Absenteeism</td>
<td></td>
</tr>
<tr>
<td>Academic Motivation and Academic Self-concept</td>
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<td></td>
</tr>
<tr>
<td>Adaptive Motivation</td>
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<td>-.23 ***</td>
</tr>
<tr>
<td>Impeding/Maladaptive Motivation</td>
<td>-.34 ***</td>
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</tr>
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<td>Maladaptive Motivation</td>
<td>.24 ***</td>
<td></td>
</tr>
<tr>
<td>Academic Self-concept</td>
<td>.67 ***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.47 ***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.23 ***</td>
<td></td>
</tr>
<tr>
<td>Cognitive Action</td>
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<td></td>
</tr>
<tr>
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<td>-.16 ***</td>
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<tr>
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<td>.17 ***</td>
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<tr>
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<td>Homework Completion</td>
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</tr>
<tr>
<td>Absenteeism</td>
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<td></td>
</tr>
</tbody>
</table>

**Note.** All coefficients completely standardised. *** \( p < .001 \)
Post hoc Analysis of the Time 2 Academic Self-system Process Model Using Modification Indices

As outlined in Chapter 6, SEM not only allows for model evaluation based on a priori predictions (see preceding section) but also model modification (by freeing model parameters) aimed at investigating alternate models that can improve the fit between the data and the model (Kaplan, 1990a). Using this approach, it is possible to free parameters with large modification indices and large expected change values provided it makes theoretical sense to do so. Hence, as was the case at Time 1 analyses, additional parameters were freed if: (a) modification indices indicated a large estimated change and (b) these parameters were conceptually defensible.

This model modification process resulted in the addition of four new beta paths (see Table 9.9) and resulted in an excellent fitting model ($\chi^2 = 15,763.68, df = 2,048$, RMSEA = .04, CFI = .98, NNFI = .98). According to this modified framework, adaptive motivation now also positively predicts class participation ($\beta = .23, p < .001$), and homework completion ($\beta = .43, p < .001$); maladaptive motivation now also negatively predicts test performance ($\beta = -.16, p < .001$); and academic self-concept now also positively predicts class participation ($\beta = .20, p < .001$). Using the above mentioned model modification process, no further significant modifications were made to the hypothesised model. Interestingly, these additional parameters are the same as those found using Time 1 data.
Table 9.9


<table>
<thead>
<tr>
<th>Cognitive Action</th>
<th>Behavioural Action</th>
<th>Academic Outcomes</th>
</tr>
</thead>
<tbody>
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<td>Positive School Appraisal and Positive Academic Plans</td>
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<td></td>
</tr>
<tr>
<td>Academic Motivation and Academic Self-concept</td>
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<td>.23***</td>
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<td>.32***</td>
</tr>
<tr>
<td>Negative School Appraisal and Cognitive Action</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. Post hoc parameters in bold. All path coefficients are completely standardised. * p < .05 *** p < .001.
Chapter Summary

The results presented in this chapter show that at Time 2 the central constructs and instrumentation are approximately normally distributed, have robust structural validity, and demonstrate strong internal consistency. Time 2 multi-group CFA tests also showed that there is gender and year-level invariance in factor structure for the first- and higher-order models. In terms of the hypothesised academic self-system process model, Time 2 data demonstrated stability in the structural relations found at Time 1. Consistent with hypotheses and findings at Time 1, data demonstrated that adaptive motivation and impeding/maladaptive motivation (to a lesser extent) as well as academic self-concept positively predicted the cognitive action of high school students. Conversely, the maladaptive motivational patterns of high school students negatively predicted cognitive action and cognitive action positively predicted class participation and homework completion (but negatively predicted absenteeism). Data also demonstrated that class participation and homework completion positively predicted academic outcomes, whereas absenteeism negatively predicted academic outcomes. Follow-up analyses that freed parameters (as suggested by modification indices) revealed four additional significant parameters: adaptive motivation to class participation and homework completion; maladaptive motivation to test performance; and academic self-concept to class participation.

Taken together, these findings are consistent with the hypotheses derived from the empirical and theoretical literature reviewed at the outset of this thesis. Time 1 and Time 2 data, then, demonstrate that the hypothesised academic self-system model is a theoretically sound and empirically stable representation of the academic related processes underlying students' educational outcomes. Having demonstrated the validity
and utility of the hypothesised model at Time 1 and again at Time 2, the next task is to examine this model from a longitudinal perspective using matched Time 1 and Time 2 data. This is the focus of the following chapter.
CHAPTER 10

ASSESSING THE LONGITUDINAL HYPOTHESED ACADEMIC SELF-SYSTEM PROCESS MODEL

Introduction

Previous chapters (see Chapter 7 through to Chapter 9) have demonstrated strong psychometric properties of the instrumentation at each time wave (via CFAs) and have also demonstrated support for the hypothesised academic self-system process model (via SEMs). Having estimated and confirmed the stability of the hypothesised academic self-system process model at both Time 1 and Time 2, it is important now to assess the validity and stability of this model for the matched Time 1 and Time 2 sample (N = 1,866). The matched Time 1 and Time 2 sample is a data set comprising only students with data at both time points.

Using this matched sample and consistent with analyses in previous chapters (see Chapter 7 and 9), the present chapter assesses the factor structure of academic motivation, academic self-concept, cognitive action (positive school appraisal and positive academic plans), behavioural action (class participation, homework completion, and absenteeism), and academic outcomes (test performance and test effort). Additionally the present chapter also examines the stability of the hypothesised academic self-system process model across time using a longitudinal SEM.

Consistent with Time 1 and Time 2 predictions, it is hypothesised that the central constructs will evince sound reliability and a distinct factor structure (both first- and higher-order). Once these psychometric properties are established with the matched Time 1 and Time 2 sample, the chapter will also determine the degree of
correspondence between the hypothesised academic self-system process model and the
data-estimated model using separate matched Time 1, separate matched Time 2
responses, and a longitudinal model (with both time waves in the same model).
Consistent with previous chapters, it is broadly hypothesised that the theoretically
driven academic self-system process model (see Figure 3.5) will adequately fit the
matched Time 1 and Time 2 data as well as the longitudinal data.

First-order Factor Analysis of the Instrumentation for the Matched Time 1 and
Matched Time 2 Sample

In order to determine comparability with earlier Time 1 and Time 2 analyses, a
CFA using the same central measures was conducted on the matched Time 1 and
matched Time 2 data (i.e., only students with both Time 1 and Time 2 data were
included in analyses). As in previous analyses, all first-order factors were assessed,
yielding a 19-factor model (comprising the first-order factor structure of academic
motivation, academic self-concept, cognitive action, behavioural action, and academic
outcomes). Results of the CFA testing the first-order factors of academic motivation,
amazon self-concept, cognitive action, behavioural action, and academic outcomes are
presented in Tables 10.1 through to 10.3. The first-order factor model provided an
excellent fit to both the matched Time 1 data, ($\chi^2 = 6,634.22$, $df = 1,910$, RMSEA = .04,
CFI = .98, NNFI = .98) and the matched Time 2 data ($\chi^2 = 7,479.34$, $df = 1,910$,
RMSEA = .04, CFI = .98, NNFI = .98). The factor loadings presented in Table 10.1
indicate that the factors for both the matched Time 1 data and the matched Time 2 data
are well defined and factor loadings are strong (with the exception of test effort). All
items for both matched samples load highly on the factors they are intended to measure
Correlations between the first-order factors for matched Time 1 and matched Time 2 data are presented in Table 10.2 and Table 10.3. Once more, the correlations amongst the motivation factors are in line with previous research (Martin, 2001, 2003b, 2007) and the hypotheses presented in Chapter 5. As presented in Table 10.2 and Table 10.3, the adaptive cognitive motivation factors are highly correlated with each other and less correlated with the adaptive behavioural motivation factors. Similarly, there are moderate correlations within the impeding/maladaptive motivation factors and these are less correlated with the maladaptive motivation factors. It can be also seen that the impeding/maladaptive and maladaptive motivation factors are negatively correlated with the adaptive motivation factors. Furthermore, these analyses demonstrate that the adaptive motivation factors are positively correlated with cognitive and behavioural action (with the exception of absenteeism which reflects maladaptive action) and academic outcomes, the impeding/maladaptive motivation factors are correlated around zero or modestly negative with these constructs, and the maladaptive motivation factors are correlated more markedly negatively.

In terms of academic self-concept, the factor correlations show that academic self-concept is strongly positively correlated with the adaptive motivation factors, moderately negatively correlated with the impeding/maladaptive motivation factors, and correlated more distinctly negatively with the maladaptive motivation factors. Similarly, academic self-concept appears to be positively correlated with cognitive and behavioural action and academic outcomes; except absenteeism for which academic self-concept is predictably negatively correlated.
Table 10.1

Matched Time 1 and Matched Time 2 (N=1,866) First-order Factor Loadings for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Item 1</th>
<th>Item 2</th>
<th>Item 3</th>
<th>Item 4</th>
</tr>
</thead>
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<td></td>
<td>T1</td>
<td>T2</td>
<td>T1</td>
<td>T2</td>
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<tr>
<td>Self-efficacy</td>
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<td>.76</td>
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<td>Anxiety</td>
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<td>.70</td>
<td>.69</td>
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<td>Uncertain Control</td>
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<td>.64</td>
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<td>Self-handicapping</td>
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<td>Disengagement</td>
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<td>Positive Academic Plans</td>
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<td>Absenteeism</td>
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<td>Test Effort</td>
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<td>.38</td>
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</table>

Note. Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort). T1 = Time 1, T2 = Time 2.
Table 10.2

Matched Time 1 (N=1,866) First-order CFA Factor Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

<table>
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<th>TM</th>
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Note. SE= Self-efficacy, MO= Mastery orientation, VS= Valuing of school, PL= Planning, TM= Task management, P= Persistence, A= Anxiety, FA= Failure avoidance, UC= Uncertain control, SH= Self-handicapping, D= Disengagement, AS= Academic self-concept, PS= Positive school appraisal, PA= Positive academic plans, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. All r-values > .06 are significant at p<.05.
Table 10.3

Matched Time 2 (N=1,866) First-order CFA Factor Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

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Note: SE= Self-efficacy, MO= Mastery orientation, VS= Valuing of school, PL= Planning, TM= Task management, P= Persistence, A= Anxiety, FA= Failure avoidance, UC= Uncertain control, SH= Self-handicapping, D= Disengagement, AS= Academic self-concept, PS= Positive school appraisal, PA= Positive academic plans, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. All r-values > .06 are significant at p< .05.
Higher-order Factor Analysis of the Instrumentation for the Matched Time 1 Sample 
and the Matched Time 2 Sample

It will be recalled from previous chapters (see Chapter 7 through to Chapter 9) that in addition to the first-order factor structure comprising the eleven facets of the motivation instrument (MES-HS), there is also a hypothesised higher-order factor structure characterised by four dimensions; adaptive cognitive motivation dimension, adaptive behavioural motivation dimension, impeding/maladaptive motivation dimension, and maladaptive motivation dimension. As detailed in previous chapters suppression effects were identified in this higher-order model. As a result, post hoc adjustments to this higher-order model were implemented. These adjustments subsequently represented motivation in terms of three higher-order factors (adaptive motivation, impeding/maladaptive motivation, and maladaptive motivation) and one higher-order cognitive action factor (positive school appraisal and positive academic plans). In order to retain consistency with Time 1 and Time 2 higher-order CFA analyses, this same higher-order structure was retained for both the matched Time 1 analyses and the matched Time 2 analyses.

The results of this higher-order CFA model provided an excellent fit to the matched Time 1 data ($\chi^2 = 8,374.12$, $df = 2,025$, RMSEA = .04, CFI = .98, NNFI = .98) and the matched Time 2 data ($\chi^2 = 9,391.01$, $df = 2,025$, RMSEA = .04, CFI = .98, NNFI = .98). Consistent with previous higher-order CFA analyses (see Chapter 7 and 9), Table 10.4 and Table 10.5 demonstrate that all higher-order factors for both matched time waves are well defined and that each factor loading is substantial in size. Further, factor correlations within the higher-order factor structure of motivation (see Table 10.4 and Table 10.5) demonstrate
that adaptive motivation is negatively correlated with the impeding/maladaptive motivation and more markedly negatively correlated with the maladaptive motivation. Notwithstanding absenteeism (in which higher scores reflect higher absenteeism), adaptive motivation is also positively correlated with cognitive action, behavioural action, and academic outcomes, impeding/maladaptive motivation is correlated somewhat negatively with these constructs, and the maladaptive motivation is correlated more markedly negatively. Interestingly, correlations between the higher-order motivation factors and academic outcomes for matched Time 1 are lower than the Time 1, Time 2 sample and the matched T2 sample.
Table 10.4

Matched Time 1 \((N=1,866)\) Higher-order Factor Loadings (range and means in diagonal) and Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

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Note. Range and mean of higher-order CFA loadings are in the diagonal of the upper part of table. All correlations are significant at \(p < .05\).
Table 10.5

Matched Time 2 (N=1,866) Higher-order Factor Loadings (range and means in diagonal) and Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

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</table>

Note. Range and mean of higher-order CFA loadings are in the diagonal of the upper part of table. All correlations are significant at p<.05.
Overall, the first-order and higher-order factor solutions for the matched Time 1 and matched Time 2 data support the hypothesised factor structure underpinning the instrumentation. Furthermore, at both matched time waves, goodness-of-fit indices, the first- and higher-order factor loadings, and the factor correlations further supported this hypothesised process model. Once again, although the structure and relations among the first-order factors are well defined, there is also strong support for the parsimonious higher-order solution.

**Assessment of the Hypothesised Academic Self-system Process Model for the Matched Time 1 and Matched Time 2 Sample**

As detailed in previous chapters (see Chapter 8 and Chapter 9), the SEM model under focus concerns the relations between the higher-order academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes. This hypothesised academic self-system process model has been shown to be an empirically sound, parsimonious representation of the processes underlying students' educational outcomes at both Time 1 and Time 2. However, in this longitudinal chapter it is necessary to confirm these relations using the matched Time 1 and matched Time 2 data ($N = 1,866$). Consistent with previous separate analyses of this process model at Time 1 and Time 2, it is hypothesised that this model will provide a good fit to the data for the matched sample.

Results of the hypothesised SEM provided an excellent fit to the matched Time 1 data ($\chi^2 = 9,292.23$, $df = 2,048$, RMSEA = .04, CFI = .98, NNFI = .97) and the matched Time 2 data ($\chi^2 = 10,396.48$, $df = 2,048$, RMSEA = .05, CFI = .98, NNFI = .98). As expected, and shown in previous CFAs, the factors in this hypothesised model are well
defined and factor loadings are robust. Beta coefficients are shown in Table 10.6 and Table 10.7. Results for both the matched Time 1 and matched Time 2 data show that cognitive action is positively predicted by adaptive motivation (Time 1: $\beta = .30, p < .001$; Time 2: $\beta = .38, p < .001$) and academic self-concept (Time 1: $\beta = .30, p < .001$; Time 2: $\beta = .24, p < .001$), weakly by impeding/maladaptive motivation (Time 1: $\beta = .11, p < .001$; Time 2: $\beta = .08, p < .001$), and negatively by maladaptive motivation (Time 1: $\beta = -.47, p < .001$; Time 2: $\beta = -.41, p < .001$). In turn, cognitive action positively predicts behavioural action in the form of class participation (Time 1: $\beta = .61, p < .001$; Time 2: $\beta = .65, p < .001$) and homework completion (Time 1: $\beta = .53, p < .001$; Time 2: $\beta = .51, p < .001$) and negatively predicts absenteeism (Time 1: $\beta = -.19, p < .001$; Time 2: $\beta = -.25, p < .001$). In terms of behavioural action, class participation positively predicts test performance (Time 1: $\beta = .05, p < .10$; Time 2: $\beta = .08, p < .001$) and test effort (Time 1: $\beta = .06, p < .10$; Time 2: $\beta = .09, p < .001$), and homework completion also positively predicts test performance (Time 1: $\beta = .22, p < .001$; Time 2: $\beta = .20, p < .001$) and test effort (Time 1: $\beta = .13, p < .001$; Time 2: $\beta = .17, p < .001$). Not surprisingly, absenteeism from school negatively predicts test performance (Time 1: $\beta = -.18, p < .001$; Time 2: $\beta = -.20, p < .001$) and test effort (Time 1: $\beta = -.05, p < .10$; Time 2: $\beta = -.20, p < .001$).
### Table 10.6


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*Note. All coefficients completely standardised. *** p<.001, † p<.10*
Table 10.7


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Note. All coefficients completely standardised. ** p< .01, *** p< .001
Longitudinal Data Analyses

Analyses from previous sections in this chapter, as well as analyses reported in previous chapters (see Chapter 7 through to Chapter 9), provide important cross-sectional approaches to the measurement model (using CFA) and the structural model (using SEM). However, pooling Time 1 and Time 2 data in the one longitudinal model have the potential to provide more robust perspectives on the substantive issues at hand. Since correlations and beta coefficients presented in previous chapters are based on single waves of data, they provide no clear basis for concluding whether the central constructs and their relations with each other are stable over time - nor do they allow insights into the role of Time 1 factors in predicting Time 2 factors. Accordingly, the final set of analyses in the present chapter involves longitudinal CFA and SEM with a view to harnessing the full empirical benefits to be derived from a pooled longitudinal dataset.

In the first instance, longitudinal CFA will be conducted whereby all variables from both Time 1 and Time 2 are included in the one CFA model. This is an important first step because it allows the researcher to address any possible measurement issues before assessing the longitudinal structural model. Once the measurement component has been established, a longitudinal SEM will be proposed which seeks to extend those SEMs performed at Time 1 ($N = 3,450$), Time 2 ($N = 3,261$), and the cross-sectional analyses of the matched Time 1 and Time 2 data ($N = 1,866$).

Longitudinal Data and Correlated Uniquenesses

When modelling longitudinal data, it is considered appropriate practice to account for the correlation of measurement error over time (see Marsh, 1990b). In
SEM, parallel data (e.g., Time 1 academic self-concept items and Time 2 academic self-concept parallel items) have the potential to cause statistical problems such that measurement errors associated with matching items across time waves are likely to be correlated. As detailed elsewhere in this thesis (see Chapter 6), the correlation of uniquenesses may lead to positively biased relations between the latent constructs (Marsh et al., 1997). Therefore in order to obtain more accurate estimates of relations among parallel constructs, correlations among these uniquenesses must be included in such models (see Jöreskog, 1979; Marsh et al., 1997). Thus, in the longitudinal CFAs and SEMs used in the present study, parallel Time 1 and Time 2 item uniquenesses are correlated. It is necessary to incorporate this statistical technique into the longitudinal models in order to obtain more accurate estimates of correlations and structural paths between matching factors across time waves. On the basis of these recommendations, and in order to facilitate substantive interpretations of the results, subsequent CFAs and SEMs for longitudinal analyses included measurement errors correlated across both time waves for the same indicator.

**First-order Longitudinal CFA of the Instrumentation**

To retain uniformity across all CFA analyses, a first-order CFA utilising the same central measures in earlier chapters was conducted on the longitudinal data set \( N = 1,866 \). All first-order factors for both Time 1 and Time 2 were assessed in the same CFA model yielding a 38-factor model comprising the first-order factor structure of academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes. As explained, it was also necessary to correlate the measurement errors of each indicator across the two time waves in order to avoid biased parameter estimates. The first-order CFA for the longitudinal sample provided an excellent fit to
the data ($\chi^2 = 20,686.80$, $df = 7,755$, RMSEA = .03, CFI = .98, NNFI = .98). Factor loadings are consistent with those derived in CFAs earlier in this chapter and are presented in Table 10.8. As is evident in Table 10.8, the factor loadings at Time 1 and Time 2 are acceptable. Within- and between-time correlations are displayed in Table 10.9 and Table 10.10 respectively. As expected, within-time correlations between the first-order factors are in line with previous analyses such that the adaptive motivation factors are highly correlated with each other, correlated at zero or slightly negatively with impeding/maladaptive motivation factors, and markedly negatively correlated with maladaptive motivation factors. High correlations amongst impeding/maladaptive motivation factors and amongst maladaptive motivation factors also exist. The factor correlations also demonstrate that at each time wave the adaptive motivation factors are positively correlated with cognitive action, behavioural action (not withstanding absenteeism to which they are negatively correlated) and academic outcomes, the impeding/maladaptive motivation factors are correlated around zero or modestly negative with these constructs, and the maladaptive motivation factors are correlated more markedly negatively. Additionally, the factor correlations also show that academic self-concept is strongly positively correlated with the adaptive motivation factors, and moderately negatively correlated with the impeding/maladaptive motivation factors and correlated more distinctly negatively with the maladaptive motivation factors. Similarly, academic self-concept appears to be significantly positively correlated with both cognitive and behavioural action (with the exception of absenteeism) as well as academic outcomes.
Table 10.8

Longitudinal (N=1,866) First-order Factor Loadings for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

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Note. T1 = Time 1. T2 = Time 2. Homework completion and absenteeism are single-item factors. Test performance and test effort are two-item factors (measured by spelling and mathematic scores of performance and effort).
Table 10.9

Within-Time Longitudinal CFA Correlations (N=1,866) for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

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**Note.** SE=Self-efficacy, MO=Mastery orientation, VS=Valuing of school, PL=Planning, TM=Task management, P=Persistence, A=Anxiety, FA=Failure avoidance, UC=Uncertain control, SH=Self-handicapping, D=Disengagement, AS=Academic self-concept, PS=Positive school appraisal, PA=Positive academic plans, PT=Class participation, HW=Homework, AB=Absenteeism, TP=Test performance, TE=Test effort. Within-Time 1 correlations are in Upper Diagonal and Within-Time 2 correlations are in Lower Diagonal. All r-values > .04 are significant at p< .05.
Table 10.10

*Between-Time Longitudinal CFA Correlations (N=1,866) for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes*

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**Note.** SE= Self-efficacy, MO= Mastery orientation, VS= Valuing of school, PL= Planning, TM= Task management, P= Persistence, A= Anxiety, FA= Failure avoidance, UC= Uncertain control, SH= Self-handicapping, D= Disengagement, AS= Academic self-concept, PS= Positive school appraisal, PA= Positive academic plans, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. Test-retest correlations are bolded in diagonal. All r-values > .05 are significant at p< .05.
In regards to the between-time relations, these results show that correlations for corresponding factors across time (e.g., Time 1 self-efficacy and Time 2 self-efficacy), range between .34 and .89. This suggests that although these between-time constructs comprise the same measures, there is distinctiveness across time and across constructs. Not surprisingly, the adaptive motivation factors at Time 1 are positively correlated with the adaptive motivation factors at Time 2, correlated at zero or negatively with Time 2 impeding/maladaptive motivation factors, and more markedly negatively correlated with Time 2 maladaptive motivation factors. The Time 1 adaptive motivation factors are also positively correlated with the Time 2 cognitive action, Time 2 behavioural action (with the exception of absenteeism to which it is negatively correlated), and Time 2 academic outcomes.

The impeding/maladaptive motivation factors at Time 1 are positively correlated with the corresponding factors at Time 2, weakly negatively correlated with Time 2 academic self-concept, as well as Time 2 cognitive action, behavioural action, and academic outcomes. Conversely, the factor correlations show that the Time 1 maladaptive motivation factors are positively correlated with the Time 2 maladaptive motivation factors, markedly negatively correlated with Time 2 academic self-concept, as well as negatively correlated with Time 2 cognitive action, behavioural action, and academic outcomes. Taken together, the nature and significance of these between-time correlations provide support for assessing a longitudinal SEM.

**Higher-order Longitudinal CFA of the Instrumentation**

As explained in the earlier analyses for the matched Time 1 and matched Time 2 sample ($N = 1,866$), there is also a more parsimonious higher-order factor structure that can be fitted to the data. The longitudinal higher-order CFA model also provided an
excellent fit to the data ($\chi^2 = 27,680.80$, $df = 8,246$, RMSEA = .04, CFI = .98, NNFI = .98). Consistent with previous higher-order CFA analyses in this chapter and elsewhere, higher-order factors are well defined by their corresponding first-order factors and each factor loading is substantial in size. These factor loadings are predominantly the same as those found for the Time 1 and Time 2 cross-sectional analyses (see Table 10.11).

Table 10.11

*Longitudinal Higher-order CFA Factor Loadings for Academic Motivation, and Cognitive Action*

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*Note.* T1 = Time 1, T2 = Time 2. All factor loadings are significant at $p < .05$.

Within-time factor correlations of the higher-order factor structure (see Table 10.12) are consistent with those discussed in the longitudinal first-order CFA (see
above section). Of most interest, however, are the between-time factor correlations (see Table 10.13). The higher-order CFA demonstrates that Time 1 adaptive motivation is strongly positively correlated with the adaptive motivation at Time 2, is negatively correlated with Time 2 impeding/maladaptive motivation, and is more distinctly negatively correlated with Time 2 maladaptive motivation. Not surprisingly, Time 1 adaptive motivation is positively correlated with Time 2 academic self-concept, cognitive action, behavioural action (with the exception of absenteeism which it is weakly negatively correlated), and the academic outcomes.

Impeding/maladaptive motivation at Time 1 is strongly positively correlated with the corresponding impeding/maladaptive motivation at Time 2, negatively correlated with Time 2 academic self-concept, cognitive action, behavioural action (with the exception of absenteeism which it is weakly positively correlated), and Time 2 academic outcomes. Conversely, the factor correlations also show that the Time 1 maladaptive motivation is strongly positively correlated with the Time 2 maladaptive motivation, negatively correlated with Time 2 academic self-concept, as well as the Time 2 cognitive action, behavioural action (with the exception of absenteeism which it is weakly positively correlated), and academic outcomes. As with conclusions for the first-order longitudinal correlations, the nature and significance of these between-time correlations provide support for assessing a longitudinal SEM.
Table 10.12

Within-Time Longitudinal Higher-order CFA Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes

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Note. AM= Adaptive motivation, IM= Impeding/Maladaptive motivation, MM= Maladaptive motivation, AS= Academic self-concept, CA= Cognitive action, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. Within-time 1 correlations are in upper diagonal and within-time 2 correlations are in lower diagonal. All r-values > .04 are significant at p < .05.
### Table 10.13

**Between-Time Longitudinal Higher-order CFA Correlations for Academic Motivation, Academic Self-concept, Cognitive Action, Behavioural Action, and Academic Outcomes**

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**Note.** AM= Adaptive motivation, IM= Impeding/Maladaptive motivation, MM= Maladaptive motivation, AS= Academic self-concept, CA= Cognitive action, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. Test-retest correlations are bolded in diagonal. All r-values >.02 are significant at $p<.05$. 
Assessment of the Longitudinal Hypothesised Academic Self-system Process Model

A primary aim of the present research is to investigate longitudinal (Time 1-Time 2) structural relations between motivation, self-concept, cognitive action (positive school appraisal and positive academic plans), behavioural action (class participation, homework completion, and absenteeism), and academic outcomes (test performance and test effort). This longitudinal SEM comprised three higher-order motivation factors (adaptive motivation, impeding/maladaptive motivation, and maladaptive motivation) and academic self-concept predicting higher-order cognitive action (positive school appraisal and positive academic plans) which in turn predicted behavioural action (class participation, homework completion, and absenteeism). These behavioural actions then predict the academic outcomes (test performance and test effort scores). As with earlier cross-sectional analyses of the matched Time 1 and Time 2 sample, the measurement errors of each parallel indicator were correlated across the two time waves in order to avoid biased parameter estimates. Additionally, this model also specified predictive paths between corresponding factors at Time 1 and Time 2 (e.g., academic self-concept at Time 1 predicts academic self-concept at Time 2).

Results of the hypothesised longitudinal SEM provided an excellent fit to the data ($\chi^2 = 28,973.24$, $df = 8,378$, RMSEA = .04, CFI = .98, NNFI = .98). Beta coefficients are shown in Table 10.14 and the path model is depicted in Figure 10.1. It is important to note that the test-retest beta paths for parallel factors (e.g., the beta path between Time 1 academic self-concept and Time 2 academic self-concept) are freely estimated in this longitudinal model. Therefore, the predictive paths within Time 2 are particularly important and illuminating because Time 1 variance in Time 2 factors has
been explained and so remaining Time 2 effects can be deemed very robust and over
and above that explained by their Time 1 counterparts.

Completely standardised coefficients shown in Table 10.14 indicate that at both
Time 1 and Time 2, cognitive action is positively predicted by the adaptive motivation
(Time 1: $\beta = .30, p < .001$; Time 2: $\beta = .30, p < .001$) and academic self-concept (Time
1: $\beta = .28, p < .001$; Time 2: $\beta = .22, p < .001$), weakly by impeding/maladaptive
motivation (Time 1: $\beta = .12, p < .001$; Time 2: $\beta = .12, p < .001$), and negatively by
maladaptive motivation (Time 1: $\beta = -.46, p < .001$; Time 2: $\beta = -.41, p < .001$). In turn,
cognitive action for both Time 1 and Time 2 positively predicts behavioural action in
the form of class participation (Time 1: $\beta = .60, p < .001$; Time 2: $\beta = .48, p < .001$) and
homework completion (Time 1: $\beta = .52, p < .001$; Time 2: $\beta = .37, p < .001$) and
negatively predicts absenteeism (Time 1: $\beta = -.19, p < .001$; Time 2: $\beta = -.23, p < .001$).
In terms of behavioural action, class participation positively predicts test performance
(Time 1: $\beta = .04, ns$; Time 2: $\beta = .05, p < .05$) and test effort (Time 1: $\beta = .06, ns$; Time
2: $\beta = .07, p < .05$) and homework completion also positively predicts test performance
(Time 1: $\beta = .25, p < .001$; Time 2: $\beta = .09, p < .001$) and test effort (Time 1: $\beta = .21,
p < .001$; Time 2: $\beta = .15, p < .001$). Additionally, weeks absent from school negatively
predicts test performance (Time 1: $\beta = -.14, p < .001$; Time 2: $\beta = -.12, p < .001$) and
test effort (Time 1: $\beta = -.05, ns$; Time 2: $\beta = -.21, p < .001$).

As noted above, paths between corresponding factors at Time 1 and Time 2
were also specified in this longitudinal SEM. Results show that Time 1 adaptive
motivation positively predicts adaptive motivation at Time 2 ($\beta = .64, p < .001$), Time 1
impeding/maladaptive motivation strongly positively predicts Time 2
impeding/maladaptive motivation ($\beta = .85, p < .001$), and Time 1 maladaptive motivation positively predicts Time 2 maladaptive motivation ($\beta = .66, p < .001$).

Academic self-concept at Time 1 positively predicts academic self-concept at Time 2 ($\beta = .61, p < .001$) and Time 1 cognitive action positively predicts Time 2 cognitive action ($\beta = .11, p < .001$). Additionally, Time 1 behavioural action positively predicts their Time 2 counterparts in the form of class participation ($\beta = .40, p < .001$), homework completion ($\beta = .21, p < .001$) and absenteeism ($\beta = .20, p < .001$). Finally, Time 1 test performance was also found to strongly positively predict test performance at Time 2 ($\beta = .83, p < .001$), as was Time 1 test effort found to positively predict subsequent test effort at Time 2 ($\beta = .50, p < .001$).
Table 10.14

Beta Coefficients for the Longitudinal Academic Self-system Process Model

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Note. AM= Adaptive motivation, IM= Impeding/Maladaptive motivation, MM= Maladaptive motivation, AS= Academic self-concept, CA= Cognitive action, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. All coefficients completely standardised. *** p < .001, * p < .05.
Figure 10.1. Derived longitudinal academic self-system process model.

AM = Adaptive motivation, IM = Impeding/Maladaptive motivation, MM = Maladaptive motivation, AS = Academic self-concept, CA = Cognitive action, PT = Class participation, HW = Homework, AB = Absenteeism, TP = Test performance, TE = Test effort. Time 1 - Time 2 test-retest paths are indicated in brackets [ ].

$\chi^2 = 28,973.24$, $df = 8,378$, RMSEA = .04, CFI = .98, NNFI = .98. All path coefficients are completely standardised. ns = non-significant at $p < .10$. All other paths significant at $p < .05$. 

$\chi^2 = 28,973.24$, $df = 8,378$, RMSEA = .04, CFI = .98, NNFI = .98. All path coefficients are completely standardised. ns = non-significant at $p < .10$. All other paths significant at $p < .05$. 

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Post Hoc Analysis of the Hypothesised Longitudinal Model Using Modification Indices

As outlined in earlier chapters (see Chapter 6, 8 and 9), SEM not only allows for model evaluation based on *a priori* predictions (see preceding section) but also model modification (Kaplan, 1990a). As was the case for the cross-sectional analyses, additional parameters were freed if: (a) modification indices indicated a large estimated change and (b) these parameters were conceptually defensible. This model modification process resulted in the addition of five new beta paths with a similar good-fitting model ($\chi^2 = 28, 914.79$, $df = 8,373$, RMSEA = .04, CFI = .98, NNFI = .98). Beta coefficients are shown in Table 10.15 and the *post hoc* paths are depicted in Figure 10.2. According to this modified model: Time 1 test performance now also positively predicts Time 2 test effort ($\beta = .16, p< .01$), and negatively predicts Time 2 maladaptive motivation ($\beta = -.06, p< .05$); Time 1 academic self-concept now also negatively predicts the Time 2 maladaptive motivation ($\beta = -.09, p< .001$); and Time 2 academic self-concept is now also positively predicted by Time 1 class participation ($\beta = .08, p< .001$) and Time 1 homework completion ($\beta = .04, p< .05$).
Table 10.15

*Post hoc Beta Coefficients for the Longitudinal Academic Self-system Process Model*

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Note. AM= Adaptive motivation, IM= Impeding/Maladaptive motivation, MM= Maladaptive motivation, AS= Academic self-concept, CA= Cognitive action, PT= Class participation, HW= Homework, AB= Absenteeism, TP= Test performance, TE= Test effort. All coefficients completely standardised. *Post hoc* beta paths are in bold.

*** p<.001, ** p<.01, * p<.05.
Figure 10.2. Post hoc structural relations in the longitudinal model.

AM = Adaptive motivation, IM = Impeding/Maladaptive motivation, MM = Maladaptive motivation, AS = Academic self-concept, CA = Cognitive action, PT = Class participation, HW = Homework, AB = Absenteeism, TP = Test performance, TE = Test effort. Time 1 - Time 2 test-retest paths are indicated in brackets [ ]. Post hoc paths are represented by dashed lines. \( \chi^2 = 28, 914.79, \) df = 8,373, RMSEA = .04, CFI = .98, NNFI = .98. All path coefficients are completely standardised. ns= non-significant at \( p<.10 \). All other paths significant at \( p<.05 \).
Chapter Summary

The proposed yields of the present chapter are multi-fold. First, it demonstrated the stability of the first-order and higher-order factor structure with the matched Time 1 data, the matched Time 2 data, as well as the longitudinal data (i.e., matched Time 1 and Time 2 data in the one model). Second, it confirmed the hypothesised structural relations of the academic self-system process model identified in earlier chapters (see Chapter 8 and Chapter 9) for the matched Time 1 data, the matched Time 2 data, and longitudinal data. Finally, of particular importance to this chapter and the study as a whole are the findings derived in the longitudinal SEM. These results showed that: (a) adaptive and impeding/maladaptive motivation as well as academic self-concept positively predict the cognitive action high school students use, whereas maladaptive motivation of high school students negatively predicts cognitive action; (b) cognitive action positively predicts class participation and homework completion but negatively predicts absenteeism; (c) class participation and homework completion positively predict academic outcomes, whereas absenteeism negatively predicts academic outcomes; (d) Time 1 factors positively predict their corresponding Time 2 factors (e.g., Time 1 maladaptive motivation positively predicts Time 2 maladaptive motivation); (e) there is merit in correlating parallel uniquenesses to reduce bias in Time 1-Time 2 parameters; (f) additional conceptually defensible parameters are evident after inspection of modification indices that are proposed to enhance the model; and (g) perhaps most importantly, after accounting for Time 1 variance, a majority of the hypothesised predictors of Time 2 factors remain significant. Taken together, these longitudinal findings provide expanded insight into the academic processes that are predictive of diverse educational outcomes.
CHAPTER 11

DISCUSSION AND IMPLICATIONS FOR FURTHER RESEARCH AND PRACTICE

Introduction

In seeking to better understand and illuminate the academic processes involved in high school students' academic development, the present study proposed and examined an integrative model drawing on three distinct lines of theoretical and empirical enquiry. The first is from Connell and colleagues' (Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990) self-system process model that casts academic processes in terms of relations between social context, self, action, and outcomes. The second is the cognitive-behavioural approach (see Dobson & Dozois, 2001; Hughes & Hall, 1989; Kraus, 1995 for an overview of the cognitive-behavioural perspective), which recognises distinct dimensions of self-system processes (i.e., cognitive action and behavioural action) that are relevant to practice and intervention. The third is a methodological perspective that advocates a construct validation approach (Marsh et al., 2006) to most effectively assess the processes and outcomes under focus in this study. The confluence of these three lines of enquiry led to a hypothesised academic self-system process model that incorporated motivational components, academic self-concept, cognitive action, behavioural action, and academic outcomes. This hypothesised model was examined across time to address the complex nature of these student variables and their associations with academic-related outcomes. The three distinct but interrelated perspectives, then, formed the basis of the measurement and modelling vital to understanding the relative roles of academic motivation, academic self-concept, and academic action in students' educational outcomes.
Although there were numerous objectives underpinning the current investigation, the primary aims were to utilise a large cross-sectional and longitudinal design in order to:

(a) Assess across all samples the psychometric properties of key instrumentation cross-sectionally (Time 1 and Time 2 samples independently) and longitudinally (matched Time 1 and Time 2 samples) to ensure component items and factors were psychometrically robust elements for the study;

(b) Examine the gender and year-level invariance in factor structure for all instrumentation at both Time 1 and Time 2 to ensure that the instrumentation was robust for sub-groups within the entire sample – and to then justify pooling data for whole-sample analyses;

(c) Assess for possible mean-level effects on the central constructs as a function of gender and year-level;

(d) Apply appropriate methodological design and statistical techniques (e.g., latent modelling) to empirically evaluate a model of student academic processes that posit relations between academic motivation, academic self-concept, cognitive action, behavioural action, and educational outcomes;

(e) Examine, using appropriate methodological design and statistical techniques, the stability of this hypothesised academic self-system process model cross-sectionally (for separate Time 1 and Time 2
samples) and longitudinally (for the Time 1-2 sample of students present in both years);

(f) Assess, using appropriate methodological design and statistical techniques, a hypothesised longitudinal model that seeks to identify significant paths from one year to the next and significant paths that exist at Time 2 after controlling for Time 1 variance; and

(g) Better understand the relative salience of motivation and self-concept in predicting academic processes and the relative salience of cognitive and behavioural action in predicting academic outcomes.

Taken together, these primary aims comprise three interrelated investigative components. The first is concerned with the cross-sectional and longitudinal construct validation of instrumentation – that also comprises assessment of group effects (e.g., multi-group factor invariance and group mean-level effects). The second involves cross-sectional examination of the hypothesised academic self-system process model at both Time 1 and Time 2. The third involves assessment of this proposed academic self-system process model from a longitudinal perspective (using a matched Time 1 and Time 2 sample). The preceding four chapters (see Chapter 7 through to Chapter 10) have presented findings emanating from these three interrelated components. The intent of the present chapter is to discuss the pivotal findings relevant to the aims detailed above, elucidate the implications of the study’s findings for theory, research, measurement and practice, and detail some of the strengths and limitations that guide direction for future educational research.
Construct Validation of the Instrumentation: Key Cross-sectional and Longitudinal Findings

As highlighted throughout (see Chapter 4), construct validation perspectives emphasise the importance of demonstrating the reliability and validity of measures central to empirical modelling. In the present study, construct validity was established through within-network validity and between-network validity. Within-network testing explores the internal structure of a construct using statistical procedures such as factor and reliability analysis, with a view to demonstrating that the construct has consistent and distinct multidimensional components. Once within-validity properties are sufficiently demonstrated (or resolved) and the psychometric properties of the instrumentation are deemed to be sound, it is then important to explore between-network validity. In the present study this involved testing mean-level effects of gender and year-level, and most importantly, the empirical links between hypothesised factors that together comprise the academic self-system process model.

Within-network issues were assessed by way of reliability estimates using Cronbach's alpha for each factor (with the exception of homework completion and absenteeism as these were single-item indicators), analysis of distribution properties, CFA, as well as multi-group invariance testing using CFA (conducted across gender and year-level). To establish between-network validity, zero-order correlations (derived from the CFAs) were examined to gain a first sense of relationships amongst factors, MIMIC modelling was conducted to investigate the mean-level effects of gender and year-level on all factors, and most importantly, SEM was conducted to evaluate the hypothesised links between the central constructs (i.e., testing the hypothesised academic self-system process model). Although some of the instruments utilised in the
present investigation have previously demonstrated sound psychometric properties, it is good practice to conduct construct validation in any new sample in order to demonstrate that the measurement underpinning substantive questions and answers is sound. These findings are now discussed.

**Within-network findings**

The first component of analyses aimed to demonstrate a sound foundation for between-construct analyses by evaluating the psychometric properties (reliability and latent factor structure) of all instrumentation administered in the present investigation. Using CFA, the first-order (e.g., self-efficacy) and higher-order (e.g., adaptive motivation) factors were found to be approximately normally distributed, have robust structural validity, demonstrate strong internal consistency and yielded excellent CFA model fit for Time 1 and Time 2 samples independently. In order to establish comparability and stability with these cross-sectional findings, first- and higher-order analyses using the same central measures were also conducted on the matched Time 1-2 data (i.e., only students with both Time 1 and Time 2 data were included in analyses). These analyses also supported the psychometric properties of the first- and higher-order factors.

To further support the within-network validity of the instrumentation, it was also important to examine the invariance of the hypothesised factor structure across key subgroups in analyses. Although rarely tested, an important assumption in the comparison of groups is that the underlying constructs being measured are the same across groups (Martin, 2004; Vandenberg & Lance, 2000). As described in Chapter 6, the issue of factor invariance is different to mean-level testing as it is concerned with the factor structure underlying the instruments (Green et al., 2006b; Martin, 2004). Invariance
essentially involves comparing a range of models in which aspects of the factor structure are systematically held invariant across groups. Relatively invariant fit indices are indicative of invariant factor structure (Cheung & Rensvold, 2002; Martin, 2004).

Time 1 and Time 2 multi-group CFAs were conducted to explore factor invariance as a function of gender and year-level. Findings showed strong support for gender and year-level invariance in factor structure for both the first-order model and the higher-order models (which is particularly relevant to subsequent analyses). These findings are in line with previous research showing gender and year-level invariance of first-order and higher-order models of motivation (Green et al., 2006b; Martin, 2003b, 2004, 2007; Martin et al., in press; Martin, Marsh et al., 2007). Gender and year-level invariance of academic self-concept derived in this study also support previous self-concept research (Marsh, 1993b; Marsh & Hocevar, 1985).

In terms of the factor structure of the instrumentation, these invariance findings suggest there are no fundamental differences in kind (i.e., there is parallel factor structure across males and females and across different year-levels). This finding shows that the given instrumentation measures the same components or underlying constructs with equal validity for males and females and for students across different high school year-levels, hence further supporting the soundness of the instrumentation administered to this sample of adolescents. Thus, there was justification to pool all sub-groups and conduct whole-sample analyses (i.e., not disaggregated by gender or year-level).

Taken together, the within-network findings demonstrate that the instrumentation (and the central constructs underpinning the instrumentation) were approximately normally distributed, had robust structural validity, as well as strong internal consistency. Furthermore, in terms of the factor structure of academic
motivation (both first-order and higher-order), academic self-concept, cognitive action, 
behavioural action, and academic outcomes, multi-group CFA tests demonstrate that 
males and females across different year-levels were not substantially different. These 
strong within-network findings support the measurement underpinning the hypothesised 
academic self-system process model and provide a sound basis for inspecting mean-
level differences between these groups as well as support for performing more complex 
analyses such as SEM.

**Between-network Findings**

CFAs also produce factor correlations which provide a first sense of relations 
that exist amongst factors and a first test of between-network validity. Indeed, 
examining factor correlations also enables the researcher to observe the extent to which 
such relations are consistent with previous research. First- and higher-order CFAs were 
conducted and both models demonstrated excellent fit to the data. Because only the 
higher-order model was utilised in the testing of the hypothesised academic self-system 
process model, these higher-order factor correlations are the focus in the following 
discussion.

**Within-Scale Correlations of Academic Motivation and Academic Self-concept**

When examining findings from cross-sectional (Time 1 and Time 2 data) and 
longitudinal (matched Time 1 and matched Time 2 data) samples, the within-scale 
academic motivation correlations were found to be generally consistent with previous 
research examining the first-order and higher-order model of motivation (Green et al., 
2006a; Green et al., 2007; Martin, 2003b, 2004, 2007; Martin et al., 2004). Specifically, 
adaptive motivation dimensions were found to be highly correlated with each other, 
correlated at zero or slightly negatively with impeding/maladaptive motivation, and
markedly negatively correlated with maladaptive motivation. There were moderately high correlations amongst impeding/maladaptive motivation dimensions and amongst maladaptive motivation dimensions with the latter two clusters modestly positively correlated. Furthermore, these analyses also demonstrated the relations between academic motivation and academic self-concept. Specifically, factor correlations demonstrated that academic self-concept is strongly positively correlated with the adaptive dimensions of motivation, moderately negatively correlated with impeding/maladaptive motivation dimensions, and correlated more distinctly negatively with maladaptive motivation dimensions.

**Between-scale Correlations**

Based on these correlational data (cross-sectional Time 1 and Time 2 data and longitudinal matched Time 1 and matched Time 2 data), some preliminarily observations can also be made about some of the hypothesised links in the academic self-system process model. As these are correlations, the findings can only be suggestive of relations, but they do provide a preliminary picture of how the hypothesised model might unfold.

In relation to this, CFA demonstrated significant relationships between the ‘self’ component (academic motivation and academic self-concept) of the model and a range of academic relevant correlates (i.e., cognitive action, behavioural action, and academic outcomes). In the first instance, the adaptive motivation and academic self-concept were positively correlated with cognitive action (positive school appraisal and positive academic plans), impeding/maladaptive motivation was correlated somewhat negatively with cognitive action, and the maladaptive motivation was correlated more markedly negatively with cognitive action. These analyses also demonstrated that,
notwithstanding absenteeism (in which higher scores reflect a more maladaptive outcome), cognitive action was positively correlated with behavioural action (homework completion and class participation) and negatively correlated with absenteeism. Finally, in terms of behavioural action, significant correlations were found with academic outcomes (test performance and test effort), such that homework completion and class participation were positively correlated with academic outcomes, and absenteeism was negatively correlated with academic outcomes. The strong positive correlation between motivation and cognitive action (positive school appraisal and positive academic plans) finding is in line with Martin and colleagues' work (Green et al., 2006a; Green et al., 2007; Martin, 2007; Martin et al., 2004) which consistently report between-network validity between motivation and these cognitive constructs.

Although the motivation dimensions were significantly correlated with behavioural action as well as academic outcomes, the strongest relationship was found between academic motivation and cognitive action – consistent with what is hypothesised in relation to the academic self-system process model (discussed below). The weaker correlation between motivation and academic outcomes (test performance and test effort) is relatively consistent with previous motivational research which has failed to produce consistent results when attempting to elucidate the relations between motivational constructs and academic achievement (e.g., McInerney, 2003). The finding that adaptive and maladaptive motivation dimensions were relatively stronger correlates of cognitive action than impeding/maladaptive motivation is also supported by the work of Martin and colleagues (Green et al., 2006b; Green et al., 2007; Martin, 2007; Martin, et al., 2004). The strong relations between adaptive and maladaptive motivation and more subjective processes (positive school appraisal and positive academic plans) found in this investigation, and the work of Martin and colleagues (2007; Green et al., 2007),
suggests that these motivational constructs may be more directly related to engagement (i.e., action) with school rather than performance or achievement at school. Again, this finding lends further support to one of the hypothesised links in the academic self-system process model (i.e., academic motivation is linked to cognitive action).

**MIMIC Findings of Gender and Year-level**

From a between-network construct validity perspective there is also merit in investigating the mean-level effects of gender and year-level on the central measures. To do this, MIMIC models were utilised to examine the main effects of gender and year-level, and the gender by year-level interaction for each of the central measures at Time I (i.e., academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcome variables).

**Main effects of gender and year-level.**

Again, because higher-order models were utilised in subsequent SEMs’ testing the hypothesised academic self-system process model, the present discussion will focus only on MIMIC findings for factors in the higher-order model. MIMIC analyses found that female students were significantly higher on adaptive motivation (e.g., mastery orientation, valuing of school, planning, persistence) and significantly higher on impeding/maladaptive motivation (e.g., anxiety). These results largely support previous findings of Martin (2001, 2003b, 2004, 2007), who has found that females generally reflect a more adaptive pattern of motivation than males, with the exception of anxiety (see also Green et al., 2005). Although these findings show that females report some impeding motivational constructs (e.g., anxiety), it appears that these dimensions may result in greater conscientiousness and diligence rather than disengagement and failure acceptance. This notion is once again supported by Martin’s (2007) work which has
found this to be the case in his research utilising the MES-HS and cognitive action factors (i.e., positive school appraisal and positive academic plans).

In addition to the main effects of gender, there were also motivation-related main effects for year-level. In the present investigation, lower year-level school students reported higher levels of adaptive motivation and lower impeding/maladaptive and maladaptive motivation. This finding is generally in line with previous research which has found that students in lower year-levels (i.e., middle high school) reflect less adaptive patterns of motivation (e.g., Green et al., 2005; Martin, 2007). In terms of academic self-concept, the non-significant finding of year-level differences in academic self-concept is not surprising considering the inconsistent year-level effects of self-concept found in previous research (e.g., Chung et al., 1998; Dusek & Flaherty, 1981; Marsh, 1989; Marsh et al., 2005; see also Chapter 3).

**Interaction effects of gender and year-level.**

It is important to note that the findings in relation to adaptive motivation for gender and maladaptive motivation for year-level were qualified by interaction effects. That is, gender differences in adaptive motivation change as a function of year grouping and year-level differences and maladaptive motivation also change as a function of gender. For adaptive motivation cognitive dimensions (i.e., self-efficacy, valuing of school, and mastery orientation), both males and females decline across the high school years, however, between junior high and middle high school the decline for males is sharper and this trajectory continues into senior high school (see Figure 7.2a). The interaction effect for maladaptive motivation dimensions showed that male and females tend to experience a steady increase across the high school years, however, between junior and middle high, increases for males in maladaptive behavioural motivation
dimensions tends to be sharper (see Figure 7.2b). These interaction effects are in broad alignment with previous research conducted by Martin and colleagues (Martin, 2001, 2003b, 2004, 2007; Green et al., 2005) who report that the middle high school year-levels reflect less adaptive motivation and that male students tend to reflect these problematic motivation patterns to a greater degree than females.

Summary of Key Construct Validity Findings

In summary, instrumentation central to this investigation demonstrated sound within- and between-network construct validity. In particular, within-network findings confirmed the instrumentation was approximately normally distributed and comprised reliable scales. Furthermore, multigroup CFA invariance results showed that males and females of all year-levels appeared to respond to the structure of academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcome variables in similar ways. These strong within-network findings supported the measurement component underpinning the hypothesised academic self-system process model.

Between-network findings demonstrated that the inter-scale correlations of academic motivation and academic self-concept were logically related. Other between-construct correlations were consistent with theory and the hypothesised links in the academic self-system process model. Taken together, this multidimensional instrumentation comprising academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes (test performance and test effort) provided a strong foundation for more complex between-network analyses (such as SEM) that are designed to assess the links in the hypothesised academic self-system process model. The next component of the discussion directly addresses the
hypothesised academic self-system model that explores the relative salience of academic motivation and academic self-concept in predicting the processes that influence academic outcomes.

**The Hypothesised Academic Self-system Process Model: Key Cross-sectional Findings**

Having established the measurement framework and identified preliminary correlations central to the hypothesised model, the vital substantive issues relevant to the hypothesised model were then addressed. These substantive issues were pursued through the application of SEMs to disentangle the relations between academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes. In doing so, the present study goes beyond much prior research that has considered these issues in a less integrative way and seeks to explicate the specific ordering of factors both cross-sectionally and longitudinally. This section summarises the cross-sectional analyses (using the Time 1 and Time 2 samples as well as the matched Time 1 and Time 2 sample) and the following section summarises the longitudinal pattern of results. In this and the following section, major findings are summarised, and a detailed interpretation of findings is developed in subsequent sections.

It will be recalled that the academic self-system process model posits links between individuals' experience of context (addressed here through embedding the study in adolescence and the high school context), self-system processes (academic motivation and academic self-concept), patterns of cognitive action (e.g., positive appraisal of school) and behavioural action (e.g., homework completion), and contextually-relevant outcomes (e.g., test performance) in the high school academic
setting. The model is one in which: (a) academic motivation (adaptive, impeding/maladaptive, and maladaptive motivation) and academic self-concept predict cognitive action; (b) cognitive action (positive school appraisal and positive academic plans) predicts behavioural action; and (c) behavioural action (homework completion, class participation, and absenteeism) predicts academic outcomes (test performance and test effort).

In the first instance, a first-order model was tested in which academic motivation and other elements of the model were represented in terms of their individual first-order factors. Although this first-order model provided an excellent fit to the data (indicating broad support for the hypotheses advanced in this study), this model also generated five suppression effects (see Chapter 8 and 9) deemed to be a result of the high correlations between some of the first-order motivation factors and the high correlation between positive school appraisal and positive academic plans. Hence, it was considered appropriate to combine adaptive cognitive and adaptive behavioural motivation dimensions into one higher-order adaptive motivation dimension, thus resulting in three higher-order motivation factors. Similarly, the two cognitive action factors (positive school appraisal and positive academic plans) were modelled to form a higher-order cognitive action factor.

This newly derived model comprising higher-order motivation, academic self-concept, higher-order cognitive action, behavioural action, and academic outcomes was then used for testing the central substantive predictions (see Figure 8.1). This adjusted model (using the 3 higher-order factor structure of motivation as well as the higher-order cognitive action factor) was then tested using the cross-sectional Time 1 and Time 2 samples as well as with the matched Time 1 and Time 2 sample. For each sample, the
academic self-system process model was found to be an excellent fit. Each of the specific links (i.e., beta paths) between constructs is now discussed.

**Academic Motivation and Academic Self-concept Links to Cognitive Action**

In relation to the hypothesised links between academic motivation, academic self-concept, and cognitive action, findings show that for each sample (i.e., the separate Time 1 and Time 2 samples as well as the matched Time 1-2 sample) the adaptive motivation dimension, impeding/maladaptive motivation dimension, and academic self-concept positively predicted cognitive action and the maladaptive motivation dimension negatively predicted cognitive action. These significant relationships between academic motivation, academic self-concept, and cognitive action support previous contentions that motivation constructs (e.g., Goetz et al., 2006; Green et al., 2007; Martin, 2003b, 2007) and academic self-concept (e.g., Bodkin-Andrew et al., 2005a; Craven et al., 2006; Marsh, 1991) are positively related to positive school appraisal and positive academic plans. Importantly, although a number of studies have examined relations between motivation, self-concept constructs, and cognitive action, the current investigation's conceptualisation and operationalisation was unique in that it combined these two constructs in the one model to examine their juxtaposition in predicting academic processes.

Further inspection of the beta coefficients show that maladaptive motivation was the strongest predictor of cognitive action at Time 1, matched Time 1, and matched Time 2. However at Time 2, adaptive motivation was the strongest predictor of cognitive action (followed closely by maladaptive motivation). Although both academic motivation and academic self-concept play a significant role in predicting cognitive action, when included in the same model, motivation dimensions (in particular
maladaptive and adaptive motivation) appear to be more salient than academic self-concept in predicting cognitive action. However, academic self-concept played a salient role in predicting behavioural action (i.e., class participation) when post hoc adjustments were made (discussed below). The strength of the model in the present study, then, is its inclusion of both motivation and self-concept in the one analytic model, controlling for each other’s effects, and then identifying their unique and combined roles in predicting cognitive action.

Existing research which combines both motivation and self-concept in the one model is limited. Research that has included these two constructs has examined links between motivation, self-concept, and academic achievement— but not links to academic processes such as cognitive action (e.g., Barker, 2007a, 2007b; Barker et al., 2005a, 2005b). Although research has found causal relations between motivation and cognitive action constructs as well as academic self-concept and cognitive action, it has not done so in the one analytical model examining the relative salience of these predictors (see Bodkin-Andrews, 2008). Hence, the present findings show that considering academic motivation and academic self-concept in the one model provides important information over and above research that considers each in isolation.

**Cognitive Action Links to Behavioural Action**

In relation to the hypothesised link between cognitive action and behavioural action, findings showed that cognitive action positively predicted homework completion and class participation but negatively predicted absenteeism. Interestingly, at each of the testing stages, cognitive action yielded the strongest relationship with class participation. In the broadest sense these findings are in line with the cognitive-behavioural framework, which proposes that cognitions can guide or predict subsequent
behaviour (see Dobson & Dozois, 2001; Kraus, 1995; Reinecke & Clark, 2004).

However, at the individual construct level, these findings also support correlational research that has found relations between cognition and class participation (e.g., Green et al., 2007; Martin, 2007), homework completion (e.g., Trautwein et al., 2006), and absenteeism (e.g., Crespo, 1984). Although previous research has shown evidence of these relations, to the author’s knowledge, no model exists which specifies predictive links between cognitive action and behavioural action as mediating points for motivation and self-concept leading to academic outcomes.

**Behavioural Action Links to Academic Outcomes**

In terms of the hypothesised link between behavioural action and academic achievement outcomes, the present investigation found that homework completion and class participation positively predicted test performance and test effort. Not surprisingly, the number of weeks absent from school negatively predicted test performance and test effort outcomes. These findings confirm previous research that has demonstrated links between homework completion and academic outcomes (e.g., Cooper, 2001a), class participation and academic outcomes (e.g., Finn, 1993), and school attendance and academic outcomes (e.g., Edward & Malcolm, 2002). Once again, although previous research has shown evidence of these relations, to the author’s knowledge, no model exists which specifies predictive links between each of these behavioural action and academic outcomes simultaneously.

It was interesting to note that at Time 1 and the matched Time 1 data, the strongest predictors of test performance and test effort was homework completion; at Time 2, homework completion and absenteeism were equally predictive of test performance and test effort; and in the matched Time 2 data the strongest predictors for
test performance were homework completion and absenteeism, and the strongest predictor of test effort was absenteeism. Taken together, then, it seems that homework completion is most salient in predicting test performance and test effort (followed by days absent from school). That is, students who report regular completion of homework and regular attendance at school perform better and attempt more items on the standardised achievement measure. This finding is an important one as there is a lack of clarity about the influence of homework on educational attainment (e.g., see Trautwein & Köller, 2003). In the present model, homework completion was operationalised as a self-report of how often (using a 5-point rating scale) a student completes his/her homework rather than assessing the time spent on homework. The latter line of research has typically found conflicting results (see Cooper, 2001) and so the present study’s focus on frequency of homework completion lends clarity to this ongoing debate. The finding that absenteeism consistently negatively predicted academic outcomes further supports the notion that regular attendance at school is an important factor in school success (Caldas, 1993; Rothman, 2001, 2002; Sutton & Soderstrom, 1999).

**Stability of Cross-sectional Paths**

In addition to the confirmed cross-sectional links in the academic self-system process model, attention also needs to be paid to the stability of the cross-sectional paths at each time wave (Time 1, Time 2, and matched Time 1 and Time 2 samples). Encouragingly, the predictive paths (i.e., beta coefficients) for each data set were broadly parallel at Time 1 and Time 2; that is, the links between these constructs (and by implication the academic self-system process model) are stable, generalisable across time, and present robust parameters. This is a noteworthy finding because most previous research is predominately of a cross-sectional nature which does not address
the question as to whether the individual links are stable and generalisable across time. The current investigation goes beyond previous cross-sectional research by confirming this integrative process model not only one year later but also with the matched data set (i.e., the dataset comprising only students present at both Time 1 and Time 2). These stability findings enable more conclusive interpretations that ultimately lead to greater confidence in proposing applied implications (discussed below).

Post Hoc Analyses Based on Modification Indices

The findings summarised above relate to the hypothesised a priori academic self-system process model and the predictive paths proposed on the basis of the conceptual review in Chapters 3 and 4. In addition to evaluating hypothesised parameters, SEM also allows for model modification by identifying parameters that improve the fit between the data and the hypothesised model. Based on empirical and substantive grounds the researcher may decide to include these parameters in a final adjusted model (Kaplan, 1990a). Post hoc analyses were performed on both the Time 1 and Time 2 samples. In both datasets, additional potential paths were identified, as follows: (a) positive paths between adaptive motivation and both homework completion and class participation; (b) a negative path between maladaptive motivation and test performance; and (c) a positive path between academic self-concept and class participation. Notably, these significant paths were identical for both Time 1 and Time 2, providing support for the validity of their inclusion in the final models as well as their stability across time. Additionally, it is promising to see that motivation and academic self-concept (i.e., ‘self’ in the academic self-system process model) are the only factors found to influence subsequent factors at post hoc analyses. That is, cognitive action was not found to predict academic outcomes, lending further support to
the cognitive and behavioural action link proposed in the model. Thus, the confirmatory
and post hoc analyses confirm the ordering of these constructs in proposed academic
self-system process model.

**Summary of Key Cross-sectional Findings for the Hypothesised Academic Self-

system Process Model**

In sum, cross-sectional findings demonstrate that the hypothesised academic
self-system process model is sound and a good fitting representation of the processes
underlying students' academic outcomes. Specifically, the following links were
confirmed at each data set: (a) academic motivation and academic self-concept were
found to predict cognitive action, (b) cognitive action was found to predict behavioural
action, and (c) behavioural action was found to predict academic outcomes.

Furthermore, post hoc analyses suggested the following links: (a) adaptive motivation
positively predicting homework completion and class participation; (b) maladaptive
motivation negatively predicting test performance; and (c) academic self-concept
positively predicting class participation. The observation that Time 1 and Time 2
process models operated in much the same way demonstrates the generalisability of the
proposed processes over time. These consistent findings across both time waves suggest
that these proposed processes are common across students' academic lives and not just
particular to the year they were assessed. Hence, over and above the findings at Time 1,
findings at Time 2 were very important for demonstrating the generality of the
hypothesised academic self-system process model.
The final component of the analyses sought to replicate cross-sectional findings utilising longitudinal CFA and SEM techniques and across two time waves in the one analytic model. In the first instance, longitudinal first-order and higher-order CFAs were conducted such that all variables from Time 1 and Time 2 were included in the one CFA. This was an important part of longitudinal analyses as it laid the measurement foundations for the hypothesised longitudinal model. Following this, longitudinal SEM was conducted to assess the hypothesised processes over time (see Figure 10.1). One of the major strengths of longitudinal SEM is that it can specify paths across time as well as simultaneously testing many parameters within each time wave (e.g., paths between cognitive action and behavioural action within both Time 1 and within Time 2). It also enables appropriate modelling of various aspects of the structure such as correlating Time 1 and Time 2 uniquenesses associated with parallel items (e.g., Time 1 academic self-concept items and Time 2 academic self-concept items) and freeing paths between corresponding Time 1 and Time 2 factors (e.g., academic self-concept at Time 1 predicting academic self-concept at Time 2). By estimating correlated uniquenesses between parallel items across time waves, the researcher is able to control for (and assess) shared method variance. Furthermore, by specifying paths between corresponding Time 1 and Time 2 factors, the researcher is able to control for (and assess) test-retest variance. The latter inclusions are also substantively interesting because they provide a sense of the stability of parallel constructs across time. They also provide added strength to any significant paths between factors at Time 2 because these paths are significant even after controlling for Time 1 variance.
**Longitudinal Psychometric Findings**

As was the case with cross-sectional analyses, the findings of the longitudinal analyses demonstrated the internal consistency and stability of the first-order and higher-order factor structure. Perhaps not surprisingly, within-time longitudinal first- and higher-order CFA findings were consistent with previous cross-sectional findings discussed above. Of greater interest, however, were the between-time longitudinal findings. For the first- and higher-order longitudinal CFA, corresponding Time 1 and Time 2 factors were found to be related, yet also distinctive across time and constructs. The nature and significance of the between-time correlations provide support for the measurement component of the longitudinal SEM.

**Longitudinal SEM Findings**

As with the cross-sectional SEM findings, the longitudinal SEM analyses sought to test the hypothesised academic self-system process model *within* each time wave. This longitudinal model also specified paths *between* corresponding Time 1 and Time 2 factors (e.g., Time 1 academic self-concept and Time 2 academic self-concept) and correlated uniquenesses between parallel items at Times 1 and 2. Finally, *post hoc* analyses were conducted to determine what paths to free across Times 1 and 2. Hence, in addition to the within-time processes identified in cross-sectional analyses, numerous additional paths across Times 1 and 2 were also estimated – gaining full yield from the longitudinal design.

Within-Time 1 and within-Time 2 findings show that cognitive action is positively predicted by adaptive motivation and academic self-concept, weakly predicted by impeding motivation, and negatively predicted by maladaptive motivation. In turn, cognitive action at both Time 1 and Time 2 positively predicted behavioural
action in the form of homework completion and class participation, and negatively predicted absenteeism. In turn, homework completion and class participation were found to positively predict test performance and test effort, whereas weeks absent from school negatively predicted test performance and test effort outcomes. Interestingly, when fitting this longitudinal SEM, some paths within Time 1 became non-significant. These paths were between Time 1 class participation and Time 1 academic outcomes (i.e., test performance and test effort) as well as Time 1 absenteeism and Time 1 test effort. Thus, caution is advised when interpreting findings in relation to these parameters as it is suggestive that these particular paths may not be robust.

Not surprisingly, test-retest findings indicated that all Time 1 factors significantly and positively predicted their corresponding factors at Time 2. Having controlled for test-retest variance, of paramount interest were the Time 2 parameters. These Time 2 parameters explained variance over and above what was explained by shared test-retest variance. In a sense, then, findings at Time 2 in this longitudinal model can be considered a robust test of the within-time processes because Time 1 variance in Time 2 factors has already been accounted for. Importantly, all hypothesised parameters within Time 2 remained significant after controlling for Time 1 counterparts. This finding reflects favourably on the conceptual development of the hypothesised academic self-system process model. As discussed in the cross-sectional findings, previous research has shown support for the individual links proposed in this academic self-system process model, however, no research has assessed these constructs simultaneously in the one model, nor has research assessed these constructs in a longitudinal process model.
Post Hoc Findings for the Longitudinal SEM Using Modification Indices

As with cross-sectional analyses of the hypothesised academic self-system process model, it was deemed useful to explore additional parameters that may better represent the complex relations between the constructs across time. Over and above additional parameters identified in the cross-sectional analyses (noted above), post hoc analyses for the longitudinal model were also focused on feasible and defensible parameters across Times 1 and 2. Based on significant modification indices, five new conceptually feasible paths were freed: (a) Time 1 test performance leading to Time 2 test effort, (b) Time 1 test performance leading to Time 2 maladaptive motivation, (c) Time 1 academic self-concept leading to Time 2 maladaptive motivation, (d) Time 1 class participation leading to Time 2 academic self-concept, and (e) Time 1 homework completion leading to Time 2 academic self-concept (see Figure 10.2). These post hoc findings are interesting because they not only show how the two process models are connected across time but also suggest that those constructs conceptualised to be academic outcomes (e.g., test performance) hold implications for non-corresponding factors at Time 2. In this light, test performance can also be viewed as a mediating variable in that outcomes at Time 1 represent predictors for Time 2. Recognising the way in which these processes unfold over time is essential for researchers and practitioners seeking to further understand the achievement motivation dynamics underlying academic development. However, it is important to highlight that non-significant paths existed between Time 1 class participation and Time 1 academic outcomes as well as Time 1 absenteeism and Time 1 test effort. Thus, findings pertaining to these parameters need to be interpreted with caution.
Summary of Key Longitudinal Findings for the Hypothesised Academic Self-system Process Model

The longitudinal findings discussed above demonstrated stability for first-order and higher-order factors and further confirmed the hypothesised structural relations of the academic self-system process model. Of particular importance, however, were the findings derived from the longitudinal SEM. Firstly, the longitudinal analyses confirmed the within-time model links presented earlier (i.e., academic motivation and academic self-concept predicted cognitive action, cognitive action predicted behavioural action, and behavioural action predicted academic outcomes). Secondly, Time 1 factors were found to positively predict corresponding Time 2 factors (e.g., Time 1 maladaptive dimension positively predicted Time 2 maladaptive dimension). Thirdly, the findings also show that the hypothesised predictors of Time 2 factors remained significant even after accounting for Time 1 variance. Finally, post hoc analyses showed that additional conceptually defensible parameters were evident after inspection of modification indices. The fact that the longitudinal model fit the data well and produced essentially identical results to the cross-sectional analyses (with the exception of few non-significant paths within Time 1) indicates that the hypothesised academic self-system processes model is stable and generalisable over time. For completeness, these findings are summarised in Table 11.1.
### Table 11.1

Summary of Key Findings of the Present Investigation

<table>
<thead>
<tr>
<th>Construct Validation Findings</th>
<th>Cross-sectional Findings</th>
<th>Longitudinal Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Network Findings:</td>
<td>Preliminary Assessment of the Model:</td>
<td>CFA Findings:</td>
</tr>
<tr>
<td>• First-order and higher-order factors were normally distributed, structurally valid, and internally consistent at each time wave.</td>
<td>• Excellent fit to the data; however, due to high correlations amongst factors, suppression effects were identified.</td>
<td>• First-order and higher-order factors were normally distributed, structurally valid, and internally consistent.</td>
</tr>
<tr>
<td>• Gender and year-level invariance of factor structure for first-order and higher-order models at Time 1 and Time 2.</td>
<td>Final Assessment of the Model (at each time wave):</td>
<td></td>
</tr>
<tr>
<td>Between-Network Findings:</td>
<td>• Adaptive cognitive motivation and adaptive behavioural motivation were combined into one higher-order adaptive motivation dimension and two cognitive actions were modelled to form a higher-order factor.</td>
<td>Longitudinal SEM Findings:</td>
</tr>
<tr>
<td>• Theoretically consistent within-scale and between-scale correlations.</td>
<td>• Hypothesised links confirmed via SEM: motivation, academic self-concept significantly predicted cognitive action, which then significantly predicted behavioural action, which then predicted academic outcomes.</td>
<td>• Within-time findings show that a majority of the hypothesised links remain significant (with the exception of Time 1 class participation and Time 1 academic outcomes and Time 1 absenteeism and Time 1 test effort).</td>
</tr>
<tr>
<td>• MIMIC and gender main effects: females higher on adaptive motivation and impeding/maladaptive motivation.</td>
<td>• Post hoc analyses identified four additional paths: (1) adaptive motivation to class participation; (2) adaptive motivation to homework completions; (3) maladaptive motivation and test performance; and (4) academic self-concept and class participation.</td>
<td>• Test-retest findings show that all Time 1 factors significantly predict their corresponding Time 2 factors.</td>
</tr>
<tr>
<td>• MIMIC and year-level main effects: lower year-levels higher on adaptive motivation and lower on impeding/maladaptive motivation and maladaptive motivation.</td>
<td></td>
<td>• Post hoc analyses identified five additional paths: (1) Time 1 academic self-concept to Time 2 maladaptive motivation; (2) Time 1 test performance to Time 2 maladaptive motivation; (3) Time 1 test performance to Time 2 effort; (4) Time 1 class participation to Time 2 academic self-concept; and (5) Homework completion to academic self-concept.</td>
</tr>
<tr>
<td>• MIMIC and interaction effects: sharper decline in adaptive motivation across year-levels for males than females; a steady increase in maladaptive motivation for males and females across year-levels, however, between junior and middle high the increase is sharper for males.</td>
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</table>
Significance of the Present Investigation for Educational Research and Conceptualising

Over the past decade, the relations between students’ academic motivation and academic-related outcomes have been extensively explored in the literature. Similarly, students’ self-concept and its relationship to academic outcomes have also been widely investigated. However, there has been little research investigating the combined effects of motivation and self-concept on academic related outcomes beyond achievement. As outlined in Chapter 3, much prior research has examined these constructs in relative isolation - that is, predominantly independent of each other. Surprisingly, given the substantial overlap in historical development and the juxtaposition of these theoretical perspectives, there have been few longitudinal studies of relations between academic self-concept, academic motivation, and academic related outcomes. Indeed, many theorists have highlighted the need for studies to move beyond separate analyses of academic processes and outcomes (Alexander, 2000; Bong, 1996; Murphy & Alexander, 2000; Pintrich, 1994, 2003a) in order to develop more comprehensive models that examine the complex relations between key academic constructs such as cognition, motivation, engagement, and social components of learning (e.g., Pintrich, 1994, 2000b). The inconsistent measurement approaches and poor conceptualisations that typify motivation research have resulted in a somewhat fragmented picture with diffuse findings (Bong, 1996; Murphy & Alexander, 2000).

Until recently, there have been few attempts to propose a comprehensive model. Notable exceptions include recent research that has attempted to model academic motivation (from a goal orientation perspective) and academic self-concept and their combined influence on academic achievement in a longitudinal fashion (see Barker,
However, little work has been done to explore how these two constructs work in combination to promote student processes and outcomes beyond academic achievement.

In the broadest sense, an integrative approach such as this allows researchers to understand the way in which these range of constructs (including a multidimensional perspective of motivation) work in concert to inform students' academic development. Indeed, the overarching purpose of this investigation was to test an integrative and comprehensive model of academic processes in order to advance thinking about how academic constructs might contribute to academic process and academic outcomes. The multiple self-to-action-to-outcomes linkages proposed by this framework are important in that they extend beyond the self-to-outcome linkages, self-to-action linkages, or action-to-outcomes linkages tested in previous research. Thus, the present research has aimed to contribute to the educational research field by moving beyond relatively fragmented approaches typical of the area, to understanding these processes in the context of the multiple processes and factors that are relevant to the high school educational setting. This current investigation succeeded in producing an integrative process model which has demonstrated excellent model fit and relatively consistent parameters using both cross-sectional and longitudinal data. Hence, an overarching theoretical implication of the current research (in line with Pintrich, 2000b, 2003a) is that the processes by which students take to reach academic outcomes comprise a much more diverse and differentiated pathway than has typically been recognised in the literature. An integrative and comprehensive model such as the academic self-system process model proposed here enables researchers to construe how academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes operate jointly and uniquely. That is, it seems that merely having a positive academic
self perception will not automatically result in academic achievement (as has been tested in previous self-concept and motivation research) but rather it is the 'will' or 'drive' and hence the motivational processes and the 'action' required to reach such outcomes which are also important (Covington, 1998, 2002; McCombs & Marzano, 1990; Pintrich & Schunk, 2002). Indeed, this integrative model has the potential to contribute not only to the important research on self-related factors (i.e., academic motivation and self-concept) but also to the burgeoning literature on academic processes (such as engagement) related to learning.

**Significance of 'Self' for Educational Research and Conceptualising**

One yield of the present investigation is its potential for unifying self-concept and motivation research. This study has shown how two very salient and central constructs – motivation and self-concept – that have gathered much research attention over the years do not operate in isolation. Rather, whilst explaining unique variance in key factors in the model they also complement one another in something of a synergistic manner. At a specific level, the cross-sectional and longitudinal findings of this investigation suggest that motivation and self-concept are both important constructs in predicting cognitive action. That is, when these two constructs are included in the one model, they share significant variance (evidenced through their significant correlation) and are both effective in predicting cognitive action (evidenced through their significant beta parameters).

It will be recalled that *post hoc* modifications were made to the academic self-system process model using the Time 1 and Time 2 cross-sectional data, as well as the longitudinal data. Significant *post hoc* parameters showed that motivation and academic self-concept were predictive of additional constructs. Specifically, adaptive motivation
and academic self-concept predicted class participation and maladaptive motivation predicted homework completion and test performance. Post hoc analyses were also performed on the longitudinal model such that Time 1 academic self-concept and Time 1 test performance were found to predict maladaptive motivation at Time 2. These are potentially important findings as it points to the possible causal ordering of self-concept and performance. That is, prior academic self-concept and prior test performance influences future maladaptive motivational orientation. These findings suggest that self-concept and motivation variables warrant inclusion in the reciprocal effects model proposed by Marsh and colleagues (e.g., Marsh, 1990b; Marsh & Yeung, 1997b; see also Chapter 3). This model implies that self-concept and academic achievement are reciprocally related and mutually reinforcing. That is, prior self-concept predicts subsequent achievement (self-enhancement model), and prior achievement predicts subsequent self-concept (skill-enhancement model; Guay, Marsh et al., 2003). The present longitudinal relations between test performance and maladaptive motivation lend support for the skill-enhancement component of the reciprocal effects model. The finding of longitudinal relations between academic self-concept and maladaptive motivation may be an interesting addition to the future investigations of the reciprocal effects model. Taken together, confirmatory and post hoc analyses both underscore the merits for including motivation and self-concept in modelling of academic processes.

Interestingly, post hoc findings also demonstrated links between Time 1 behavioural action (classroom participation and homework completion) and Time 2 academic self-concept. That is, those students who report prior positive behavioural engagement tend to report higher academic self-concept later on. Once again, this may warrant an extension of the reciprocal effects model (as well as the self-enhancement component of the reciprocal effects model). Perhaps prior academic achievement is not
the only factor that predicts subsequent academic self-concept – it appears that processes and actions are of similar importance.

Incorporating academic self-concept and academic motivation in the one framework has also expanded aspects of the self-system process model proposed by Connell and colleagues (Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990). From Connell’s perspective (and researchers who have tested the model), the operationalisation of ‘self’ comprises an individual’s psychological needs of perceived competence, autonomy, and relatedness. According to the self-system model proposed by Connell and colleagues, individuals are motivated to act or engage in activities that meet their psychological needs for autonomy, competence, and relatedness. The current investigation extends this conceptualisation of ‘self’ by incorporating additional self-related constructs (i.e., multidimensional motivation and academic self-concept). Thus, the current research has shown not only support for Connell’s model (i.e., the ordering of constructs) but also shows that the model works well with other ‘self’ constructs.

Significance of ‘Action’ for Educational Research and Conceptualising

An integrative model along these lines also provides insight into the degree to which ‘action’ mediates self (motivation and self-concept) and academic outcomes (test performance and test effort). Mediation models, such as the present academic self-system process model, propose measurable processes that intervene or mediate predictor and outcome variables (Baron & Kenny, 1986; MacKinnon et al., 1995; MacKinnon et al., 2002). Tests of mediating variables are useful because they examine processes by which variables are related and so are critical for establishing the plausibility of causal sequences implied by theory (Frazier et al., 2004; MacKinnon et al., 2002). In this context, action can be conceptualised as an outcome in itself as well
as a predictor of academic outcomes. The cross-sectional and longitudinal data in the present research then confirmed these predictions and in so doing, provided empirical support for the mediating role of action.

Connell's self-system model implies an overarching cognitive-behavioural theme in which appraisals of self (i.e., self-perception) predict action (which then predicts outcomes). The self-action-outcome links posited by Connell's self-system process model have been further adapted and extended in the present investigation to include cognitive and behavioural action. Through harnessing cognitive-behaviour principles, Connell's self-system model has been expanded to encompass a more integrative and dynamic analysis of academic processes. This distinction provides support for the cognitive-behavioural perspective underlying the ordering of constructs as well as support for previous research which has found cognitive-behavioural relations in the education setting (e.g., Attawood & Croll, 2006; Hughes & Halls, 1989; Trautwein, Ludke, Schnyder, & Niggli, 2006; Valiente et al., 2008).

The cognitive-behavioural distinction also has implications for the literature on engagement such that it not only adopts a multifaceted approach to the measurement of engagement (thereby uniting cognitive and behavioural perspectives of engagement) but also specifies the particular ordering of these constructs. The current research shows that academic action factors are dynamically interrelated and are not individual processes - a contention which has been strongly advocated in Fredrick et al.'s (2004) work on engagement. Most engagement research models cognitive, affective, and behavioural engagement separately and not simultaneously (Fredrick et al., 2004; for exceptions see Connell et al., 1994; Connell & Wellborn, 1991; Skinner & Belmont, 1993; Skinner et al., 1990). Understanding the structure and processes of engagement as
well as the influences of engagement (i.e., motivation and self-concept) is a basis for subsequent research as well as for the formation of school interventions and policy (discussed below).

**Significance of 'Academic Outcomes' for Educational Research and Conceptualising**

The final component of the academic self-system process model showed links between behavioural action and academic outcomes (i.e., test performance and test effort). As stated in Chapter 3, previous research (Pierson & Connell, 1992; Skinner et al., 1990) acknowledges both academic performance and academic effort as desirable outcomes in the academic domain. Indeed, the findings of the present investigation further support this contention. As was the case with the ‘self’ constructs, the present research demonstrated the juxtaposition of test performance and test effort by showing that both these factors are predicted by behavioural action, hence, both constructs can be considered important for inclusion in modelling achievement motivation.

As identified at the outset, the measures of behavioural action incorporated in this investigation were by no means intended to encompass the full scope of possible behavioural action factors. Nevertheless, the demonstrated relations between behavioural action and academic outcomes showed that there is merit in considering home (i.e., homework completion), classroom (i.e., class participation), and school based (i.e., absenteeism) dimensions as measures of behavioural action. Each construct demonstrated significant relations with the academic outcomes posed in this study. At a specific level, this research has implications for research on active class participation by showing that when a student is actively involved in the classroom there is a positive relationship with test performance and test effort. Similarly, in the longitudinal *post hoc* analyses there also appeared to be merit in considering the link between Time 1 class
participation and Time 2 academic self-concept. That is, students' academic self-concept is positively influenced by prior active participation in the classroom.

The finding that homework completion is positively linked to test performance and test effort contests those few studies which report a weak or a non-existent relationship between homework and academic achievement (e.g., Trautwein & Koller, 2003; DeJong et al., 2000). According to Cooper et al. (1998), the reason most cited for administering homework is to improve student retention and understanding of material covered during class. It appears that when a student reports regular completion of homework there is a positive relationship with test performance and test effort on a standardised achievement measure - suggesting merit in Cooper et al.'s contentions. Not only this, longitudinal post hoc findings suggested that completion of homework also contributes to academic self-concept at Time 2. Once again, students' academic self-concept is positively influenced by prior active participation in the home (via homework completion).

Finally, this study also found a negative relationship between school absenteeism and academic outcomes. This follows the line of research reporting significant links between poor school attendance and poor academic attainment (e.g., Edward & Malcolm, 2002; Willms, 2003). Research examining behavioural engagement (or action) typically assesses those behavioural factors which are based on the assumption that the student actually attends school regularly (e.g., Skinner & Belmont, 1993). In this present investigation this is certainly the case for class participation and homework completion. Indeed, in Fredrick et al.'s (2004) review on school engagement, they noted that behavioural engagement can be defined in three ways: positive conduct (including school attendance), involvement with learning, and
participation in school-related activities. The link between absenteeism and academic outcomes is perhaps an important reminder that some behavioural factors are more critical than others – that is, getting students to school in the first place is an obvious necessary precursor to any in-school and in-class engagement. This is particularly the case for research which not only links school absenteeism with academic attainment but also that which links school absenteeism with high school drop out and early school leaving (e.g., Balfanz et al., 2007; Barrington & Hendrick, 1989; Reid, 2005).

Post hoc findings also demonstrated links between prior test performance and subsequent test effort at Time 2. This is an interesting finding given that students were not provided with the results of their test performance at Time 1. However, despite this, the finding does show that in order for students to put in effort they need to perform well. By implication, if a student is not competent (in this case not competent on a standardised achievement measure) at Time 1 then the student is less likely to try at Time 2. This is a cycle that would need to be broken and is an important message to educators to not only foster students' competence and skills but also encourage students to try or put in effort during assessment despite previous attempts.

Summary of Significant Implications for Educational Research and Conceptualising

In sum, the integration of these three frameworks (and their corresponding theoretical underpinnings) in the one model has contributed to a more differentiated characterisation of academic processes. The present investigation has captured key factors that are theoretically and empirically important to consider in the academic development process, thus resulting in a more ecologically valid description of academic processes (e.g., see Bronfenbrenner, 1979). The hypothesised academic self-system process model not only supports the ordering of constructs proposed by
Connell’s self-system process model but also provides insight into other applications of the model. The additional applications of this model include the conceptualisation of ‘self’ via multidimensional academic motivation and academic self-concept as well as support for the cognitive-behavioural perspective important to operationalising ‘action’. The cognitive-behavioural distinction of ‘action’ has not been applied to Connell’s model before. It will also be recalled that a third perspective – construct validation – informed the bases of the present study. Indeed, it was this perspective that informed the proposed substantive-methodological synergy inherent in the research. This is now discussed in detail.

Significance of the Present Investigation for a Methodological and Substantive Synergy

The present research not only adopted relevant theoretical perspectives to implement an integrative framework but also utilised a construct validation approach to guide research design and analyses. This was based on the rationale that research should hold substantive and methodological implications (Marsh & Hau, 2007; Marsh et al., 2006; Tracey & Glidden-Tracey, 1999). The construct validation approach was important for influencing this study’s research design, instrument construction, and data analysis (including measurement and modelling of constructs). The significance of the present investigation for methodological and substantive synergistic research will be discussed.

Multimethod Approach to Substantive issues

Multimethod research was originally inspired by Campbell and Fiske’s (1959) article on measurement validation and essentially warns against an over-reliance or overconfidence in any one research method. As detailed in Chapter 4, the term
'multimethod' can represent multiple indicators of constructs, multiple constructs (and a prior relations), multiple instrumentation, multiple outcome measures, multiple occasions, multiple raters, and multiple methodological approaches (Marsh & Hau, 2007; Marsh et al., 2006). These multimethod approaches and their yields in the present investigation are now discussed.

The Need for Multidimensional Measurement of Constructs

As mentioned elsewhere in this thesis (see Chapter 3), the conceptualisation of academic motivation and self-concept in the psychological literature encompasses a diverse array of theoretical viewpoints. Early research has conceived self-concept and motivation to be unidimensional constructs emphasising a single, global measure (Bong, 1996; Hattie, 1992a; Marsh, 2007). The value of a unidimensional perspective has since been criticised by many prominent authors (see Bong, 1996; Hattie, 1992a; Wylie, 1979; Marsh, 2007; Murphy & Alexander, 2000; Shavelson et al., 1976) and now it is commonly acknowledged that latent constructs such as these need to be conceptualised from a multidimensional perspective. Multidimensionality essentially ensures further clarity of construct definition (Tracey & Glidden-Tracey, 1999) and is a first step in ensuring an adequate measurement model component of research. Indeed, when unidimensional and global constructs are pursued at the expense of multidimensional ones, this diminishes significant relationships between factors that are known to be significant (e.g., see debate between Baumeister et al., 2003 and Marsh & Craven, 2006 in relation to global self-esteem and multidimensional self-concept). Accordingly, the present research emphasised the adoption of a multidimensional measure of academic motivation, the use of academic self-concept (a subscale taken from the multidimensional measure of self-concept, SDQ-II Short), the distinction
between cognitive and behavioural action, multidimensional measures of behavioural action (home, class, and school based behavioural action), and two indicators of academic outcome (test performance and test effort).

Although the complete academic self-system process model yielded an excellent fit to each dataset, and all factors contributed uniquely in the hypothesised model, clearly there were some factors that explained relatively more variance than others – demonstrating the yield of a multidimensional approach. For example, in regards to the self-to-action links, the findings of the present investigation suggest that there is merit in using a multidimensional approach to measure academic motivation because the most prominent predictors of cognitive action across the time waves were maladaptive motivation and adaptive motivation dimensions. If one of these dimensions were to be omitted, substantial meaning might be lost. This finding advocates that in future conceptualisations of academic motivation, both adaptive and maladaptive motivational dimensions need to be explored - lending further support to the call for multidimensional approaches to academic motivation.

Another implication of support for the academic self-system process model is that students’ academic process and the factors that underpin it comprise a diverse and differentiated framework. The present study is a good example of how and why researchers might look to incorporate multidimensional measurement into their research designs. Thus, prospective studies may find it beneficial to employ multidimensional instrumentation in order to more fully and appropriately investigate the nature of students’ academic development.
The Need for Multiple Indicators

According to Marsh and colleagues (Marsh et al., 1999; Marsh & Hau, 2007; Marsh, Hau et al., 1998), it is important that constructs are measured by multiple indicators in order to produce strong, psychometrically sound instrumentation. In the present investigation, each latent construct (e.g., academic self-concept) was inferred by multiple items (notwithstanding measures such as ‘days absent from school’ that are inevitably single-item factors). A multidimensional (multi-factor) perspective was adopted for virtually all constructs in the model. Moreover, the model incorporated a multi-component range of predictors, processes, and outcomes. In terms of sampling, the present research sought to extend this ‘more is better’ approach, by assessing multiple year levels (year 7 through to year 12) across a range of schools and across multiple time points. Taken together, the multiple methods utilised in the present investigation ensured a strong foundation for the proposed academic self-system process model, both cross-sectionally and longitudinally.

The Need for Multiple Occasions: Longitudinal Research

Another key methodological guideline concerns the issue of measurement across time. Longitudinal modelling has the potential to provide stronger empirical evidence on how variables influence one another over time (Quintana & Maxwell, 1999). In line with the multimethod approach, Marsh et al. (1999) proposed that ‘ideal’ longitudinal research (updated from Byrne’s 1984 guidelines) should not only infer all latent constructs on the basis of multiple indicators, but also measure the focal constructs at least twice (i.e., a 2-wave study) and at least one year apart. A significant limitation to most research is the predominance of cross-sectional or correlational data (Bong, 1996; Marsh et al., 1999). Although cross-sectional research is a useful and necessary
Step in determining the existence of relationships between hypothesised factors (indeed this was the case in the present investigation), it does not provide a genuine understanding of the mechanisms that predict these relationships over the passage of time—a vital factor in educational research. The cross-sectional data in this study was considered a valuable prelude to confirming or disconfirming the relations hypothesised in the academic self-system process model before moving onto longitudinal analyses. Given this, perhaps one of the strongest aspects of the present investigation and subsequent findings is the availability of two waves of data collected one year apart. This served a number of key methodological purposes that then had implications for substantive conclusions.

First, in order to overcome potentially biased path estimates, the present study incorporated correlated uniquenesses between parallel items across time (see also Marsh & Hau, 1996). The utilisation of identical multiple indicators at each time wave allowed for the correlation of measurement errors of matching items across time—a technique which is not possible when constructs are assessed using a single score (Guay, Marsh et al., 2003). Second, in order to better understand unique variance in the hypothesised academic self-system process model, the longitudinal analyses included test-retest paths between parallel factors across time—thus, remaining parameters within the Time 2 process component of the model can be considered to explain unique variance over and above that explained by Time 1 counterparts. Put simply, the essence of this model is that findings at subsequent time points are viewed in the context of findings from previous time points. Therefore, the influence of any remaining constructs at Time 2 is viewed as conditional on the Time 1 construct (Quintana & Maxwell, 1999). Third, by exploring modification indices across time, additional paths not considered at the outset were considered for inclusion. The joint effect of these
three approaches enabled by longitudinal data resulted in findings and substantive conclusions that control for confounding and limiting factors. Taken together, then, as a result of employing a longitudinal sample this study has demonstrated robust effects in relation to other variables and has addressed one of the most significant limitations characterising the majority of achievement motivation research - the predominance of cross-sectional designs and data.

The Need for Large Samples

In shaping guidelines for quality research, Marsh et al. (1999) also emphasised the need for large samples that are generalisable, provide sufficient statistical power, and allow researchers to most effectively explore complex models. The present investigation utilised a large representative sample both cross-sectionally (Time 1 $N = 3,450$; Time 2 $N = 3,261$) and longitudinally (matched Time 1-2 sample, $N = 1,866$), thus allowing for increased generalisability of the study's findings and the ability to study a variety of phenomena (Robinson et al., 2005; Schumaker & Lomax, 1996).

More complex models involve estimation of more statistical effects and larger samples are necessary in order for the findings of such models to be reasonably stable (Kline, 1998; Schumaker & Lomax, 1996). Larger samples were also needed for the multiple indicators used to define latent variables (degrees of freedom in a measurement model; Schumaker & Lomax, 1996). Models utilising large samples are capable of conducting analyses at the item level and capable of including multiple factors because the ratio of cases to items is adequate (Kline, 1998). A study that utilises a smaller sample size may only be able to model at the scale score level (and so cannot correct for measurement error) or model small components of the model at a time (Byrne, 2001;
Quintana & Maxwell, 1999). In the present study, a large sample allowed the researcher to specify fully encompassing models at the item level.

However, this is not to suggest there were no sample-related issues in this research. One of the most common threats to validity of longitudinal studies is the unscheduled sample attrition with the passage of time (Goldstein, 1979; Robinson et al., 2005). The loss of sample over time can influence the power and ultimately the findings of longitudinal analyses. Hence, researchers are advised to plan for attrition through careful selection, large sampling at Time 1, and tracking of participants (Goldstein, 1979; Robinson et al., 2005; Van Der Kamp & Bijleveld, 1998). The present study planned for attrition by acknowledging the fact that there would be the inclusion of a new year 7 cohort at Time 2 (thus no Time 1 data for them), and the loss of the year 12 cohort who had graduated at Time 1 (thus no Time 2 data for them). In preparation for this attrition, the present investigation ensured that a large sample was obtained from the outset (at Time 1 and Time 2) and participants were tracked by obtaining names of participants for matching purposes (once matched a unique identification number was assigned to each participant and names discarded). Thus, even in the face of the smaller matched Time 1 – Time 2 sample, the sample was large (N = 1,866) by most standards.

In sum, the large representative sample used in this investigation provided a good basis for addressing the generalisability, power, and complex modelling issues flagged above. A large sample size such as the one utilised in the present investigation ensured the accuracy and representativeness of parameter estimates in the academic self-system process model.
The Need for Appropriate Statistical Approaches

The final guiding principle proposed by Marsh et al. (1999) emphasises the need for advanced statistical analyses to most appropriately address the issues inherent in educational research and longitudinal designs. A study that is significant in scope and size makes it possible to take advantage of relatively more sophisticated statistical techniques such as CFA and SEM (as well as sub-analyses such as MIMIC modelling and multi-group invariance testing) that are ideally suited for longitudinal research. Marsh et al. (1999) also recommend that data be fit to a variety of CFAs and SEMs to incorporate measurement error and test for the likely residual co-variation among measured variables (i.e., correlated uniquenesses).

In the first instance, advanced statistical techniques should ideally begin with CFA to determine measurement issues before moving onto more complex SEMs based on a wide variety of theoretical models and possible idiosyncrasies (Byrne, 2001). Techniques such as CFA and SEM allow complex relations to be investigated in the one analytic model and they also circumvent problems associated with directly observed scale scores that do not account for measurement error (Quintana & Maxwell, 1999). Through these latent modelling approaches, the present research was able to gain a more complete understanding of the complex interrelations and underlying processes involved in students' academic development. The study is, then, a good demonstration of the benefits of employing these appropriate latent statistical techniques.

Following from this, although the utility of CFA and SEM approaches are widely recognised and supported (e.g., see Kline, 1998; Raykov & Marcoulides, 2000; Schumaker & Lomax, 1996), a well-known limitation of SEM is that several alternate models can be feasible and may possibly fit the data equally well (or better) (Kaplan,
1989; Martens & Haase, 2006; Raykov & Marcoulides, 2000). The present investigation adopted a confirmatory approach to the assessment of the proposed academic self-system process model and a ‘theory building’ approach through the use of modification indices (Jöreskog & Sörbom, 1984, 1988) and the expected parameter change statistic proposed by Saris et al. (1987). Despite the well-documented limitations of the model modification process (see Bollen, 1990; Hayduk, 1990; Kaplan, 1990b; Stieger, 1990), there is agreement that there can be yields when modification is conducted with caution and based on sound substantive and statistical judgement (Olsson et al., 1999). The present investigation was a good demonstration of the valuable information that can be derived from the re-specification process. Hence, through the joint operation of theory confirming and theory building, this research has sought to extend current understanding of the dynamics relevant to students’ achievement motivation.

**Model Parsimony**

Although unrelated to the multimethod approach, the use of a range of previously validated instruments (i.e., academic motivation, academic self-concept, cognitive action and a standardised achievement measure) is ideal in providing a good measurement basis for this study. In line with Marsh and Hau (2007), even when there is clear support for an *a priori* factor structure it remains important to establish that the factor structure generalises to the sample in the current study – a procedure that was routinely performed at each time wave.

Following from this, there is merit in utilising a model that evinces a higher-order structure as this enables more parsimonious models. As discussed in Chapter 6, a higher-order model seeks to ascertain whether various combinations of first-order
factors adequately represent the higher-order factors. The number of higher-order factor loadings is typically much smaller than the number of correlations among the first-order factors (Marsh & Hocevar, 1985), thus resulting in a more parsimonious model. The utilisation of a higher-order factor structure also allowed for the management of suppression effects found at the first-order level of academic motivation. In the higher-order academic self-system process model, the factors demonstrated sufficient distinctiveness and sufficient relatedness to warrant being conceptualised as part of a cluster in the academic self-system process model (e.g., academic motivation and academic self-concept were part of the ‘self’ cluster).

**Summary of the Implications for Substantive and Methodological Synergy**

The present investigation’s findings demonstrate the numerous yields of adopting a multimehod approach under the construct validation framework. The study showed the benefit of a multidimensional conceptualisation of constructs as well as the use of multiple indicators for each construct. In order to examine the multitude of constructs, a large sample was utilised to improve the power of the findings. Following from this, the present study confirmed the potential of assessing constructs across multiple time waves (i.e., longitudinal research) as well as the use of appropriate statistical analytical procedures such as CFA and SEM. Finally, the yields of specifying a parsimonious model were also evident.

**Implications for the Educational Context**

The current investigation holds not only substantive and methodological implications for researchers but also implications for practitioners and educators operating in the high school context. The ‘real-world’ relevance of this research has been essential from the outset as it was deemed important to be concerned with both
scientific understanding and relevant application. This notion is in line with Pintrich (2000b, 2003a) who advocated the importance of 'use inspired basic research', which reflects a focus on a deeper scientific understanding of motivational constructs and an applied utility to improve motivation in educational settings. Indeed, one of the recognised challenges for researchers and practitioners is to integrate empirical understanding of the complex student motivation processes with the practical realities of student experiences in the academic domain (Diperna, 2006). It is therefore important to conceptualise and package academic motivation and other key-related constructs in a way that enables educators to understand and facilitate students' academic processes and academic development (Galloway, Rogers, Armstrong, & Leo, 1998).

In the current research there has been an attempt to integrate theory, measurement, research evidence, and substantive application. According to Wentzel and Wigfield (2007), motivation intervention efforts need to be developed on clear theoretical foundations and based on reliable and valid measures of latent constructs (see also Wigfield & Wentzel, 2007). According to Ornstein (1991), a test of good theory is whether it can guide and translate into practice, such that the knowledge gained by research is generalisable and potential users can make informed decisions about effective practices. The constructs under focus in the academic self-system process model (in particular academic motivation and academic self-concept) have a theoretical basis enabling researchers to draw on theory to provide direction for intervention.
Intervention Opportunities Under the Proposed Process Model

Educational research has identified many factors that are related to academic outcomes. Before moving onto the discussion of specific intervention suggestions, it is important to note that the academic self-system process model proposed and tested in this current investigation is an attempt to synthesise the educational research literature into a readily applicable format. A major advantage of the academic self-system process model is that it provides a way of empirically examining the simultaneous effects of an array of variables, thereby providing a clearer picture of key influences on student outcomes. Following from this, the model allows practitioners to understand academic processes in a way that a more restrictive model may not adequately capture.

Of additional importance is the view that the academic self-system process model is based on constructs that are malleable and hence open to intervention by teachers, parents, schools, and students themselves. The inclusion of process factors (e.g., cognitive and behavioural action) in the model rather than input factors (e.g., socioeconomic characteristics of the student) allows for greater links between the model and intervention (Caldas, 1993). A vital guiding framework for the present research was Connell’s self-system process model (Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990) which is broadly based on a view that the self-system processes are not unalterable or stable ‘traits’; rather, they reflect dynamic relations between the social context (i.e., high school setting), the students’ experience of self, their action, as well as contextualised outcomes. Indeed, the academic motivation and academic self-concept framework that is the initial focus of the academic self-system process model have previously been shown to be amenable to change (see Martin, 2005a, 2008a; O’Mara, Marsh et al., 2006) and so are feasible candidates for educational intervention.
There is limited evidence, however, about the malleability of academic action (i.e., engagement) as most interventions do not explicitly aim to improve engagement but often implicitly target aspects of the context which indirectly affects engagement (Fredricks et al., 2004). Along this vein, prior research has shown that targeted intervention which focuses on specific behaviours and cognitions is more effective than global intervention (O'Mara, Craven, & Marsh, 2005; O'Mara, Marsh et al., 2006; Weisz, Weiss, Han, Granger, & Morton, 1995) and so a multidimensional approach like the one utilised in the present investigation is likely to evince enhanced intervention and pedagogical outcomes.

The inclusion of numerous constructs in the one model allows for the direct comparison of these measures to determine which are relatively more important for intervention in the high school context – and what particular weighting should be given to each in such intervention work. Naturally, the framework for this discussion of intervention is based around the academic self-system process model itself. Thus, wherever the point of academic concern for students lies, intervention would best be directed at that area of concern and also at the factor that immediately precedes that concerning area. For example, if motivational processes (i.e., academic motivation and academic self-concept) are of concern, then it would be useful to address academic motivation directly. For those wanting to enhance students’ cognitive action a logical focus would be not only cognitive action itself but also students’ motivation and self-concept (the constructs that precede cognitive action in the model). If behavioural action is of concern then both behavioural and cognitive action intervention may be warranted. Finally, if a student is falling behind academically, there may be merit in directly targeting academic skill as well as the behavioural action of the student.

Developing a model such as the academic self-system process model is a first step in
developing more effective interventions. In the discussion to follow, intervention relevant to key components of the academic self-system process model is detailed. These suggestions for intervention are not intended to be prescriptive or exhaustive; rather, they seek to demonstrate how seminal research from which the constructs are derived are able to guide recommendations for intervention.

**Academic Motivation Intervention**

In the context of the present study’s findings, it appears there is value in addressing academic motivation and academic self-concept. The motivational framework (based on the higher-order factors of the Wheel; Martin, 2007), which is the initial focus of the academic self-system process model, has direct relevance and implications for the education setting and has been designed with the intention of applied utility. As reiterated throughout this thesis, recent commentaries (see Bong, 1996; Murphy & Alexander, 2000; Pintrich, 2003a) have identified the fragmented nature of motivation research as a potential impediment to application in the real world. In response to these recent calls for an integrative framework, the current investigation utilised a multidimensional measure of academic motivation that has previously informed suggestions for multidimensional intervention (Martin, 2005a, 2008a). The multidimensional academic motivation instrument is intended to provide practitioners with greater insights into student strengths and weaknesses, thereby allowing for differentiated pedagogy and specific feedback that is more useful to students than global or general feedback (O’Mara, Marsh et al., 2006). Martin (2001, 2002a, 2002b, 2003a, 2003b, 2004, 2007) has articulated suggestions for intervention elsewhere (based around the factors underpinning the academic motivation instrumentation) and
this information is summarised and adapted in light of the hypothesised academic self-system process model and the findings.

**Intervention for Adaptive Motivational Dimensions**

In terms of the adaptive dimensions of motivation, the development of self-efficacy, mastery orientation, valuing of school, planning, task management, and persistence are deemed important. *Self-efficacy* research, as it pertains to the academic domain, posits that as students make academic progress they gain a sense of capability (Bandura, 1997; Schunk, 2001; Schunk & Miller, 2002). In this sense, students’ self-efficacy can therefore be enhanced by providing a learning environment that promotes genuine opportunities for academic success in the classroom (Schunk & Miller, 2002).

According to Martin (2003a, 2008a), a way to enhance a self-efficacy (as well as reduce anxiety) is to assist students with challenging their negative thinking. In line with the principles of cognitive-behavioural therapy (CBT; e.g., Beck, 1976; Meichenbaum, 1977), it would be useful to encourage students to identify their negative thinking or self-talk and their academic capabilities. In the broadest sense, the CBT approach aims to encourage individuals to look for evidence that challenges their negative thinking patterns and to replace those negative thoughts with positive and more realistic thoughts which are based on all the evidence available to the student (Hughes, 1988). It is also possible to enhance students’ self-efficacy by breaking tasks into manageable components (i.e., ‘chunking’) so that each component can be viewed as achievable and an opportunity for success (see also McInerney, 2000). Success on each manageable part of a task can lead to enhanced self-efficacy which ultimately encourages students to attempt more challenging work (Martin, 2003a; Urdan & Schoenfelder, 2006).
As suggested by Martin (2002a, 2002b, 2003a), it would also be useful to encourage students to broaden or redefine the views and meanings they hold about success. This is made possible through encouraging a classroom climate of learning from errors and mistakes. This can be achieved by casting academic success in terms of internal processes such as personal bests, skill development, and personal improvement rather than viewing success in relative terms such as beating others or topping the class (Covington, 1992; McInerney, 2000).

Stemming from this, goal theory also provides broad guidelines or principles for enhancing students’ goal focus as well as the processes involved in attaining mastery such as planning, study management, and persistence (Martin, 2002a, 2002b, 2003a, 2007). Mastery oriented students’ criteria for success is primarily self-referenced (Seifert, 2004) such that an emphasis is placed on learning a skill or increasing understanding rather than to achieve favourable judgements of competence such as grades or to outperform others (Ames, 1992; Butler, 1999; Graham & Golan, 1991; Meece, 1994; Nicholls & Utesch, 1998; Solomon, 1996). Central to a mastery orientation is the belief that effort as much as or more than ability leads to success; hence, enhancing student motivation in these respects involves demonstrating to students how effort and strategy are key means for skill improvement (Craven, Marsh, & Debus, 1991; Martin, 2002a, 2002b, 2003a, 2007; McInerney, 2000). This can be demonstrated and facilitated in the classroom through a variety of ways such as: non-competitive evaluation (such as through portfolios or personal bests) which emphasises the value of learning and improvement rather than social comparison; assigning students a variety of challenging and meaningful work; encouraging student goal setting; and offering students more opportunities for choice in the classroom (Ames, 1992; Martin, 2003a; McInerney, 2000; Urdan & Schoenfelder, 2006; Wigfield, Eccles,
It is also beneficial to focus on developing students' self-regulatory skills such as self-monitoring, problem-solving, and time management in order to improve students' planning, task management, and persistence in the face of challenges (Locke & Latham, 2002; Martin, 2003a; McInerney, 2000; Schunk, 2001; Zimmerman, 2002). If students are explicitly taught a repertoire of strategies, they are well placed to adopt and implement these self-regulatory skills into their academic life (Martin, 2003a).

Students who value school are those who consider school, learning, achievement, and accomplishment relevant and meaningful (Deci, Vallerand, Pelletier, & Ryan, 1991). Indeed, Wolters and Pintrich (1998) found that students who valued a subject were more likely to be interested in the subject and were more likely to report a deep information processing approach. According to Martin (2003a), students' valuing of school is increased when an attempt is made to maximise the relevance and meaning of school to students' lives and the real world. Other researchers have also highlighted the need to present educational material in more meaningful contexts which demonstrate the utility of learning and make it more personally relevant (e.g., Cordova & Lepper, 1996; Mitchell, 1993; Parker & Lepper, 1992).

Students are also more likely to value school when significant others (in this case, educators) attach value to school and serve as positive role models for valuing what they teach (Astill, Feather, & Keeves, 2002; McInerney, 2000). In fact, teacher or student modelling of appropriate and effective strategies is also a practical method for promoting self-efficacy and self-regulatory behaviours because students have access to an example of a successful strategy they can readily emulate (Urdan & Schoenfelder, 2006; Zimmerman, 2002; Zimmerman, Bonner, & Kovach, 1996). Indeed, the need to
cultivate students' appreciation of academic content and learning was recently highlighted by Brophy (2008). He suggested that educators should look to use a combination of cognitive modelling (i.e., verbalisation of thinking that guides the use of content or the discussion of why the teaching material is important) and scaffolding of students' engagement in activities that fosters opportunities for students to recognise the value of the learning content (see also Brophy, 1985). Indeed, the modelling of appropriate problem-solving strategies by significant others can certainly aid in enhancing other aspects of the academic self-system process model, such as reading achievement (e.g., Alexander & Hare, 1989) and mathematic achievement (e.g., Keller & Lloyd, 1989).

**Intervention for Impeding and Maladaptive Motivational Dimensions**

Motivation is a multifaceted construct and so students can be motivated in multiple ways (Linnenbrink & Pintrich, 2002a). Addressing motivation from this perspective moves beyond the simple motivated versus unmotivated student dichotomy by showing that even those students who are typically labelled unmotivated can in fact be highly motivated – but for unhelpful reasons (McInerney, 2000). Under this conceptualisation, impeding/maladaptive motivation dimensions (anxiety, failure avoidance, and uncertain control) and maladaptive motivation dimensions (disengagement and self-handicapping) are key areas for intervention and prevention work.

Broadly speaking, failure avoidance, anxiety, self-handicapping, and disengagement are constructs that have relevance to self-worth motivation theory (Covington, 1992, 1998). According to self-worth motivation theory, an individual's self-worth very much depends on his/her ability to achieve and demonstrate
competence (and avoid the implications of a demonstration of incompetence). In the academic setting, self-worth is often derived from how well one performs at school (Atkinson, 1957; Covington, 1984, 1992; McClelland, 1965). When students’ self-worth is under threat due to their inability to academically perform, a fear of failure can emerge and can lead students to anxiety, failure avoidance, self-handicapping, and/or disengagement (Covington, 1992; Martin, Marsh et al., 2001a, 2001b, 2003). An effective way to reduce a fear of failure involves the promotion of effort and strategy use as a means to subsequent achievement (Covington, 1984, 1992; Covington & Omelich, 1979; Martin & Marsh, 2003). Educators can also encourage students to reconceptualise mistakes as learning opportunities rather than as indicators of self-worth (Covington, 1992) and establish learning agreements or contracts with students in order to develop plans for overcoming potential learning obstacles (Covington, 1984). It seems, then, that non-competitive learning environments that reduce the emphasis on competition and value cooperation would also be considered useful in reducing students’ fear of failure (Covington, 1984; Martin, 2007). The notion of cooperative learning structures will be discussed further in the section pertaining to class participation intervention.

In addition to the above recommended approaches, a range of cognitive-behavioural therapy intervention approaches also appear to be effective in reducing anxiety symptoms of children and adolescents in the school setting (Tomb & Hunter, 2004). These techniques include educating students about relaxation strategies (e.g., progressive muscle relaxation, active imagination, self-talk; see Allen & Klein, 1996 – Ready...Set...RELAX program) as well as cognitive (e.g., identifying and modifying anxious self-talk) and behavioural (e.g., the development and implementation of graded exposure to anxiety provoking situations) coping strategies for dealing with stress,
anxiety, and their effects (see Barrett & Turner, 2001; Dadds, Holland, Laurens, Mullins, Barrett, & Spence, 1999; Dadds, Spence, Holland, Barrett, & Laurens, 1997; Kendall, 1994; Kendall, Chu, Pimentel, & Choudhury, 2000; Shortt, Barrett, & Fox, 2001).

In terms of uncertain control, a key feature of implementing change would entail the promotion of the connection between effort and strategy in order for students to gain a greater sense of control over their ability to obtain or sustain academic success (Martin, 2003a; McInerney, 2000). Other practical ways to build a sense of control include: the provision of choice in classrooms (within sensible parameters; McInerney, 2000), fostering a supportive and autonomous classroom environment (see Reeve, Bolt, & Cai, 1999; Ryan & Patrick, 2001; Wentzel, 1997), as well as administering rewards, which are directly contingent on students’ actions (Martin, 2002b). Teacher contingency and teacher involvement is also highlighted as a way to enhance students’ perceived control (Skinner et al., 1990). According to Skinner et al. (1990), teacher contingency refers to clear communication of teacher expectations. Teacher involvement refers to the extent to which a teacher shows positive interest in students and considers student opinions when making decisions in the classroom (Skinner et al., 1990). Following from this, control is also enhanced through consistent and effective feedback which makes it clear how students can improve on what they already know or have completed (Craven et al., 1991; Hattie & Timperley, 2007; Martin, 2007). From a cognitive therapy perspective, effective feedback also assists students to adopt more realistic thoughts (cognitions) about their control over their academic situation (Hattie & Marsh, 1996). The notion of effective feedback will be discussed further in the self-concept intervention section.
In terms of enhancing the broad motivation of students, research has also demonstrated the role of professional development for teachers in enhancing student motivation (see Cherubini, Zambelli, & Boscolo, 2002; Rowe & Rowe, 1999; Stipek, Givvin, Salmon, & MacGyvers, 1998). Professional development in these studies typically involve educating teachers about the theoretical and methodological aspects of motivation research and strategies. These studies have found that teachers who participate in professional development (or in-servicing) operate in more effective ways in the classroom. This is seen through their increased ability to recognise motivational problems within the classroom, implement new instructional programs which emphasise effort, mastery and student autonomy, as well as collaborative planning of educational interventions (Cherubini et al., 2002; Stipek et al., 1998). Indeed, research by Martin et al. (2007) found that teacher-student relationships were highly salient in the development of student motivation and self-esteem (see also Martin et al., in press). Following from this, Marzano (2003) also recommends students be educated directly about the dynamics of motivation in order to give them greater insights into their own motivation styles and patterns. Helping students to identify their adaptive and maladaptive motivation styles will influence their thinking about some of the learning and self-protection strategies they may use as well as the attributions they may make about academic success (see also Andrews & Debus, 1978; Chapin & Dyck, 1976; Dweck, 1975). The instrument used to measure academic motivation in the academic self-system process model developed in this thesis would be an ideal way to help students identify their adaptive and maladaptive motivational patterns.
Self-concept Intervention

Self-concept also significantly and positively predicted academic cognitive action. Thus, for example, students may have difficulty in school not because they are incapable of performing academically but because they have a negative academic self-perception that is impeding their academic development. According to Valentine and DuBois (2005), educators should aim to not only improve students' achievement but also nurture students' beliefs about themselves as learners. Strategies that enhance performance, but hinder academic self-conceptions, may ultimately undermine achievement (e.g., Marsh & Craven, 2005; Marsh et al., 2002). The results of various self-concept enhancement studies highlight the need for designing interventions that recognise the multidimensionality of self-concept by targeting specific aspects of self-concept. According to O'Mara, Marsh et al. (2006), previous intervention work has either focused directly on self-concept enhancement through activities designed to foster improved self-conceptions (e.g., The Developing Understanding of Self and Other Package; see Morse, Bockoven, & Bettsworth, 1988), while others have indirectly influenced self-concept through skill building (e.g., reading ability peer tutoring programs) or through intervention of related constructs (e.g., self-attributions; Craven et al., 1991; Marsh & Craven, 1997; O'Mara, Marsh et al., 2006).

In a comprehensive meta-analysis of self-concept intervention, O'Mara, Marsh et al. (2006) found that self-concept intervention using performance feedback and praise were the most effective in enhancing self-conceptions (see also O'Mara, Marsh, & Craven, 2005). Performance feedback communicates to students that they are mastering skills and so the underlying assumption in this approach is that it generates feelings of competence and self-concept (Marsh & Craven, 1997). It has been noted that educators
often use praise to convey performance feedback without considering appropriate strategies to maximise its effectiveness (Craven et al., 1991; Hattie, 1992a; Hattie & Timperley, 2007). Ideally, effective feedback should be specific and task related, thereby providing information that is directly related to the task/process of learning. Effective feedback should also aim to fill the gap between what is understood by a student and what needs to be understood by relating new information to what is already known (Hattie & Timperley, 2007).

Interestingly, Kluger and DeNisi's (1996) meta-analysis on the effects of feedback types found that the most powerful feedback was one that provided information on correct responses and improvements from previous attempts rather than incorrect responses. Following from this, according to Craven et al. (1991), the use of performance feedback based on praise will only enhance self-concept if it is internalised by the student — that is, the student adopts a positive academic self-concept. The internalisation of performance feedback is best achieved when a student not only receives and perceives the performance feedback itself (e.g., "you have done that mathematic task well"), but also perceives their efforts as competent (e.g., "I did well on that task"), generalises the feedback (e.g., "I am good at mathematics"), and internalises this feedback as a positive feeling or a self-concept internalisation (e.g., "I feel good about my ability in mathematics"; see Craven et al., 1991; Marsh & Craven, 1997).

As noted by Craven et al. (1991), twelve guidelines for effectively using praise to convey performance feedback have been proposed by Brophy (1981). Those with direct implications for the enhancement of self-concept include: (1) specifying the accomplishment; (2) making praise credible; (3) providing information to students
about their competence; (4) attributing success to effort and ability; and (5) delivering praise contingently and occasionally. By praising intermittently and meeting the criteria of contingency, specificity, and credibility, educators can teach students to attribute outcomes to their own efforts or ability and thus assist them to gain a sense of personal control and self-concept (Craven et al., 1991). In sum, enhancing self-concept through effectively presented praise that is credible may be an important component for educational intervention.

An obvious benefit of this type of intervention is that it is generally easy to implement in classrooms and requires minimal cost for administration and training. Perhaps more importantly, recent research has shown that the intervention administrator type (i.e., teachers or mental health professionals) bears little effect on the influence of performance feedback. Hence, performance feedback intervention requires little training of administrators and can be implemented by natural agents such as teachers (O'Mara, Green et al., 2006). Designing intervention to be administered by teachers in naturalistic setting (i.e., within the classroom) would be deemed a desirable goal as this is the target setting where interventions will have the most direct practical significance to students in their academic lives.

**Cognitive Action and Behavioural Action Intervention**

According to Wentzel and Wigfield's (2007) review of motivational interventions, in order for intervention efforts to succeed, it is crucial that change be implemented at not only the level of motivational processes but also at the level of engaged action (in this case, cognitive and behavioural action). Although most educational interventions have as their main goal the development of academic achievement or performance (Fredricks et al., 2004), it is suggested there is also applied
utility in addressing the processes required to reach academic achievement. Relatively few studies explicitly target engagement, instead implicitly targeting aspects of context and curriculum which can affect engagement (Borman, Hewes, Overmann, & Brown, 2003; Fredricks et al., 2004). For those wanting to promote student engagement or academic action, a logical focus would be on students' motivational processes and academic self-concept. In contrast, a more proximal target for promoting academic outcomes would be to intervene at the level of engaged action. Below are some suggestions on how to address academic engagement — in this study operationalised as cognitive and behavioural action — in educational practice.

**Intervention and Cognitive Action**

From a cognitive-behavioural perspective, many students act as a result of the beliefs or cognitions they hold about themselves, their achievement experiences, and their future experiences (Pearl, 1985). There is, therefore, potential for the importance of cognition as a mediator of change. The conclusion that follows from this is that if students' cognitions are impeding subsequent behaviour then changing these cognitions should result in more desirable academic behaviour (Dobson & Dozois, 2001; Hughes, 1988; Pearl, 1985; Reinecke & Clark, 2004). In order to change behaviour, various cognitions need to be addressed. In the process model this would involve addressing students' appraisals of school and their future academic aspirations and plans.

The extent to which students *positively appraise school* relies in large part on

the extent to which they find learning and school enjoyable and interesting (Huebner et al., 2001; Tsai, Kunter, Ludtke, Trautwein, & Ryan, 2008). Many studies have highlighted the influence of environmental variables on school satisfaction (e.g., Huebner et al., 2001) and interest (e.g., Hidi, 1990). According to interest theory, the
experience of interest can be influenced by both individual characteristics (i.e., individual interest) as well as situational factors (i.e., situational interest; see Hidi, 1990; Renninger, 1992, 2000). Eliciting interest via environmental stimuli is particularly relevant for educators of students who do not possess individual or personal interest (Ainley, Hidi, & Berndoff, 2002; Hidi & Renninger, 2006; Mitchell, 1993) and by implication, teaching methods that create interest (thereby reducing boredom) are likely to evince a more positive appraisal of school (Tsai et al., 2008). The process through which situational interest is initially triggered and maintained is explained via 'catch' (i.e., arousal or attention) and 'hold' (i.e., personal value and meaning) distinctions in instructional styles (Dewey, 1913; Hidi & Baird, 1986). Although a complete overview of research surrounding interest development is beyond the scope of this discussion (see Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008; Hidi & Renninger, 2006; Hidi & Harackiewicz, 2000), on the basis of the available research, some suggestions of pedagogical practices that may enhance and promote interest can be advanced. For example, practices that may stimulate or 'catch' students' attention include the use of hands-on activities (e.g., games or puzzles), novel stimuli (e.g., music), group work, and computer-based lessons (Bergin, 1999; Mitchell, 1993). In order to maintain or 'hold' student interest over time, research suggests that educators need to present educational content in a way that is personally meaningful to students and which promotes students to become active participants in the learning process (Mitchell, 1993). Furthermore, there is considerable support that student interest and school satisfaction is enhanced if teachers create an autonomy-supportive environment through practices such as non-controlling teacher behaviour which considers the interests and needs of students (e.g., Huebner et al., 2001; Reeve et al.,
1999; Suldo, Riley, & Shaffer, 2006). The notion of autonomy-support will be discussed in a later section as it is also relevant to the discussion of school attendance.

The extent to which students perceive the task or classroom learning as instrumental to achieving personally valued future goals also has an influence on students' cognitive appraisal of school. For example, Australian research has shown that when year 11 curriculum is closely tied to that at year 12 and post-school endeavours, students' intentions to stay on at school are enhanced (i.e., school retention; Ainley, Batten, & Miller, 1984). Additional research has sought to understand the factors beyond the actual school curriculum that shape students' decisions to pursue future academic endeavours. As mentioned in Chapter 3, positive academic planning in large part stems from the notion of a positive future self. Thus, interventions aimed at increasing the concreteness of the future self in the first instance may be beneficial (e.g., Cohen, Garcia, Apfel, & Master, 2006; Oyserman et al., 2006). Research shows that there is utility in teaching and encouraging students to define explicit and detailed descriptions of academic future selves (e.g., via writing about central values or selecting pictures of their adult images), identifying specific strategies (e.g., action plans) for reaching future goals (e.g., thinking ahead about the process of schoolwork completion and what has been learnt), maintaining persistence in strategy use through the use of meta-cognitive routines, providing students with clear feedback about their progress, and assisting students to see the positive connection between current behaviour and the attainment of future selves or goals (e.g., drawing posters connecting current strategies with proximal and distal selves; see Cohen et al., 2006; Day, Borkowsy, Punzo, & Howsepiam, 1994; Oyserman et al., 2006; Oyserman et al., 2004; Oyserman et al., 2002).
Goal setting research is also relevant to students' academic aspirations. According to Locke and Latham (2002), goals are conceptualised as the actual 'aim' of an action. Of relevance to educators, two major aspects are highlighted in this section to increase the likelihood of students reaching their goals - goal commitment and goal feedback. Research shows that high commitment to goals is best achieved when goals are explicit, challenging, conceived as attainable, deemed to be important, and self-created (i.e., when students are active participants in the development of their goals; see Locke, 1996; Locke & Latham, 2002). In addition to goal commitment, goal setting is most effective when there is feedback relevant to students' progress toward the goal (Locke, 1996). Indeed, studies have shown that high school students who met with their teacher to discuss their academic goals and their progress towards meeting their goals had higher academic achievement than those students in control conditions (Gaa, 1973, 1979). Teacher feedback is also effective in conveying student progress that can lead to enhanced competency beliefs (Schunk & Zimmerman, 2006). Effective goal feedback includes informing students where they are at in relation to their goals and guidance about progress from that point on (Locke & Latham, 2002; Martin, 2003a, 2006).

**Intervention and Behavioural Action**

Relative to cognitive action, behavioural action can be more readily translated into target behaviours for intervention planning. The three forms of behavioural action in the present study were class participation, homework completion, and absenteeism. Although there can be potentially numerous ways to enhance students' class participation, a research tradition that speaks directly to this issue of participation and involvement is that put forward under cooperative and collaborative learning. A large body of research suggests that students become more involved (and also more interested
— see Hidi & Harackiewicz, 2000) in educational activities and achieve more when they work in cooperative learning environments (e.g., Johnson & Johnson, 2008; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Qin, Johnson, & Johnson, 1995; Roseth, Johnson, & Johnson, 2008; Slavin, 1983, 1990). In broad terms, cooperative learning is an approach in which small teams work collaboratively to achieve shared goals that benefit the group. Therefore, each member of the group might be responsible for not only learning what is taught but also for helping other team members to be involved and learn— and by implication, enhancing the likelihood of classroom participation (Johnson, Johnson, & Holubec, 1998; Johnson et al., 1981; Krause, Bochner, & Duchesne, 2003; Nystrand & Gamoran, 1991; Qin et al., 1995). Through cooperative learning, a student plays an essential role in their own and the group’s learning (Nystrand & Gamoran, 1991). Facilitating a learning environment, which fosters cooperation rather than competition, can allow less confident students to participate in class discussion as there is less fear of making mistakes (Krause, Bochner, & Duchesne, 2003). Students are also more likely to be engaged in classroom activities when the treatment of subject matter allows for extensive interaction between students and teacher— particularly when both student and teacher actively respond to each other’s contributions (Nystrand & Gamoran, 1991).

Importantly, classroom participation is not the only time students are active and engaged in learning. Out-of-school learning is also relevant to homework and homework completion. However, encouraging and promoting homework completion has long been a challenge for teachers and parents (Cooper, 2001b; Lieberman, 1983; Martin, 2005b). Unfortunately, the current research findings (Cooper et al., 1998; see also Cooper, 2001a) show that a failure to complete homework is likely to have an adverse effect on academic outcomes. Although homework completion is


predominately a home-based activity, the teacher has an important influence through
design of homework and monitoring its completion (Martin, 2005b). Research into
quality homework suggests teachers would do well to assign subject-relevant
homework that is clearly articulated (i.e., clear instructions on what is expected of
students), achievable (i.e., students are able to complete it), challenges a range of ability
levels, is interesting and stimulating to students, has real-world applicability (i.e.,
students use skills and strategies they learn in school and in their everyday lives), and
provide positive consequences for homework completion (to reinforce the desired
behaviour; Bryan, Burstein, & Bryan, 2001; Martin, 2005b, Rathvon, 1999). Instilling
specific strategies for students to monitor homework completion such as homework
planners, school-home notes (designed to provide feedback to parents and facilitate
parent-teacher communication), and the development of self-monitoring techniques are
also recognised as useful (Bryan & Sullivan-Burstein, 1998; Rathvon, 1999; Trammel,
Schloss, & Alper, 1995).

Class participation and homework completion can be considered classroom and
home behavioural action that are important for students’ academic development. There
is also a school-based engagement that is important for students to work to their
potential. Arguably one of the most critical elements of school engagement is students’
attendance at school. In the literature, it is recognised that absenteeism from school is a
complex and multifaceted problem which can be influenced by a combination of: (a)
personal characteristics of the absentee (e.g., social phobia, low perceived utility of
school); (b) family and parental factors (e.g., parental attitudes, domestic problems); (c)
peer factors (e.g., peer pressure or school bullying); (c) classroom factors (e.g., poor
teacher-student relations); and (d) school factors (e.g., poor absenteeism policy;
Corville-Smith et al., 1998; Reid 1999, 2000, 2005; Teasley, 2004). Research on
effective truancy interventions has concluded that schools need to change the structure of schools, improve the quality of curriculum, and improve the interpersonal relationships between teachers and students through three key strategies: “(1) taking a comprehensive approach to attendance with activities that involve students, families, and the community; (2) using more positive involvement activities rather than negative or punishing activities; and (3) sustaining focus on improving attendance over time” (Epstein & Sheldon, 2002, p. 316). Along these lines, Finn (1989) proposed the participation-identification model which argues that the initial antecedent to school withdrawal is a lack of participation (e.g., attendance of school) in school activities which leads to alienation or a lack of identification with school. He emphasised the need for school intervention to reduce alienation by increasing and maintaining students’ participation levels (see also Worrell & Hale, 2001). This contention is echoed by Christenson and colleagues (Christenson, Sinclair, Lehr, & Godber, 2001; Christenson & Thurlow, 2004), who assert that successful interventions should do more than increase student attendance, they should also help students feel connected to learning and the school community. Thus, students’ sense of belonging to school and feeling valued by the school could be a potential protective factor for students at-risk of high school drop out. Finn (1989) suggests that this can be achieved through encouragement of participation in social school activities, extracurricular activities (e.g., athletics), as well as through the implementation of policies that do not exclude students.

A large body of research has also focused on how high school students’ experience of school, impacts their orientation to schoolwork, teachers, and education more broadly (Reid, 2005). One of the most consistent perceptions reported by students who truant (and hence are considered ‘at risk’ of school drop out) is that teachers do not
care about them (Kagan, 1990; Reid, 1999, 2005). A range of studies have shown that poor teacher-student relationships (e.g., Attwood & Croll, 2006; O'Keefe, 1994) and perceived unsupportive classroom environments (e.g., Klem & Connell, 2004; Hughes, Luo, Kwok, & Loyd, 2008; Reeve, Jang, Carrell, Jeon, & Barch, 2004) influence student engagement in the classroom. In particular, teacher-student relations have been implicated in influencing student attendance (e.g., Bealing, 1990; Harte, 1994; Nielsen & Gerber, 1979; Sommer, 1985). It has been demonstrated that when perceived support from parents, peers, and teachers is considered jointly, perceived support from teachers has the most direct link to students' liking of school (Wentzel, 1996b). Indeed, it makes intuitive sense that when students feel supported, cared, and respected by their teachers, they are more likely to comply with the rules and expectations and engage in those behaviours endorsed by such authority figures (Brophy, 1983; Furrer & Skinner, 2003; Juvonen, 2007; Skinner & Belmont, 1993; Wentzel, 1998). In this sense, a positive teacher-student relationship and perceived supportive classroom environment would be key factors that can influence engagement and consequent attendance.

In fact, Connell's self-system process model and research utilising this model have repeatedly shown that autonomy-support from teachers positively impacts student engagement (e.g., Connell, 1990; Connell & Wellborn, 1991; Skinner et al., 1990; Klem & Connell, 2004; Skinner & Belmont, 1993) and is a protective factor for students at risk of drop out (e.g., Vallerand et al., 1997). Although teacher support has been defined in different ways by various researchers (Ryan & Patrick, 2001), the research generally suggests that a supportive teacher and a supportive environment is one that involves characteristics such as caring, warmth/friendliness, respect, and understanding. Teachers who facilitate rather than control the classroom and teachers who nurture students' needs, interests, and preferences by allowing students latitude in
their learning experiences are also indicative of a supportive classroom environment (see Hayes, Mills, Christie, & Lingard, 2006; Klem & Connell, 2004; Reeve et al., 1999; Reeve et al., 2004; Ryan & Patrick, 2001; Skinner & Belmont, 1993; Vallerand et al., 1997; Wentzel, 1997). As summarised by Tsai et al. (2008), specific autonomy-supportive instructional behaviours include: listening to students, responding to student questions, acknowledging student perspectives, allowing students to work independently, using praise as informational feedback, and offering encouragement.

**Intervention and Academic Outcomes**

There is a good deal of research that has attempted to identify major sources of variation in students’ achievement. Although an extensive review is beyond the present parameters, a vast majority of the research has shown that a significant portion of the variance in student achievement is found at both the student-level and the class-level (see Rowe, 2003 for a major review teacher/class-level effects). As mentioned in Chapter 4, Hattie’s (2003) major review of influences on achievement found that student-level attributes accounted for approximately 50% of the variance in achievement (hence, justification for assessing student-level variables in the academic self-system process model), whilst teacher-level variables accounted for 30% of the variance. This conclusion is further exemplified by findings from the Victorian Certificate of Education (VCE) Data Project (see Rowe, 2000; Rowe, Turner, & Lane, 1999, 2002) which found that after adjusting for students’ abilities, gender, and school type, classroom/teacher effects consistently accounted for an average of 59% of the residual variance (i.e., variance remaining after student-level characteristics) in students’ achievement, compared to 5.5% at the school-level. In addition, qualitative work has reported similar contentions regarding the influence of teacher- and class level
factors (Martino & Meyenn, 2002). This conclusion does not mean that school-level effects are not important. Naturally, classrooms and teachers are influenced and are a function of school-level factors. However, according to the available research, school-level factors are largely accounted for by internal, within-school variation at the student, teacher, and class level (Hattie, 2003; Rowe, 2003). This finding underscores the centrality of quality pedagogy and the importance of understanding the critical factors that contribute to quality pedagogy. Hence, in identifying major sources of variation in students' achievement, the research demonstrates that the critical point for intervention or action resides in the classroom with teachers.

There have been numerous attempts to identify what makes an effective teacher in the classroom. Some authors refer to dimensions of 'productive pedagogies' (see Hayes et al., 2006), some demarcate effective teaching into specific instructional strategies such as providing feedback (e.g., Cremers, 1994; Hattie, 1992b; Marzano, 1998; Marzano, Gaddy, & Dean, 2000; Marzano, Pickering, & Pollock, 2001), and others identify key differences between expert and non-expert teachers (Hattie, 2003). These varied approaches to the investigation of effective pedagogy attempt to provide perspective on the crucial elements that reflect an effective teacher. Importantly, however, although there have been many taxonomies of teacher effectiveness, what is commonly agreed is that effective teachers possess not only content and curriculum knowledge, but also pedagogical knowledge. Hence, they are able to communicate high quality substantive material in high quality ways (see Hattie, 2003; Hoy, 2000; Marzano, 2003).

Recent Australian research emanating from the Queensland School Reform Longitudinal Study has resulted in the 'productive pedagogy' framework (Hayes et al.,
2006). Through extensive mapping of teacher practices (via structured classroom observational data), productive pedagogies are proposed to encompass four major dimensions – intellectual quality, connectedness, valuing differences, and supportive classroom environment. The first dimension suggests that all students (including students from marginalised backgrounds) need to be provided with work of high intellectual quality. The next dimension suggests that the curriculum needs to be made relevant to students’ lives and the real world – that is, there needs to be a connection between what is being taught in classrooms and the world beyond it. The third dimension demonstrates that a supportive classroom in which students are encouraged to not fear failure but to take risks with their learning is also considered a productive pedagogy. According to Hayes et al. (2006), working with and valuing differences is the most important dimension of productive pedagogy. Some practices that reflect this final dimension include practices that provide students with knowledge about non-dominant ways of being, ensuring students from all backgrounds have the opportunity to engage in the classroom in positive ways, as well as employing a range of teaching styles.

Research conducted by Hattie (2003) investigated the differences between expert and non-expert teachers. He found that expert teachers can: identify essential representations of the content (e.g., they can combine new subject matter with prior knowledge), guide learning through classroom interactions (e.g., they are effective in creating optimal classroom environments where student questioning is high), monitor learning and provide feedback (e.g., they can detect and prevent student problems), attend to affective attributes (e.g., they are passionate about teaching and learning), and influence students’ outcomes (e.g., they are able to engage students in the learning process and enhance surface and deep learning processes).
What is evident from the above summaries is that effective teachers use more effective instructional strategies. Marzano and colleagues (1998; Marzano et al., 2000; Marzano et al., 2001) and other researchers (see Cremers, 1994; Hattie, 1992b) have attempted to research and develop taxonomies of key instructional behaviours that influence student achievement. As researched, identified, and summarised by Marzano (2003), nine categories of instructional strategies that influence student achievement are posited as ways in which to provide a comprehensive taxonomy of effective instructional strategies. These nine categories of instructional strategies include:

1) Identifying similarities and differences (e.g., assigning both in-class and homework tasks that involve comparison, classification, metaphors, and analogies);

2) Summarising and note-taking (e.g., asking students to take notes, revise their notes, and generate verbal and written summaries);

3) Reinforcing effort and providing recognition of progress (e.g., recognising and celebrating progress toward learning goals);

4) Assigning homework and specific feedback (e.g., assigning homework for the purpose of practicing skills and procedures);

5) Non-linguistic representations (e.g., asking students to construct graphic organisers such as pictographs, pictures, and physical models to represent content);

6) Cooperative learning (e.g., organising students into cooperative groups and ability groups when appropriate);
7) Setting objectives and providing feedback (e.g., asking students to set their own learning goals and monitor their own progress); 

8) Generating and testing hypotheses (e.g., engaging students in projects and problem solving tasks that allow for the generation and testing of hypotheses); and 

9) Questions, cues, and advance organisers (e.g., Prior to presenting new content, providing students with direct links with what they have previously studied).

**Summary of Educational Implications Under the Proposed Model**

The academic self-system process model proposed and tested in this research acts as a catalyst to guide educational intervention. Given that the process model posits links between a wide range of factors, the findings of the present investigation support the use of interventions that attempt to enhance academic outcomes through mutually supportive mechanisms encompassing pedagogy, the home, school, and curriculum. All things being equal, intervention aimed at developing academic motivation and academic self-concept might be a useful place to start. Intervention might also be aimed at enhancing and encouraging positive cognitive action (e.g., positive school appraisal and positive academic plans) and behavioural action (e.g., homework completion, class participation, and absenteeism). It may be, however, that there are issues more directly related to achievement and effort and this brings into consideration various instructional techniques that have been shown to enhance academic achievement. Pedagogical practice that promotes academic achievement in concert with the promotion of academic motivation, academic self-concept, cognitive action, and behavioural action lay a very solid foundation for academic development.
Limitations and Directions for Future Research

The present investigation provides an expansive model of the academic processes underlying academic relevant outcomes. Despite the numerous strengths and proposed yields of the current investigation, there are a number of potential limitations that need to be considered when interpreting findings and these form a basis for future research. These limitations stem largely from potential extensions of the multimethod approach and encompass the following: attention to self-report data, inclusion of additional measures, consideration of the educational context, implementation of a developmental perspective, and the inclusion of emotion in subsequent educational research.

Self-report Data

The data presented in this study are predominantly of a self-report nature (though standardised spelling and mathematic achievement data were collected as well). A potential problem with self-report measures is the assumption that individuals have a direct awareness of the motivational constructs (e.g., maladaptive motivation) under investigation (Murphy & Alexander, 2000; Pintrich, 2000a). Whilst some research has found evidence to suggest that individuals are in fact prepared to admit to the maladaptive dimensions in their lives (e.g., Arkin & Oleson, 1998; Brener, Billy, & Grady, 2003; Martin, Marsh, Williamson et al., 2003), some students may not be inclined to admit to factors such as, for example, absenteeism. In fact, student perception data have been criticised because of a possible discrepancy between what students self-report and what they actually do (Cook & Campbell, 1979). It has been proposed that cognitive factors such as poor comprehension, misinterpretation of item meaning, and faulty recall have the potential to compromise validity and yield
inaccurate data (Karabenick et al., 2007). Thus, it is acknowledged that the accessibility by measurement of the motivational constructs used in self-report measures is a topic that has come under close scrutiny in recent years (see Bong, 1996; Karabenick, et al., 2007; Murphy & Alexander, 2000). Hence, the present results must be interpreted with the possibility of defensive self-reports in mind.

Although the limitations related to self-report data are important to consider when interpreting findings, there are some important advantages and yields of self-report data. A review of literature reveals that self-report items can provide accurate data when proper data collection procedures and proper instrument construction is followed (see Brener et al., 2003; Crockett, Schulenberg, & Petersen, 1987; Freier, Bell, & Ellickson, 1991; Hanna, Bligh, & Lenke, 1970). For example, some researchers have found that student perception data can explain more variance then observational data (e.g., Fraser & Walberg, 1981; Rosenshine, 1971). Moreover, the inclusion of self-report data in the present investigation of academic motivation and academic self-concept is defensible and logical because these constructs are by nature subjective, intra-psychic, and mentalistic (Crockett et al., 1987; Karabenick et al., 2007). Further, as noted above, the present study included a standardised achievement test measuring spelling and mathematic performance and effort and so it was not entirely comprised of self-report data. Most importantly, the self-report data predicted test performance and test effort in hypothesised ways – lending further support to the validity of utilising the self-report measures.

**Inclusion of Additional Measures**

Notwithstanding the self-report and performance data collected in the present investigation, there may be benefits to extending the multimethod approach even
further. Thus, for example, the findings of this research might be further illuminated through the use of additional measures. These might include subject-specific standardised achievement measures, grades, teacher reports, parent reports, and structured observations to name a few (e.g., Dowson & McInerney, 2003; Johnson & Christensen, 2004; Powell, Mihalas, Onwuegbuzie, Suldo, & Daley, 2008). In relation to the present study, it may also be beneficial to administer a standardised achievement measure which has been normed on Australian samples. Indeed the cross-cultural validity of the WRAT-3 for use in countries outside U.S.A has been questioned (Parker, 2002).

In conjunction to the above mentioned measures, there may also be scope for detailed qualitative work. Although Martin, Marsh, Williamson et al. (2003) conducted qualitative work focusing on some of this study’s constructs, future research might encompass qualitative work that can more effectively scope the detailed nature and extent of the processes under focus in the present investigation. As indicated above, this investigation might also be expanded by examining the same constructs using an extended range of respondents or informants. For example, data derived from additional sources such as teachers and parents could be helpful in addressing the substantive issues under focus in this investigation. It has been previously recognised that there is an over-reliance on single-method studies (e.g., studies based solely on self-report) and that different modes of inquiry are necessary to extend the research base in academic processes (Bong, 1996; Pintrich, 2000b; Powell et al., 2008).

Consideration of the Educational Context

Given that the present investigation is based on the assumption that the individual operates within a social context, there might also be merit in exploring the
specific aspects of the educational context in which students are located and how they facilitate or constrain academic development and outcomes (Lerner & Galambos, 1995; Pintrich, 2000b; Turner & Patrick, 2008). For example, as recognised by prominent authors (e.g., Bong, 1996; Murphy & Alexander, 2000), one limitation of much achievement motivation research is that it is conducted from a domain general perspective, typically ignoring its possible domain-specific nature. Recently, a body of literature has shown support for the utility of studying the domain specificity of various motivational constructs (Bong, 2001; Duda & Nicholls, 1992; Green et al., 2007; Marsh, Walker, & Debus, 1991; Wigfield et al., 1991).

There is also an opportunity to explore these constructs not only at the individual student-level but also at classroom, and school levels (see Wigfield et al., 1998). Although strong support exists for assessing student-level attributes, there may also be merit in assessing classroom- and teacher-level factors (Clements, Bolt, Hoyt, & Kratochwill, 2007; Koth et al., 2008). For example, in terms of academic achievement, existing research indicates that a large proportion of the variance resides at the student and class levels (e.g., Hattie, 2003). The point to be made here is that if significant variance at upper levels exists, then it is important to understand the extent to which the key factors in the academic self-system process model vary as a function of student, class, teacher, and school.

A relevant body of work is the sociocultural framework, which recognises that the individual cannot be studied in isolation from the social context in which they are situated (Hickey, 2003). In fact, of particular relevance to the hypothesised academic self-system process model, recent efforts to consider the influence of contextual variables have been made in the field of motivation and learning research (e.g., Hickey
Sociocultural perspectives on motivation have prompted motivation research which considers the classroom/learning context, teaching context, and social support structure (Perry, Turner, & Meyer, 2006). For example, Turner and Patrick (2008) recently emphasised the need for motivation research to take a situated view – one that considers the dynamics of the individual in various contexts (see also Turner & Meyer, 2000). They presented a situated framework that is based on Rogoff’s (1997) work. This situated framework suggests that research must deal with the personal, interpersonal, and community planes in which individuals participate. Although multi-level research has been conducted using the academic motivation instrumentation (see Marsh, Martin, & Cheng, 2008; Martin & Marsh, 2005b) and cross-cultural research has been conducted on the academic self-concept measure (see for example Hau, Kong, & Marsh, 2003; Kong, Hau, & Marsh, 2003; Marsh & Hau, 2003, 2004; Marsh et al., 2002; Marsh, Hau, Artelt, & Baumert, 2006), future research needs to extend this research across a broader number of constructs and processes such as those assessed in the present investigation. Future research that adopts a sociocultural perspective would indeed enhance the understanding and generalisability of the processes underpinning the hypothesised academic self-system process model.

Today, advances in statistical software enable researchers to more accurately assess the relative influence of individual-, class-, and school-level factors using multi-level modelling (Hill & Rowe, 1996; Marsh & Rowe, 1996). The importance of this multi-level approach stems from the fact that the characteristics associated with individual students are also embedded in those characteristics associated with the groups to which they belong (e.g., classrooms and schools; Marsh & Rowe, 1996). For
example, students are taught within classes, which are nested within schools, which are nested within communities. Hence, students in the same class are likely to be more similar to each other than they are to students from different classes. When data are aggregated to a single level of analysis, results are confounded by the multiple levels at which they occur (see Darmawan & Keeves, 2006; Goldstein, 2003; Hill & Rowe, 1996; Raudenbush, Rowan, & Kang, 1991) leading to important ramifications for the substantive interpretation of findings (Clements et al., 2007; Rowe & Hill, 1998).

As identified by Marsh et al. (2008), multi-level data analysis holds educational implications not only for more appropriately targeted and directed intervention but also for system-level and school policy seeking to develop tailored and nuanced approaches to students’ academic development (see also Koth et al., 2008). Although multi-level analyses of motivation and self-concept conducted to date suggest the bulk of variance resides at the student level (Marsh et al., 2008; Martin & Marsh, 2005b), it is important to assess this issue in the context of all constructs in the present study. Indeed, there are some variables that might evince more significant upper level variance, which might benefit from whole-class and whole-school approaches – for example, class participation might be a factor important to model at the class-level, absenteeism might be a factor important to model at the school level, and student motivation might evince more variance at the student level.

**Developmental Perspective**

The focus on adolescents in high school (as is the case in the present investigation) is warranted given that students’ academic motivation tends to decline during this developmental period (Fredricks & Eccles, 2002; Harter, 1981; Martin, in press a; Otis et al., 2005), however future research might also consider developmental
differences as they assess models of academic processes (see Jimerson, Egeland, & Teo, 1999; Lerner & Galambos, 1998; Turner & Patrick, 2008 for support of a developmental approach). For example, what remains uncertain is the extent to which the effects and ordering of constructs demonstrated here also apply to primary (elementary) school children. It may be that the academic self-system process model takes a different form in the younger years. For example, research indicates that time spent on homework in the early school years is not related to higher achievement whereas in middle and high school years time spent on homework is related to higher achievement (Cooper, 2001a). In fact, relatively few studies utilise younger age groups (often due to operational and logistic challenges such as those in self-report procedures, literacy, and the like; Murphy & Alexander, 2000) and so future research assessing the proposed model amongst younger students would be a useful addition to the present findings. It is acknowledged that research with younger students will no doubt require some refinement of the instrumentation as well as where possible, one-on-one and read-aloud administration.

At the other end of the continuum, the study did not include post-school samples and measures. It would be beneficial for future research to investigate how the central factors that develop during school life serve to influence development later on. For example, it may be interesting to investigate the extent to which patterns of academic motivation, cognitive action, and behavioural action are entrenched after adolescence. It would also be interesting to identify what factors in the final year of high school predict further education or career trajectories after leaving school. Indeed, Alexander (2000) proposed that research into academic development needs to assess models that account for academic growth during childhood, adolescence, and adulthood. Although Martin (in press
a) has conducted preliminary research along these lines amongst primary school, high school, and university students using the Motivation and Engagement Scale (finding invariance in factor structure but also mean-level differences across the three stages), research needs to assess a wider range of constructs and the processes hypothesised in the present investigation.

Taken together, an extended developmental perspective would provide further insight into how the different processes proposed in the model follow different life-span trajectories. Applying effective age-appropriate educational interventions depends on a fuller understanding of how these constructs and the processes they underpin operate at distinct developmental levels. This would more effectively generate interventions that are uniquely suited to an individual’s developmental phase and context.

**Emotion and Educational Research**

Another direction for future research is the inclusion of emotion in education. The lack of inquiry on emotions in education (with the partial exception of anxiety) has been noted by an array of researchers (e.g., Ainley, 2006; Maehr, 2001; Pekrun et al., 2002; Schutz & Lanehurt, 2002). Encouragingly, however, in the last decade discussions of motivation and engagement have broadened to include affective components – with academic emotion being highlighted as significant to our understanding of student learning (Ainley, 2006, 2007; Ainley, Hidi, & Berndoff, 2002; Fredricks et al., 2004; Linnenbrink & Pintrich, 2002b; Schutz & Pekrun, 2007). Academic engagement is one area in which emotion as a critical variable is steadily receiving increasing attention. At this stage there is only modest conceptual clarity about the construct (Appleton et al., 2008; Fredricks et al., 2004), further underscoring...
the need to consider emotion in future educational research. Conceptualisations of emotional engagement have ranged from identification or belongingness with school (e.g., Finn, 1989), to emotional tone in the classroom (e.g., Skinner et al., 1990), to interest and value in an activity or class (Fredrickson, 2000). Of relevance to the present investigation, research into interest has been identified as a promising positive emotion requiring further investigation (Ainley, 2006; Ainley, Hidi, & Berndorff, 2002; Fredrickson, 2000, 2001). This is a noteworthy construct which one might consider to be aligned with the positive school appraisal construct used in the present investigation.

Empirical evidence on the relationship between emotion and the constructs in the academic self-system process model is complex; hence, placing emotion in the academic self-system process model may not be straightforward. Some research shows that emotion and cognition are connected. For example, subjective valuing and perceived controllability of an activity are proposed to relate to emotions such as joy, pride, boredom, and shame, to name a few (Pekrun, Frenzel, Goetz, & Perry, 2007). Similarly, some research has shown that motivation is related to emotion such that mastery-approach goal orientations have been found to be positively related to pleasant emotion and negatively related to unpleasant emotion (Linnenbrink, 2005, 2007; Linnenbrinck & Pintrich, 2002b). Moreover, engagement research shows that when students are in an unpleasant mood there is likely to be minimal behavioural engagement in academic activities (Linnenbrink, 2007; Linnenbrink, Kelley, & Kempler, 2005; Linnenbrinck & Pintrich, 2003). In terms of the links between cognition and emotion, there has been a history of work examining the ordering of cognition and emotion (Smith & Kirby, 2000; Zajonc, 2000). For example, school satisfaction research suggests that a positive attitude towards school is in fact a cognitive-affective evaluation of one’s overall satisfaction with school experiences (Huebner, 1994) and
cognitive-motivational models propose that the influence of emotions on learning are mediated by cognitive and motivational mechanisms – that is, cognitive appraisals may lead to or elicit differences in emotions (Pekrun, 1992). Given these findings and the overlap in construct conceptualisation, it is important to include emotion constructs in further testing of the academic self-system process model with a view to aiding the development of more nuanced and potentially more accurate models of students’ academic processes (Linnenbrink & Pintrich, 2002a).

**Chapter Summary**

This chapter has summarised key findings from the three empirical components comprising this investigation: (1) cross-sectional and longitudinal construct validation of instrumentation, (2) cross-sectional examination of the hypothesised academic self-system process model, and (3) longitudinal modelling of the hypothesised academic self-system process model. Findings showed that construct validity has been achieved and the hypothesised academic self-system process model has been supported both cross-sectionally and longitudinally. The numerous yields of this research for subsequent theory, research, and methodology have been discussed. Suggestions for educational practice have also been detailed along with potential refinements to the investigation that can enhance future research.
CHAPTER 12

SUMMARY AND CONCLUSIONS

The present investigation sought to assess a multidimensional and integrative model of the academic processes relevant to academic outcomes. As discussed, a relatively limited body of research has previously examined the hypothesised range of constructs in the one analytical model. Harnessing a large-scale cross-sectional and longitudinal design, the present study aimed to redress this by testing the roles of academic motivation, academic self-concept, cognitive action, and behavioural action in the academic process. Employing a synergistic blend of substantive and methodological considerations, the hypothesised academic self-system process model was confirmed cross-sectionally and longitudinally. An overarching conclusion from the key findings is that the processes and factors involved in attaining academic outcomes reflect a diverse and differentiated framework that has not readily been empirically recognised in literature.

Informing this overarching conclusion is a set of more specific yields emanating from this program of research including: (a) providing support for an integrative model of academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes relations; (b) extending previous research and theory by demonstrating the unique and combined effects of academic motivation and academic self-concept in academic development; (c) extending previous research by specifying a more encompassing process model in which a wide range of constructs are considered together in the one analytical model; (d) underscoring the potential yields of substantive-methodological synergistic psycho-educational research; (e) highlighting numerous implications for educational and psychological conceptualisation,
measurement, and assessment; and (f) suggesting further perspectives for practitioners on promoting academic motivation, academic self-concept, cognitive action, behavioural action, and academic outcomes in the high school context. In conclusion, the findings from the present investigation hold substantive and methodological implications for researchers investigating the processes relevant to academic outcomes in the educational domain and are also relevant to practitioners striving to facilitate students' academic development.
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APPENDICES

Appendix A

The Motivation and Engagement Wheel

Appendix B

Further Clarification of the Conceptualisation of Motivation and Action in the Proposed Model

When embarking on a discussion of the ‘action’ component of the academic self-system process model, it is important to acknowledge that the terminology of ‘motivation and engagement’ used to describe the constructs underpinning the MES-HS is similar to that of the ‘action’ or engagement component of the academic self-system process model. Indeed, although engagement and action are related terms (as identified in the action section of this chapter) there are several points relevant to this issue of conceptual overlap between the motivation instrument and the action constructs which comprise the action component of the academic self-system process model. In the first instance, at no point in Martin’s motivation research are the individual constructs which comprise the MES-HS explicitly demarcated into motivation and engagement – rather, they are broadly referred to as motivation and engagement constructs. Secondly, the constructs used to measure the ‘action’ component in the academic self-system process model are clearly differentiated from the constructs underpinning the motivation instrument. For example, in terms of cognitive action, a positive appraisal of school is clearly distinct from the adaptive and impeding/maladaptive cognitions underpinning the MES-HS such as self-efficacy, mastery orientation, and uncertain control. All which are clearly based on motivation research. Similarly, participating in class, completing homework and attending school are clearly observable behavioural actions which are separate from the adaptive and maladaptive behaviours identified in the MES-HS (e.g., self-handicapping). In a bid to avoid conceptual confusion, and for the purposes of testing the hypothesised academic self-system process model, the constructs underpinning the MES-HS will be referred to as motivation and the constructs
underpinning the engagement component of the academic self-system process model will be reflected as cognitive and behavioural action. As is the case with a majority of motivation and engagement research, there is conceptual overlap to which this current research is no exception (although every effort has been made to avoid potential overlap and conflation).
Appendix C

School Motivation and Self-Concept Survey

Dear Student

We would like to invite you to assist in a study that looks at your motivation and engagement, how you study, what you think of yourself as a student, as well as your scores on a brief math and verbal quiz. When we are finished we would like to combine all the answers together in order to get a broad picture of how school students describe themselves and see what strategies students use when going about their studies.

If you would prefer not to answer the survey, that is okay. If in the middle of the survey you want to stop, that is also okay. There will be no disadvantage to you if you would prefer not to participate in the survey. When you have finished the survey, hold onto it until a student comes to collect it and places it into an envelope to be sealed and signed. When the researchers receive your survey, the front page containing your name will be detached and an id number assigned to the answer part of the survey. Your answers will be confidential and under no circumstances will the answers that you give to the survey be known to anyone other than the researchers. All the surveys will be stored in a secured location that only researchers can access and answers entered into a computer will be accessed using a password known only to researchers.

When answering the survey, if you want to change an answer just cross it out and circle the answer that you prefer. You should have ONLY ONE answer for each question. Do not leave out any questions. If you are not sure which answer to circle, just circle the one that you think is the closest to what you think.

If you have any questions or concerns about the project, feel free to contact: Dr. Andrew Martin at (02) 9772 6656; via e-mail at a.martin@uws.edu.au or Professor Herb Marsh at (02) 9772 6633; via e-mail at h.marsh@uws.edu.au. Alternatively, you can speak with your teacher or school counsellor.

You can now begin.

Thank you for your assistance.

Surname First Name

NOTE: This study has been approved by the University of Western Sydney Human Research Ethics Committee. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through the Research Ethics Officers (tel: 47 360 883). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

THIS PAGE IS TO BE DETACHED AND AN IDENTIFICATION NUMBER ASSIGNED TO THE OTHER PART OF THE SURVEY
Appendix C (Continued)

School Motivation and Self-Concept Survey

a. Grade/Year

b. Gender (circle)

Female Male

c. Month of Birth

d. Year of Birth

e. Age ________ years

f. In terms of education and work, which do you plan to do after leaving school (circle one)

1. Go into full-time work and no further study

2. Go into full-time work and some university/college study

3. Go to university/college full-time

4. Go to university/college part-time (with or without part-time work)

5. Go into a traineeship or an apprenticeship

6. Don't know

7. Other _________________________________

8. List up to 3 possible careers/jobs you are interested in after you leave school/college/university

1. ____________________________

2. ____________________________

3. ____________________________

9. At any stage, do you plan to have a 'gap year' after you finish school? (circle one)

(a break - eg. travel - before or after starting university/work) Yes No Don't Know

10. How often do you do and complete your homework and assignments (circle one)

1. Never

2. Not very often

3. Some of the time

4. Often

5. Always

11. Have you ever repeated a grade at primary or high school? (circle) Yes No

12. What grade did you repeat? __________ grade

13. About how many days were you absent from school last term? About ________ days

14. What was the main reason for your absence? ______________________________________________________________________

15. Are you Aboriginal or a Torres Strait Islander? (circle) Yes No

16. Language spoken at home

<table>
<thead>
<tr>
<th>What language is spoken most by YOUR FAMILY at home?</th>
<th>English</th>
<th>Italian</th>
<th>Greek</th>
<th>Macedonian</th>
<th>Vietnamese</th>
<th>Indigenous</th>
</tr>
</thead>
</table>
### School Motivation and Self-Concept Survey

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Somewhat Agree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. If I can’t understand my schoolwork at first, I keep going over it until I do</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2. I feel very pleased with myself when I really understand what I’m taught at school</td>
<td>1 2 3 4 5 6 7</td>
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</tr>
<tr>
<td>3. When I study, I usually study in places where I can concentrate</td>
<td>1 2 3 4 5 6 7</td>
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<td></td>
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<tr>
<td>4. I’m able to use some of the things I learn at school in other parts of my life</td>
<td>1 2 3 4 5 6 7</td>
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<tr>
<td>5. Sometimes I don’t try hard at assignments so I have an excuse if I don’t do so well</td>
<td>1 2 3 4 5 6 7</td>
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</tr>
<tr>
<td>6. When I don’t do so well at school I’m often unsure how to avoid that happening again</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>7. I feel very pleased with myself when I do well at school by working hard</td>
<td>1 2 3 4 5 6 7</td>
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<td></td>
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</tr>
<tr>
<td>8. Each week I’m trying less and less</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
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<tr>
<td>9. If my homework is difficult, I keep working at it trying to figure it out</td>
<td>1 2 3 4 5 6 7</td>
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<tr>
<td>10. When exams and assignments are coming up, I worry a lot</td>
<td>1 2 3 4 5 6 7</td>
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<tr>
<td>11. Often the main reason I work at school is because I don’t want people to think that I’m dumb</td>
<td>1 2 3 4 5 6 7</td>
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<tr>
<td>12. When I get a good mark I’m often not sure how I’m going to get that mark again</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. If I try hard, I believe I can do my schoolwork well</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>14. Learning at school is important</td>
<td>1 2 3 4 5 6 7</td>
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<td></td>
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<tr>
<td>15. I don’t really care about school anymore</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>16. When I get a bad mark I’m often unsure how I’m going to avoid getting that mark again</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>17. When I study, I usually organise my study area to help me study best</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. I’m often unsure how I can avoid doing poorly at school</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Appendix C (Continued)

**School Motivation and Self-Concept Survey**

Please circle one number for each statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Agree</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>19. I worry about failing exams and assignments</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>20. Often the main reason I work at school is because I don’t want people to think bad things about me</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>21. I get it clear in my head what I’m going to do when I sit down to study</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>22. I’ve pretty much given up being involved in things at school</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>23. If I don’t give up, I believe I can do difficult schoolwork</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>24. I sometimes don’t study very hard before exams so I have an excuse if I don’t do so well</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>25. I feel very pleased with myself when what I learn at school gives me a better idea of how something works</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>26. I feel very pleased with myself when I learn new things at school</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>27. Before I start an assignment, I plan out how I am going to do it</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>28. When I’m taught something that doesn’t make sense, I spend time to try to understand it</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>29. I’ve pretty much given up being interested in school</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>30. I try to plan things out before I start working on my homework or assignments</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>31. Often the main reason I work at school is because I don’t want to disappoint my parents</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>32. When I study, I usually try to find a place where I can study well</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>33. If I have enough time, I believe I can do well in my schoolwork</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>34. What I learn at school will be useful one day</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>35. I sometimes do things other than study the night before an exam so I have an excuse if I don’t do so well</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<td>6</td>
</tr>
<tr>
<td><strong>36. I’ll keep working at difficult schoolwork until I think I’ve worked it out</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
### Appendix C (Continued)

**School Motivation and Self-Concept Survey**

<table>
<thead>
<tr>
<th>Disagree Strongly</th>
<th>Disagree Somewhat</th>
<th>Neither Agree nor Disagree</th>
<th>Agree Somewhat</th>
<th>Agree</th>
<th>Agree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

**PLEASE CIRCLE ONE NUMBER FOR EACH STATEMENT**

37. When I do tests or exams I don't feel very good

38. Often the main reason I work at school is because I don't want my teacher to think less of me

39. I usually stick to a study timetable or study plan

40. If I work hard enough, I believe I can get on top of my schoolwork

41. It's important to understand what I'm taught at school

42. I sometimes put assignments and study off until the last moment so I have an excuse if I don't do so well

43. In terms of my schoolwork, I'd call myself a worrier

44. When I study, I usually study at times when I can concentrate best

45. When I don't do so well at school I know how to avoid that happening again

46. If I don't give up, I believe I can do difficult MATHS work

47. If I don't give up, I believe I can do difficult ENGLISH work

48. When I do my schoolwork I try to do it better than I've done before

49. I'm happy to stay on and complete school

50. I enjoy being a student

51. If I try hard, I believe I can do well in MATHS

52. If I try hard, I believe I can do well in ENGLISH

53. I don't let study stress get on top of me

54. I participate when we discuss things in class
### Appendix C (Continued)

**School Motivation and Self-Concept Survey**

<table>
<thead>
<tr>
<th>Disagree Strongly</th>
<th>Disagree Somewhat</th>
<th>Neither Agree nor Disagree</th>
<th>Agree Somewhat</th>
<th>Agree</th>
<th>Agree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PLEASE CIRCLE ONE NUMBER FOR EACH STATEMENT**


55. I look forward to continuing with most of my school subjects

56. In general, I get along well with my teachers

57. I like school

58. When I do my schoolwork I try to do the best that I've ever done

59. I get involved when we do group work in class

60. I'd like to continue studying or training after I complete school

61. In general, my teachers really listen to what I have to say

62. I think I'm good at dealing with schoolwork pressures

63. If I work hard enough, I believe I can get on top of MATHS

64. If I work hard enough, I believe I can get on top of ENGLISH

65. Being a student is pretty good

66. When I get a good mark I know how to get that mark again

67. I don't let a bad mark affect my confidence

68. In general, my teachers are interested in me

69. I get involved in things we do in class

70. I intend to complete school

71. If I have enough time, I believe I can do well in MATHS

72. If I have enough time, I believe I can do well in ENGLISH
## Appendix C (Continued)

### School Motivation and Self-Concept Survey

**PLEASE CIRCLE ONE NUMBER FOR EACH STATEMENT**

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Neither Agree</th>
<th>Agree</th>
<th>Agree Strongly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly</td>
<td>Somewhat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
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<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

73. When I’m at school I feel pretty happy 1 2 3 4 5 6 7
74. When I do my schoolwork I try to get a better result than I’ve got before 1 2 3 4 5 6 7
75. I’m good at dealing with setbacks (eg. bad mark, negative feedback on my work) 1 2 3 4 5 6 7
76. When I get a bad mark I know how to avoid getting that mark again 1 2 3 4 5 6 7
77. I participate in class activities 1 2 3 4 5 6 7
78. In general, my teachers give me the help and support I need 1 2 3 4 5 6 7
79. When I do my schoolwork I try to improve on how I’ve done before 1 2 3 4 5 6 7
80. I know how to avoid doing poorly at school 1 2 3 4 5 6 7

<table>
<thead>
<tr>
<th>FALSE</th>
<th>MOSTLY FALSE</th>
<th>MORE FALSE THAN TRUE</th>
<th>MORE TRUE THAN FALSE</th>
<th>MOSTLY TRUE</th>
<th>TRUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

81. **MATHMATICS** is one of my best subjects 1 2 3 4 5 6
82. I have a nice looking face 1 2 3 4 5 6
83. Overall, I have a lot to be proud of 1 2 3 4 5 6
84. I am honest 1 2 3 4 5 6
85. I enjoy things like sports, gym, and dance 1 2 3 4 5 6
86. I am hopeless in **ENGLISH** classes 1 2 3 4 5 6
87. I worry more than I need to 1 2 3 4 5 6
88. I get along well with my parents 1 2 3 4 5 6
89. I get bad marks in most **SCHOOL SUBJECTS** 1 2 3 4 5 6
90. I am not very popular with members of the opposite sex 1 2 3 4 5 6
91. It is difficult to make friends with members of my own sex 1 2 3 4 5 6
92. I get good marks in **MATHMATICS** 1 2 3 4 5 6
93. I am good looking 1 2 3 4 5 6
94. Most things I do, I do well 1 2 3 4 5 6
95. I often tell lies 1 2 3 4 5 6
96. I am good at things like sports, gym, and dance 1 2 3 4 5 6
97. Work in **ENGLISH** classes is easy for me 1 2 3 4 5 6
### Appendix C (Continued)

**School Motivation and Self-Concept Survey**

<table>
<thead>
<tr>
<th></th>
<th>FALSE</th>
<th>MOSTLY FALSE</th>
<th>MORE FALSE THAN TRUE</th>
<th>MORE TRUE THAN FALSE</th>
<th>MOSTLY TRUE</th>
<th>TRUE</th>
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</thead>
<tbody>
<tr>
<td>98.</td>
<td>I am a nervous person</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>99.</td>
<td>My parents treat me fairly</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>100.</td>
<td>I learn things quickly in most SCHOOL SUBJECTS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>101.</td>
<td>I make friends easily with boys</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>102.</td>
<td>I make friends easily with girls</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>103.</td>
<td>I have always done well in MATHEMATICS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>104.</td>
<td>Other people think I am good looking</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>105.</td>
<td>Overall, most things I do turn out well</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>106.</td>
<td>I sometimes cheat</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>107.</td>
<td>I am awkward at things like sports, gym, and dance</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>108.</td>
<td>ENGLISH is one of my best subjects</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>109.</td>
<td>I often feel confused and mixed up</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>110.</td>
<td>My parents understand me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>111.</td>
<td>I do well in tests in most SCHOOL SUBJECTS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>112.</td>
<td>I have lots of friends of the opposite sex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>113.</td>
<td>Not many people of my own sex like me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>114.</td>
<td>I do badly in tests in MATHEMATICS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>115.</td>
<td>I have a good looking body</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>116.</td>
<td>I can do things as well as most people</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>117.</td>
<td>I always tell the truth</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>118.</td>
<td>I am better than most of my friends at things like sports, gym, and dance</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>119.</td>
<td>I get good marks in ENGLISH</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>120.</td>
<td>I get upset easily</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>121.</td>
<td>I do not like my parents very much</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>122.</td>
<td>I am good at most SCHOOL SUBJECTS</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>123.</td>
<td>I do not get along very well with boys</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>124.</td>
<td>I do not get along very well with girls</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>125.</td>
<td>If I really try I can do almost anything I want to do</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>126.</td>
<td>I sometimes take things that belong to other people</td>
<td>1</td>
<td>2</td>
<td>3</td>
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</tr>
<tr>
<td>127.</td>
<td>I learn things quickly in ENGLISH classes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>128.</td>
<td>I worry about a lot of things</td>
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<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>129.</td>
<td>I make friends easily with members of my own sex</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>130.</td>
<td>Overall I am a failure</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
</tr>
<tr>
<td>131.</td>
<td>I sometimes tell lies to stay out of trouble</td>
<td>1</td>
<td>2</td>
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<td>5</td>
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</tbody>
</table>
### Appendix C (Continued)
#### School Motivation and Self-Concept Survey – Spelling Answer Sheet

<p>| | | | | |</p>
<table>
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<tr>
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<td>14</td>
<td></td>
<td>28</td>
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</tr>
</tbody>
</table>
### Appendix C (Continued)

**School Motivation and Self-Concept Survey – Mathematic Component (Time 1)**

*(For Research Purposes Only)*

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>$1 + 1 = 2$</td>
<td>$5 - 1 = 4$</td>
<td>$2 + 7 = 9$</td>
<td>$8 - 4 = 4$</td>
<td>$32 + 40 = 72$</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>$9 + 3 = 12$</td>
<td>$36 - 15 = 21$</td>
<td>$68 + 23 = 91$</td>
<td></td>
<td>$7 \times 6 = 42$</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$23 \times 3 = 69$</td>
<td>$33 - \frac{3}{2} = 31.5$</td>
<td>$4 \sqrt{16} = 4$</td>
<td></td>
<td>$17 \times 4 = 68$</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>$724 - 597 = 127$</td>
<td>$155 = 15$</td>
<td>$9 \sqrt{4527} = 9$</td>
<td>$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>$2 \frac{1}{2} + 1 \frac{1}{2} = 4$</td>
<td>$\frac{823}{96} = 8.5833$</td>
<td></td>
<td>$\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$</td>
<td>$\frac{38}{2.4} = 15.8333$</td>
</tr>
<tr>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>$\frac{3}{10} + \frac{3}{4} = \frac{13}{20}$</td>
<td>$6 \frac{4}{5} + 4 \frac{1}{2} = 11 \frac{3}{10}$</td>
<td>$\frac{2}{5} \text{ of } 35 = 7$</td>
<td>$27 \frac{384}{384} = 33$</td>
<td>$6.23 \frac{x}{12.7}$</td>
</tr>
<tr>
<td>26</td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
</tr>
<tr>
<td>$\frac{31}{4} = 7.75$</td>
<td>$10 \frac{1}{4} - 7 \frac{3}{4} = 2 \frac{1}{2}$</td>
<td>$-X - Y - 23$</td>
<td>$15% \text{ of } 175 = 26.25$</td>
<td>$0.075 = \frac{3}{40}$</td>
</tr>
<tr>
<td>31</td>
<td>32</td>
<td>33</td>
<td>34</td>
<td>35</td>
</tr>
<tr>
<td>$r^2 - 5r - 6 \div r + 1 = \frac{3p - q = 10}{2p - q = 7}$</td>
<td>$p = \frac{K^2 + K}{K^2 - 3} \div \frac{3K - 3}{K^2 - 1}$</td>
<td>$f(x) = 3x^2 + x - 7$</td>
<td>$f(-2)$</td>
<td>Ans:</td>
</tr>
</tbody>
</table>
### Appendix C (Continued)

**School Motivation and Self-Concept Survey – Mathematic Component (Time 2)**

*(For Research Purposes Only)*

<table>
<thead>
<tr>
<th>2 + 1 =</th>
<th>6 + 2</th>
<th>5 − 3</th>
<th>4 − 1 =</th>
<th>8 − 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

$$\begin{array}{ccc}
51 + 27 & = 497 - 176 \\
\hline
6 & \times 3 & = 417 + 534 \\
\hline
6 & 7 & 8 \\
\hline
5 \div 15 & = 452 + 137 - 245 \\
\hline
11 & 12 & 13 \\
\hline
62.04 \div 5.03 & = 9 \sqrt[9]{882} - 0.53 \\
\hline
16 & 17 & 18 \\
\hline
Which is more? 7 or 13 = 8 \times 47 \\
\hline
21 & 22 & 23 \\
\hline
5 \div 3\frac{1}{2} & = 4 \div 6 \\
\hline
26 & \hline
\hline
Write as a decimal: 52 \frac{1}{2} \% = (-5)(+9) \\
\hline
31 & 32 & 33 \\
\hline
7 − (6 + 8) = 2 \times 3\frac{1}{2} = \sqrt{2\pi x} = 6 \\
\hline
36 & 37 & 38 \\
\hline
\end{array}$$
Appendix D

Instructions to Teachers

Thank you for participating in this research.

Please do the following:

1. Hand out the surveys to the class
2. Tell students to answer the questions honestly and that students will often have different answers from each other.
3. Tell students that they need to answer ALL survey questions and provide ONLY ONE ANSWER for each question. Allow approximately 20 minutes to complete the survey. Explain the rating scale to the students. You are allowed to briefly explain individual survey questions to students if they need an additional explanation.
4. After approximately 20 minutes, tell students that you are going to read out some words and that you would like them to attempt to write the correct spelling of that word on the paper supplied (page 9). Ask students to attempt every word.
5. Clearly say the word, the sentence and the word again (refer to the examiner’s list). Repeat this process for all 40 words. Allow approximately 15 seconds per word. You are allowed to repeat the word if students request you to do so.
6. After the spelling quiz is complete, tell students to complete the math quiz on the last page of the survey. Allow exactly 15 minutes for the completion of this quiz. If students do not know the answer to a question please tell them to move onto the next one and come back to questions they have not answered (if they have time). Students are not allowed assistance with any of the math questions.
7. After the math quiz has been completed, ask a student to collect the surveys and put them in the supplied envelope. This student should then seal the envelope and sign across the seal.

Motivation and self-concept survey - approximately 20-30 minutes.
Spelling quiz - approximately 10-15 minutes (15 seconds per question)
Math quiz -15 minute time limit.
<table>
<thead>
<tr>
<th>Target Word</th>
<th>Sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 And</td>
<td>Bill <strong>and</strong> Bob play together.</td>
</tr>
<tr>
<td>2 In</td>
<td>They are <strong>in</strong> the pool.</td>
</tr>
<tr>
<td>3 Him</td>
<td>They saw <strong>him</strong> in town.</td>
</tr>
<tr>
<td>4 Make</td>
<td>She can <strong>make</strong> a dress.</td>
</tr>
<tr>
<td>5 Cook</td>
<td>We <strong>cook</strong> our own dinner.</td>
</tr>
<tr>
<td>6 Must</td>
<td>We <strong>must</strong> do our work.</td>
</tr>
<tr>
<td>7 Enter</td>
<td><strong>Enter</strong> this way.</td>
</tr>
<tr>
<td>8 Light</td>
<td>The <strong>light</strong> is bright.</td>
</tr>
<tr>
<td>9 Reach</td>
<td>She couldn't <strong>reach</strong> the ball.</td>
</tr>
<tr>
<td>10 Circle</td>
<td>A <strong>circle</strong> is a round drawing.</td>
</tr>
<tr>
<td>11 Explain</td>
<td><strong>Explain</strong> how it happened.</td>
</tr>
<tr>
<td>12 Correct</td>
<td>Put down the <strong>correct</strong> answer.</td>
</tr>
<tr>
<td>13 Ruin</td>
<td>The house was in <strong>ruin</strong> after the fire.</td>
</tr>
<tr>
<td>14 Material</td>
<td>The <strong>material</strong> was expensive.</td>
</tr>
<tr>
<td>15 Advice</td>
<td>My <strong>advice</strong> was forgotten.</td>
</tr>
<tr>
<td>16 Surprise</td>
<td>She may <strong>surprise</strong> you.</td>
</tr>
<tr>
<td>17 Believe</td>
<td>I <strong>believe</strong> you are right.</td>
</tr>
<tr>
<td>18 Brief</td>
<td>I received a <strong>brief</strong> note.</td>
</tr>
<tr>
<td>19 Reasonable</td>
<td>His request was <strong>reasonable</strong> and just.</td>
</tr>
<tr>
<td>20 Quantity</td>
<td>He ate a large <strong>quantity</strong> of food.</td>
</tr>
<tr>
<td>21 Character</td>
<td>Her fine <strong>character</strong> was praised.</td>
</tr>
<tr>
<td>22 Success</td>
<td><strong>Success</strong> makes people happy.</td>
</tr>
<tr>
<td>23 Executive</td>
<td>The governor is a state <strong>executive</strong>.</td>
</tr>
<tr>
<td>24 Decision</td>
<td>Your <strong>decision</strong> was accepted by all.</td>
</tr>
<tr>
<td>25 Recognise</td>
<td>He did not <strong>recognise</strong> me.</td>
</tr>
<tr>
<td>26 Anxiety</td>
<td>Floods create <strong>anxiety</strong> in people.</td>
</tr>
<tr>
<td>27 Opportunity</td>
<td>He had no <strong>opportunity</strong> for success</td>
</tr>
<tr>
<td>28 Lucidity</td>
<td>We think best in moments of <strong>lucidity</strong>.</td>
</tr>
<tr>
<td>29 Enthusiasm</td>
<td>People showed <strong>enthusiasm</strong> for the hero.</td>
</tr>
<tr>
<td>30 Conscience</td>
<td>His <strong>conscience</strong> was clear.</td>
</tr>
<tr>
<td>31 Possession</td>
<td>They took <strong>possession</strong> of the house.</td>
</tr>
<tr>
<td>32 Belligerent</td>
<td>The soldier was <strong>belligerent</strong> and brave.</td>
</tr>
<tr>
<td>33 Medieval</td>
<td><strong>Medieval</strong> times were long ago.</td>
</tr>
<tr>
<td>34 Charlatan</td>
<td>A <strong>charlatan</strong> is a pretender.</td>
</tr>
<tr>
<td>35 Cacophony</td>
<td>A <strong>cacophony</strong> is a mix of harsh sounds.</td>
</tr>
<tr>
<td>36 Camouflage</td>
<td><strong>Camouflage</strong> is a natural defence for many animals.</td>
</tr>
<tr>
<td>37 Acquiesce</td>
<td>To <strong>acquiesce</strong> is to comply with a demand.</td>
</tr>
<tr>
<td>38 Pusillanimous</td>
<td>A <strong>pusillanimous</strong> person is weak in spirit.</td>
</tr>
<tr>
<td>39 Malfeasance</td>
<td>The governor was found guilty of <strong>malfeasance</strong> in office.</td>
</tr>
<tr>
<td>40 Vicissitude</td>
<td>Unemployment is a <strong>vicissitude</strong> which can have devastating effects.</td>
</tr>
<tr>
<td>Target Word</td>
<td>Sentence</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
</tr>
<tr>
<td>Go</td>
<td>Children go to school.</td>
</tr>
<tr>
<td>Cat</td>
<td>The cat has fur.</td>
</tr>
<tr>
<td>Boy</td>
<td>The boy plays ball.</td>
</tr>
<tr>
<td>Run</td>
<td>Jen can run fast.</td>
</tr>
<tr>
<td>Will</td>
<td>They will wait for you.</td>
</tr>
<tr>
<td>Cut</td>
<td>Mother will cut the cake.</td>
</tr>
<tr>
<td>Arm</td>
<td>His arm hurt.</td>
</tr>
<tr>
<td>Dress</td>
<td>The dress fits well.</td>
</tr>
<tr>
<td>Train</td>
<td>The train was on time.</td>
</tr>
<tr>
<td>Shout</td>
<td>If you shout, he'll hear you.</td>
</tr>
<tr>
<td>Watch</td>
<td>My watch is fast.</td>
</tr>
<tr>
<td>Grown</td>
<td>Potatoes are grown in the field.</td>
</tr>
<tr>
<td>Kitchen</td>
<td>Our kitchen is small.</td>
</tr>
<tr>
<td>Result</td>
<td>The result of your work is good.</td>
</tr>
<tr>
<td>Heaven</td>
<td>Heaven surrounds the earth.</td>
</tr>
<tr>
<td>Educate</td>
<td>Parents educate their children.</td>
</tr>
<tr>
<td>Purchase</td>
<td>He did not purchase the car.</td>
</tr>
<tr>
<td>Institute</td>
<td>The art institute held an exhibit.</td>
</tr>
<tr>
<td>Suggestion</td>
<td>My suggestion was followed.</td>
</tr>
<tr>
<td>Equipment</td>
<td>The office got new equipment.</td>
</tr>
<tr>
<td>Museum</td>
<td>We went to the museum for the afternoon.</td>
</tr>
<tr>
<td>Occupy</td>
<td>We occupy a small apartment.</td>
</tr>
<tr>
<td>Illogical</td>
<td>His thinking was illogical.</td>
</tr>
<tr>
<td>Familiar</td>
<td>We are familiar with the news.</td>
</tr>
<tr>
<td>Reverence</td>
<td>Older people should be treated with reverence.</td>
</tr>
<tr>
<td>Physician</td>
<td>Our family physician examined me.</td>
</tr>
<tr>
<td>Prejudice</td>
<td>Prejudice is harmful to people.</td>
</tr>
<tr>
<td>Appropriation</td>
<td>Congress made an appropriation for schools.</td>
</tr>
<tr>
<td>Necessity</td>
<td>Food is a necessity.</td>
</tr>
<tr>
<td>Commission</td>
<td>The commission reported to the mayor.</td>
</tr>
<tr>
<td>Assiduous</td>
<td>Assiduous effort gets results.</td>
</tr>
<tr>
<td>Loquacious</td>
<td>He was loquacious during the interview.</td>
</tr>
<tr>
<td>Sovereignty</td>
<td>The country kept its sovereignty.</td>
</tr>
<tr>
<td>Irresistible</td>
<td>His idea was irresistible.</td>
</tr>
<tr>
<td>Occurrence</td>
<td>War is a tragic occurrence.</td>
</tr>
<tr>
<td>Auricular</td>
<td>An auricular defect pertains to the external ear.</td>
</tr>
<tr>
<td>Imperturbable</td>
<td>Her imperturbable attitude was reassuring.</td>
</tr>
<tr>
<td>Iridescence</td>
<td>Iridescence is a play of colours.</td>
</tr>
<tr>
<td>Boutonniere</td>
<td>He had a hard time pinning on his boutonniere.</td>
</tr>
<tr>
<td>Mnemonic</td>
<td>It is easier to learn a long list of words by using a mnemonic trick.</td>
</tr>
</tbody>
</table>