Exploration of achievement motivational patterns during adolescence using a 12-factor model across grades and sex

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Doctorate of Philosophy (Psychology)

College of Arts
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2007

This thesis is submitted to the University of Western Sydney, in fulfilment of the requirements for the degree of Doctor of Philosophy (Psychology)

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Acknowledgments

I would like to convey special appreciation to a unique educator, my principal supervisor, Professor Margaret Vickers. Professor Vickers encouraged me to continue during very difficult times in the process of writing this doctorate. Additionally, I would like to say thank you and convey appreciation to an amazing lady, Dr. Alexandra Kristovics, who imparts her brilliance, ever so subtly and humbly. Alex came on board in the latter part of my thesis and encouraged, discussed and theoretically broke down my arguments to a point where it was easy to relate an understanding of the very complex area of motivation. I also wish to thank Professor Herb Marsh for his unique, critical evaluations and guidance when the dissertation developed into a point of enquiry, necessitating ever-higher realms of statistical endeavour. It is an understatement to suggest that multilevel or structural equation modelling should be undertaken lightly. Herb’s genius related aspects of this investigation succinctly and I am grateful. I also wish to thank my initial supervisor, Professor Dennis McInerney, for his early supervision and for the use of his data in this dissertation; collected using an ARC grant. Additionally, appreciation is conveyed to Dr Alex Yeung, who undertook reviewing my statistical analyses at the completion of this thesis. Thank you to all these supervisors, who were invaluable educators, personally and academically.

No less importantly, are the friends and family that provide and convey their support and encouragement during the process of a doctoral dissertation. As most doctoral students would understand, whatever difficulty or obstacle may arise surely does, and always at the most inopportune time. I wish to acknowledge that my friends’ support and assistance was essential while working towards completion. I therefore, wish to sincerely thank some very special, dear friends, Maxine Johnston-King, Dianne Mills and Dr. Louise Ellis for their unending support, encouragement and assistance in the editing of this thesis. No less appreciation is conveyed to my international friends, Dr Anne Torhild Klamsten, Clara Leung and Desiree Boughtwood who conveyed their constant belief of my capability to complete this degree. Gratitude is also expressed for the proofreading of chapters undertaken by Bernie Johnson, Marguerita Cantafio and Jennifer Haigh who provided objective comments on the many drafts.

To my family, Georgina, Peter and Shaun, I wish to say thank you for the consistent love you gave across my twelve years of study. It really has been a labour of love and regardless, you always believed I would achieve and provide a better understanding of not only my goal to achieve but also others’ pursuits towards excellence.
Statement of Authentication

The work presented in this thesis is, to the best of my knowledge and belief, original, except as acknowledged in the text. I hereby declare that I have not submitted this material, either in whole or in part, for a degree at this or any other institution.

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Abstract

This thesis argues that a multidimensional profile incorporating mastery goals, performance goals, social goals and extrinsic goals, as well as factors relating to self-perceptions, would provide a better understanding of achievement motivation in adolescents than a univariate or dichotomous framework. Additionally, this thesis also explores whether the use of lower-order dimensions provides information that offers a more detailed analysis of achievement goals over and above that found by the higher-order factors alone. A newly developed multidimensional measure, the SMOSA (Self Motivational Orientation Scale for Adolescents) of achievement motivation was used to examine changes of different motivational pursuits and perceptions of self across grades and sex in an adolescent population.

The sample consisted of 2131 high school students in 3 cohorts (grades 7, 8, and 9) who were followed across a 3-year span. Firstly, the results revealed that the SMOSA had satisfactory goodness of fit to the data for the total sample as well as sound psychometric properties that provided equivalence between groups at both grade and sex. Secondly, results using multilevel modelling revealed that different patterns emerged, for both higher-order constructs and lower-order factors, among grades and between males and females. The current investigation is particularly vital, because prior research has failed to examine these lower-order factors to identify emerging patterns of development in achievement motivational pursuits between males and females across high schools. The strength of using multilevel modelling was that it allowed for the variability in the range of responses across grades and between males and females to be identified. This information provides a more detailed analysis than previous research, which relied on an evaluation of means to explain differences between samples. Therefore, educators will be
provided with a comprehensive understanding of the patterns of change in achievement motivation during adolescence and such knowledge may equip them with a way of measuring students’ approaches to facilitative learning and the ability to explore students’ paths for optimal engagement.
Achievement motivation

Chapter 1

Argument for the present research

The structure of achievement motivation is complex and investigating this phenomenon along a unitary or even dichotomous framework would limit the nature of the findings. Achievement motivation is multidimensional in nature and, arguably, the most critical period to gain an understanding of the many facets involved in achievement motivation is during adolescence (Carnegie Council on Adolescent Development, 1989). To identify whether disparate patterns emerge in the motivational pursuits of adolescents would provide educators with valuable information to develop a more focused strategy to engage and facilitate adolescent learning. This thesis argues that a multidimensional profile (similar to the one initially presented by Maehr in his Personal Investment model and later by McInerney in his Inventory of School Motivation) incorporating mastery goals, performance goals, social goals and extrinsic goals as well as factors relating to self-perceptions, would lead to a more comprehensive understanding of this complex phenomenon (Maehr & Braskamp, 1986).

The goals adolescents pursue are important, however adolescents’ self perceptions are inextricably linked with these goals and together have been shown to be a driving force in student engagement, achievement motivation and performance outcomes (Eccles & Wigfield, 2002; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Marsh & Yeung, 1997). Using a multidimensional measure of motivational pursuits incorporating self-perceptions would therefore, enhance educators’ understanding of achievement motivation.

Although a plethora of research into achievement motivation exists, there is limited research using a multidimensional measure. During high school, students
may vary in how much effort they put into a task, and how they value the task itself. Similarly, students may also vary in their perceptions regarding the importance they place on pursuits in leadership, competition, social relations, and the receipt of praise or tangible rewards. Longitudinal mapping of the different motivational pursuits and self-perceptions of adolescents would allow identification of the most salient variables to emerge across grades and sexes.

To date, research has recognised that several different theoretical perspectives have emerged trying to explain achievement motivation. One perspective, Achievement Goal Theory, initially focused on the dichotomy between mastery and performance goals. This theory argued that with an emphasis on the positive nature of mastery goals, and that with increased effort, success towards learning may be achieved (McInerney & McInerney, 1998; Midgley, Kaplan, & Middleton, 2001). More recent debates have suggested that performance goals may also be facilitative, and that dividing performance goals into approach and avoidance domains may help clarify this point (Elliott, 1999; Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002; Hidi & Harackiewicz, 2000). The division relates to performance-approach goals being more facilitative due to students’ increased efforts, whereas performance-avoidance goals are associated with either less effort (Covington, 2000), or alternatively perceptions of diminished capability (Harackiewicz & Elliott, 1993).

The motivational process undertaken during adolescence, however, may in some way be overshadowed by the narrow perception that adolescents are not motivated unless they pursue a mastery goal. As Ryan and Deci (2000) suggest “People have not only different amounts, but also different kinds of motivation. That is, they vary not only in level of motivation (i.e., how much motivation), but also in the orientation of that motivation (i.e., what type of motivation)” (p. 54). There are
Achievement motivation can be achieved in many ways, and essentially, all goals are part of that process. Students may take different paths to reach optimal achievement. This thesis will argue that if we continue to emphasise improvements in mastery goals as the only path to facilitate learning, then we are limiting our understanding of the complexities involved in this phenomenon.

Achievement motivational pursuits may vary as a factor of grade. During early adolescence some motivational pursuits may be more salient. For example, the social needs of young adolescents within the larger environment of high school may be more pertinent initially, but lessen as they progress through school. The effect of a larger school, with different teachers and changing classrooms for differing subjects, may create a less personal approach than students experienced in primary school (McInerney, Simpson, & Dowson, 2003). This new, less personal environment with a larger cohort of peers may impact on adolescents’ motivation, particularly regarding individual subject performances (Hau, 2004; Marsh & Hau, 2004a; 2004b).

Assessing achievement motivational pursuits to ascertain if they vary by degree, or possibly direction, across grades is crucial if we are to understand and evaluate adolescents’ motivational pursuits. As educators, we need to engage students during high school and without an understanding of the patterns of development using a broader motivational goal structure; we may fail to provide optimal opportunities for the majority of students. Adolescence is a time when future directions and career pathways are determined (Carnegie Council on Adolescent Development, 1989; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Therefore, failure to engage students during high school may result in limited opportunities for them both at school and in the future.
This investigation examined the movement of different motivational pursuits across grade and sex. A pivotal element of consideration in this enquiry is the mapping of the profiles of males and females to clarify whether differences emerge among the individual motivational dimensions. The recent dilemma facing educators’ day-to-day dealings with the comparative decline of males to females in performance outcomes (Nelson, 2004; van Houtte, 2004), highlights the need to elucidate whether patterns of self perceptions and achievement motivational pursuits differ during this time and in what domains these differences manifest between males and females. We need to ascertain whether males and females vary across grades, or across particular dimensions of their motivational profiles. If differences in the patterns of achievement motivation do emerge, identifying at what grade this occurs, and whether there is a discernable difference between male and females, is critical.

Essentially, several questions will be addressed in this thesis. Which dimensions vary in salience for males and females? Do males and females differ in their facilitative motivational pursuits and if so, at what grade does this occur? Alternatively, do males and females differ in the less facilitative motivational pursuits and, if so, at what grade does this occur? Or, do males and females vary in their self perceptions and, if so, at what grade does this occur? This appears a timely investigation considering the perceived disparities between males and females in their performance outcomes that have recently emerged in the literature (Nelson, 2004; van Houtte, 2004)

This research developed a parsimonious and comprehensive model of motivational pursuits and self perceptions that incorporates both sex and grade and applies across adolescence. The present research adapted McInerney’s (GAGOS –
General Achievement Goal Orientation Scale and ISMR – Inventory of School Motivation) and Marsh’s self-concept (SDQII) comprising of 130-items to a more parsimonious 53 item, 12-factor tool, the Self Motivational Orientations Scale for Adolescents (SMOSA) to measure these constructs. The twelve factors are: task pursuits, effort pursuits, competition pursuits, leader pursuits, social concern pursuits, affiliation pursuits, reward pursuits, praise pursuits, English self-concept, maths self-concept, general academic self-concept and Perceived Academic Capability (PAC). This thesis will use a cross-cohort sequential design to enhance past research. Three cohorts of Australian high-school students will be followed across three consecutive years. Therefore, the use of cross sectional and longitudinal data will better clarify our understanding of the nature of change during adolescence.

The first aim of this research will be to investigate the psychometric soundness of a 12-factor model identifying motivational pursuits and their accompanying self perceptions. The second aim is to map the emerging patterns of motivational pursuits and self-perceptions to identify whether these patterns differ by degree and direction across high school. The third aim is to investigate whether the multidimensional profiles show differences between females and males across the twelve factors. If so, the research will explore which factors represent the most salient changes by degree and/or direction by sex across the different grades. The reliance of previous research on higher-order constructs in achievement motivation rather than their lower-order factors may have limited the scope of previous findings. Therefore, this research will explore whether the use of lower-order factors (task pursuits and effort pursuits) identifies disparate patterns of development by degree and/or direction, not acknowledged when reliance on the higher-order
construct (mastery goal) is maintained. Four higher-order constructs: mastery goals, performance goals, social goals and extrinsic goals also will be assessed through their lower-order factor structures.

The distinctive contribution of the present investigation is in the provision of a single measure using a large sample that assesses the multidimensional structure of motivational pursuits and self-perceptions of males and females across the different grades. The issue of variation across sex and grade in motivational pursuits and self-perceptions has diverse theoretical, practical and methodological implications for researchers concerned with motivational, developmental and gender differences in these domains. These findings will assist educators in designing more focussed programs to enhance facilitative learning strategies for students within the school context.
Chapter 2

Literature Review – Part One

Why the study of achievement motivation within schools is important.

The idea that motivation is crucial within education has been demonstrated in much of the literature, for example, those related to student engagement, achievement and facilitative learning (Jacobs, et al., 2002). The former Secretary of Education in the United States, Terrel Bell, stressed the importance of motivation within the school context emphatically when he stated: “There are three things to remember about education. The first is motivation. The second one is motivation. The third one is motivation” (cited Maehr & Meyer, 1997, p. 372). While motivation may be often used as a singular term, its structure is complex.

History of achievement motivational research

Murray (1938) defined the need to achieve as “a desire or tendency to overcome obstacles, to exercise power, to strive to do something difficult as well as and as quickly as possible” (pp. 80-81). This definition aligns with the contemporary view of achievement motivation through the pursuit of goals. Murray’s definition of attainment follows a similar theme expressed in Achievement Goal Theory under the heading of a ‘mastery goal’. His goal of attainment was based on the journey and development of skills, rather than on the gratification of winning or being the best. This comparative aspect of winning and being the best, closely parallels a performance goal focus (Franken, 2002).

The role of competence relative to a mastery goal, that closely underpins the definitional framework associated with Achievement Goal Theory, was first emphasised by Robert White in his Generalized Theory of Effectance Motivation (Franken, 2002). White’s (1959, cited Franken, 2002) effectance motivational theory
suggests that a sense of competence or efficacy is related to individual mastering of
the task. As Walker (2003) suggests, “students who are efficacious do achieve” (p. 173). Since White’s and Murray’s early theoretical endeavours linking the role of
competence and self evaluation to the study of achievement motivation, a wealth of
related research has resulted (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002).

Achievement motivation resurfaced as a popular area of research in the work of
David McClelland in the early 1950s. McClelland’s work emphasised the
importance of the need-to-achieve as an internal drive and a major force behind
inspirational leadership, masterpieces, and scientific progress (Weiten, 2001). As the
name implies, the ‘need for achievement’ was based on some internal drive or
needs-based model, presumably related to an inherent personality trait that was more
pronounced in some individuals than others. Atkinson expanded McClelland’s
theory to “a distinctly cognitive theory of achievement motivation” (Franken, 2002,
p. 366), which was tempered by another fundamental need, that is, the need to avoid
failure. This model has primarily underpinned much of the work in Self-Worth
Theory (Covington, 2000, 2002; Martin, 2002) and has also been utilised in the
works of Elliott (1999) and Harackiewicz and colleagues (Harackiewicz, Barron,
Pintrich, Elliott, & Thrash, 2002). Harackiewicz and colleagues suggested an
expansion of achievement motivation to incorporate the revised triarchic model that
included a division of performance goals into approach and avoidance domains.

Other contemporary views of motivation have suggested the “need for achievement
is a multifaceted phenomenon steeped not in a single process but in a host of social,
cognitive and developmental processes” (Reeve, 1997, p. 136). The role of “goals are
just like any other knowledge structure, they can be activated a priori by the individual
as he or she enters a situation and they can be influenced by the information available to
them in the context” (Pintrich, 2000a, p. 102). The early pioneering work of White, Murray and Atkinson paved the way for the contemporary enquiry into students’ motivational pursuits that acknowledges the role of students’ accompanying self-perceptions.

Investigation into achievement motivation has naturally presented a challenge to educators to disseminate the structure and development of the motive to achieve. Several different theoretical models have attempted to explain achievement motivation. For example, Weiner’s (1990) theory of attribution explained that external as well as internal frames of reference underpinned motivational behaviours and that these differed as a function of the contextual situation. Other theoretical frameworks have been used to explain motivation including Self-Worth Theory (Covington, 2002; Martin, 2002); Cognitive Evaluation Theory (Deci, Koestner, & Ryan, 1999); Expectancy Value Theory (Cury, Biddle, Sarrazin, & Famose, 1997; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002); Self Determination Theory (Gagne & Deci, 2005), and Goal Theory (Midgley, Kaplan, & Middleton, 2001). Research has also investigated the area of motives-as-goals in Achievement Goal Theory (Ames, 1992; Urdan & Maehr, 1995; Urdan, Pajares, & Lapin, 1997). Three contemporary theories are particularly relevant to this investigation, which focus on explaining the purpose or reasons for student engagement and/or achievement in the classroom; Cognitive Evaluation Theory; Self-Determination Theory and Achievement Goal Theory (Anderman, Hicks, & Midgley, 1998).

**Cognitive Evaluation Theory**

Cognitive Evaluation Theory has three premises. Firstly, external factors such as tangible rewards may reduce an individual’s intrinsic motivation due to diminished feelings of autonomy, and prompt changes in perception from an internal
Achievement motivation

to an external locus of control. Secondly, external factors such as negative feedback can affect an individual’s intrinsic motivation and reduce their perceived competence, which may leave the individual feeling amotivated. Thirdly, informational, controlling and amotivating aspects of incompetence will undermine intrinsic motivation (Gagne & Deci, 2005). Cognitive Evaluation Theory specifies that the social context produces variability in intrinsic motivation where feelings of competence will enhance intrinsic motivation if accompanied by a sense of autonomy, that is, self regulation (Gagne & Deci, 2005). The issue of autonomy versus control regarding the facilitation of intrinsic motivation in the classroom has been well documented. In addition, Cognitive Evaluation Theory maintains that interest will not be undermined by rewards when they are perceived as providing positive information about competence rather than as sources of control (Deci, Koestner, & Ryan, 1999). Cognitive Evaluation Theory and Self Determination Theory are similar, because they emphasise environmental and situational factors that may facilitate or forestall intrinsic motivation. For intrinsic motivation to initiate and continue, both competence and self-determination must be high, and for this condition to exist an external situation must be non-controlling and informational (Reeve, 1997). Self Determination Theory (SDT) is a broader construct than Cognitive Evaluation Theory (CET) (Gagne & Deci, 2005).

Self Determination Theory

The theoretical basis for Self-Determination Theory (SDT) is derived from CET (Ryan & Deci, 2000). The cognitive influence allows for a distinct environmental focus within SDT, dependent upon the different reasons that give rise to the action (Ryan & Deci). Intrinsic motivation reflects the natural inclination to learn and assimilate; extrinsic motivation is argued to vary considerably to reflect either
Achievement motivation

external control or true self-regulation (Deci, Koestner, & Ryan, 1999; Gagne & Deci, 2005; Ryan, Connell, & Deci, 1985).

Intrinsic and extrinsic goals, as well as components of self-efficacy, are important elements within SDT (Ryan & Deci, 2000). SDT also includes extrinsic rewards in the evaluation of autonomous learning. As researchers have suggested “when rewards were contingent on high quality performance and the interpersonal context was supportive rather than pressuring, tangible rewards enhanced intrinsic motivation” (Gagne & Deci, 2005, p. 332). Further, tangible rewards may not be detrimental to achievement, especially if extrinsic motivation has become internalized.

SDT’s particular emphasis relates to how the individual applies meaning to intrinsic and extrinsic rewards in a situational context (Covington, 2000). In relation to extrinsic motivation, “SDT proposes that extrinsic motivation can vary greatly in the degree on which it is autonomous” (Ryan & Deci, 2000). Extrinsic motivation can, however, share similar qualities to intrinsic motivation, that is, when extrinsic motivation has become internalized, where an individual’s sense of autonomy and self-determination increase in relation to the degree of internalisation. There are several levels of internalization: the first level consists of feelings that one is obliged to undertake the behaviour; the second level relates to the individual feeling as if the behaviour has some utility in reaching a desired outcome; and the third relates to the behaviour having some value that reflects a sense of self (Eccles & Wigfield, 2002). In education, the first would relate to the student feeling as if they must pursue academic studies because it is expected of them, either from their parents, teachers or peers. The second relates to the student studying because it may lead them to obtaining a career in their desired domain or some other desired outcome.
The third relates to students studying because they might feel as if success in their studies is in some way a reflection of their own abilities or sense of self. The third level indicates a greater level of internalization than the other two levels.

The major components of SDT are the aspects of autonomy, relatedness and competence achieved during learning, whereby becoming more autonomous is seen as valuable to the process of developing competence towards facilitative learning (Anderman & Midgley, 1997). “Competence involves understanding how to, and believing that one can achieve various outcomes. Relatedness involves developing satisfactory connections to others in one’s social group. Autonomy involves initiating and regulating one’s own actions” (Anderman & Midgley, p. 3). Relatedness (with both teachers and peers) has the potential for providing supportive environments where students are more likely to adopt implicit and shared values of that group, leading to an environment that can lead to greater autonomy and self-regulation (Ryan & Deci, 2000). These three goals underpin a social cognitive framework.

**Achievement Goal Theory**

One of the major developments in motivational research has been goal theory, which encompasses the “major insights of social-cognitive motivational theory” (Anderman & Maehr, 1994, p. 294). Goal theories of achievement motivation propose that students’ choices, attitudes and performance in achievement situations are influenced by the particular goals they pursue (Bouffard, Vezeau, & Bordeleau, 1998; Grant & Dweck, 2003; Maehr & Braskamp, 1986; Pintrich, Marx, & Boyle, 1993; Urdan & Maehr, 1995). Achievement goals are presumed to direct students’ behaviour and cognitions as they become involved in their work (Ames, 1992). Goal Theory (also known as Achievement Goal Theory) has traditionally defined mastery goals as adaptive in academic contexts and performance goals as leading to less
positive patterns of motivation and self-regulation (Butler, 1999; Bouffard, Vezeau & Bordeleau, 1998).

Motivation however, is a process and identification of the factors required to determine which goals arise as salient across adolescence (Maehr & Braskamp, 1986). “Whether or how people ... invest themselves in particular activities or courses of action depends on what the activities or courses of action mean to them” (Maehr & Braskamp, 1986, p. 47). As Maehr and colleagues (Maehr & Braskamp, 1986) suggest, “the primary antecedents of choice - as well as persistence, variation in activity level, or performance - reside in the thoughts, perceptions, and beliefs of the person” (p. 46). Elliot and Thrash (2001), however, incorporate the concept of the intended or desired ‘end state’. For example, the end goal of a performance goal highlights the demonstration of competence, whereas mastery goals demonstrate the development of competence. Thus, Achievement Goal Theory implicitly describes both the meanings or reasons individuals pursue goals, as well as the desired outcomes, or competence. Further, Elliot and Thrash point out that this end state (competence) can be described as absolute, normative and/or intrapersonal: absolute relates to evaluating whether the task has been fully mastered; normative relates to whether one perceives they are better than others; and intrapersonal relates to improving one’s own skills.

Achievement Goal Theory supports the premise that students are able to self regulate and that engagement is dependent upon their particular goals (Franken, 2002). The type of goals chosen by students may have dramatic consequences. Their decisions may influence whether they develop efficacious learning principles and strive to take on new challenges, or whether they avoid challenging tasks and do not persist (McInerney, 1995b). When students perceived they were capable of
achieving a given task, this generally resulted in a mastery goal focus with expenditure of effort and value in the task (Ames, 1992; Blumenfeld, 1992).

Achievement Goal Theory originally emphasised the dichotomy between mastery and performance goals. The premise of this research suggested that “Students who adopt a mastery goal focus are more likely to engage in deep cognitive processing, such as thinking about how newly learned material relates to previous knowledge and attempting to understand complex relationships. Alternatively, students with a performance goal focus tend to use surface-level strategies, such as the rote memorisation of facts and immediately asking the teacher for assistance when confronted with difficult academic tasks” (Anderman & Maehr, 1994, p. 295). Performance goals are defined as beating others or being in charge of a group and are externally referent. The focus is not in mastering the task or applying effort for the assimilation or accommodation of new material into prior learning but instead the goal is being the best and beating others (Kaplan & Middleton, 2002).

While Achievement Goal Theory models have included mastery goals and performance goals, some researchers (Bouffard, Vezeau & Bordeleau 1995; Elliot & Dweck, 1988) have called for an expansion of Achievement Goal Theory. Researchers calling for this expansion of Achievement Goal Theory to a triarchic model suggest that the normative approach (dichotomy of a mastery or performance goals) is limited because performance goals are not always maladaptive (Bouffard, Boisvert, Vezeau, & Larouche, 1995; Elliott, 1999; Elliott & Church, 1997; Elliott & Dweck, 1988; Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002; Hidi & Harackiewicz, 2000). For example, some researchers (Elliott, 1999; Elliott & Church, 1997; Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002) have
reported that performance goals may result in improved performance and achievement, and that mastery goals are more closely linked to intrinsic interest in the task. In the revised triarchic perspective, an important distinction has been made between performance-approach and performance-avoidance goals (Elliott & Church, 1997; Middleton & Midgley, 1997; Skaalvik, 1997).

The three different goal structures in the triarchic approach are performance-approach, performance-avoidance and mastery goals. Hidi and Harackiewicz (2000) suggest that performance-approach and performance-avoidance goals are functionally different goals that lead to differing outcomes. Students who are focused on performance-approach goals are oriented to doing better than others by demonstrating their capability. Performance-avoidance goal students are attempting to avoid looking stupid or incompetent, therefore leading them to avoid the task at hand. Performance-avoidance goals are linked to less adaptive outcomes, whereas performance-approach goals are positively related to task value (a mastery orientation) and academic self-concept (Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002). Harackiewicz and her colleagues (Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002) have argued that besting others and extrinsic rewards are worthy and valued purposes. However, Kaplan and Middleton (2002) disagree that beating others should be a goal associated with facilitating the primary purposes of education, that of educating everyone, facilitating social responsibility, and developing critical reflection over societal processes in defining individual’s school success.

As outlined by Covington (2000) performance-based students approach success and invest considerable effort in their goal of outperforming others, whereas performance-avoidant students reflect patterns of reduced effort and task persistence. Either form of performance-based strategy is underpinned by competing
Achievement motivation

against others where externalised social comparisons are involved. Covington, suggests that there are two explanations as to why students apply or avoid effort: some focus on beating others in the performance-based goals while for others, a degree of inability to perform leads to avoidance mechanisms.

In response to Elliott (1999) as well as Hidi and Harackiewicz’ (2000) claims, the proposed revision into the triarchic model has been challenged by several researchers (Kaplan & Middleton, 2002; Midgley, Kaplan, & Middleton, 2001). Re-emphasising the lack of support for performance-avoidant goals, Middleton and Midgley (1997) concluded that rather than the distinction between approach or avoidance, our results indicate that it is the distinction between task and performance goals that is essential. Mastery (task) goals are related to the development of competency and gaining an understanding through insight, whereas, performance goals “relate especially to how ability is judged and how one performs, especially relative to others” (Midgley, Kaplan, & Middleton, 2001, p. 77). Performance goals may relate to some positive outcomes, however, the aspect of meaningful learning and retention of the information in a mastery goal focus is not attained to the same degree and instead a performance goal is competing or beating others.

An expansion of Achievement Goal Theory into a four goal approach, that is a two by two model, has also been proffered (Barron, Finney, Davis, & Owens, 2003). This model divides the mastery goal focus into mastery-approach goals and mastery-avoidance goals, and also divides performance goals into performance-approach goals and performance-avoidance goals (Barron et al). Recent theorising and research, however, has suggested that mastery and performance goals are not polarised goal structures and that individuals may hold differing levels on these
continuums that vary in salience, depending on the nature of the task, the school environment and the broader social and educational context of the institution (Bateman, Bransford, Goldman, & Newrbrough, 2000; Blumenfeld, 1992; McInerney & McInerney, 1998; Urdan & Maehr, 1995; Wentzel, 1991). Therefore, the call for an expansion of Achievement Goal Theory due to a necessity to explore approach and avoidant goal performance domains separately may not be necessary.

Dividing mastery and performance goals into approach and avoidant domains may actually be moving away from identifying purposeful pursuits in achievement motivation. As suggested earlier, instead of the need for an expansion of mastery goals and performance goals into approach and avoidant domains, the inclusion of measures of competence (Elliot, 1997, 1999; Elliot & Church, 1997; Elliot & Harackiewicz, 1996; Harackiewicz et al., 1998) and effort pursuits may be more appropriate. This enables understanding of the factor that is driving or alternatively lacking, in adolescents’ motives to achieve. While initial support is forthcoming from empirical research towards the triarchic model, the maladaptive patterns related to performance only occurred in the performance-avoidant groups (Elliot, 1997; Elliot & Church, 1997; Elliot & Harackiewicz, 1996; Harackiewicz et al., 1998, Pintrich, 2000) and low perceptions of competence tended to result in performance-avoidance goals. Further, Pajares, Britner and Valiante (2000) also found that performance approach and avoidance had differing relationships with measures of self, and this tended to change developmentally. In other words, younger children had different relationships between performance goals and measures of self than older children, thus giving support to the analysis undertaken in this thesis, that is, examining a developmental profile of different goal pursuits and measures of self across time.
The apparent distinction between the approach and avoidance domains is linked to perceptions of academic competence (Harackiewicz & Elliott, 1993), which in turn, may impact on the degree of effort applied (Covington, 2000). However, there may be a number and variety of reasons why students approach or avoid given goals. Elliot and Thrash (2001) describe this as an “idiographic variant”, where individuals may adopt a specific goal (or more likely a variety of goals), that is, “within each achievement goal category there may be a great deal of variability in the representational level of the goal” (p. 146). Therefore, having a measure of approach or avoidance for each primary goal structure would not facilitate a comprehensive understanding of the problem. Instead, providing an instrument that measures the salience of the student’s academic competence/capability and effort pursuits may better clarify and evaluate achievement motivation by providing a profile of the individual’s goal pursuits. In this case, this would offer educators a normative approach to achievement goals, where they may intervene to establish a student’s facilitative or non-facilitative approach towards the desired end-state.

**Social Cognitive Theory**

Social Cognitive Theory provides a mechanism to explain students’ pursuits within academic environments because it draws on studies that relate to individual differences in self-perceptions of capability and efficacy (Bandura, 1997). “In social cognitive theory, sociostructural factors operate through psychological mechanisms of the self system to produce behavioral effects” (Bandura, 2001, p. 15). Bandura states

“Perceived self-efficacy occupies a pivotal role in the causal structure of social cognitive theory because efficacy beliefs affect adaptation and change not only in their own right, but through their impact on other determinants (Bandura 1997; Maddux 1995; Schwarzer 1992). Such beliefs influence whether people think pessimistically or optimistically and in ways that are self-enhancing or self-hindering. Efficacy beliefs play a central role in the self-regulation of motivation through goal challenges and outcome
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expectations. It is partly on the basis of efficacy beliefs that people choose what challenges to undertake, how much effort to expend in the endeavour, how long to persevere in the face of obstacles and failures, and whether failures are motivating or demoralizing. The likelihood that people will act on the outcomes they expect prospective performances to produce depends on their beliefs about whether or not they can produce those performances.” (p. 10).

The use of a multidimensional approach, including self-perceptions, offers the potential for a better and more sophisticated understanding of the complex phenomena of motivation, learning and achievement. Performance goals have been suggested as the alternative to a mastery goal in the ‘normative approach’ within Achievement Goal Theory (Midgley, Kaplan, & Middleton, 2001). However, while these two domains need to be included, they have been overemphasised in the literature when trying to understand achievement motivation during adolescence. Instead, this thesis proposes that expanding Achievement Goal Theory through a social cognitive theoretical framework to include measures of competence and perceived capability as well as social and extrinsic goals would provide a more comprehensive profile for gauging achievement motivation during adolescence. The agentic perspective incorporated in a social cognitive framework suggests that adolescents are not just passive recipients to the external environment, but rather that a form of reciprocal determinism may be incorporated between the individual and the environment (Bandura, 2001).

“Goal theory assumes that goals are cognitive representations of what individuals are trying to accomplish and their purposes or reasons for doing the task” (Pintrich, 2000, p. 96). The models presented by Maehr (Maehr & Braskamp, 1986) and McInerney (McInerney & Sinclair, 1991) which incorporate self perceptions, mastery goals, performance goals, social goals and extrinsic goals provide a mechanism for a better understanding of some of the more subtle nuances of adolescents’ achievement
motivation during high school. Deci and Ryan (1989) emphasised the complimentary aspects of Achievement Goal Theory and SDT through a response to issues around task/ego involvement and intrinsic/extrinsic motivation. Both theories are based on Social Cognitive Theory and relate to the positive relationship between perceptions of competence and/or capability and facilitative learning, however as outlined they suggest each theoretical framework focuses on different aspects of motivational pursuits. SDT involves the components of autonomy, competence and relatedness where Achievement Goal Theory relies on the purposes and reasons why individuals pursue a given goal (Anderman, Hicks, & Midgley, 1998).

Summary of motivational theories

Two theories that have emerged in much of the contemporary literature to explain the purpose or reason students engage in, and/or are motivated to achieve within the context of the classroom are Self-Determination Theory and Achievement Goal Theory (Anderman, Hicks & Midgley, 1998). As outlined above these two theories provide strong support for the inclusion of their relevant factors: intrinsic, extrinsic, self-efficacy, mastery and performance goals being combined under a social-cognitive framework.

Identifying a model to enable mapping of the goals that adolescents pursue during high school would be limited if the two-goal or triarchic model was used. Instead, an investigation incorporating the main factors outlined would provide a more comprehensive approach that relates to Social Cognitive Theory. As Mackie and Skelly, (1994) have suggested “Compared to earlier approaches, the effects of resource allocation during every substage of information processing is accorded much more emphasis in a social cognitive analysis” (p. 265). Both conscious and unconscious processes may be included in the interpretation of new information that
dictates our evaluation of that information. Our perceptions may be initially based on an automatic response to our beliefs about self. Social/environmental features and past performances may impact on adolescents’ beliefs about self and in turn impact on their potential outcomes. Self perceptions are particularly malleable during adolescence and therefore measures of self need to be included when mapping the patterns of development using a multidimensional measure. This expanded model would provide educators with the knowledge to guide and direct adolescents during this critical time.

The work that both Maehr (Maehr & Braskamp, 1986) and McInerney and colleagues (Hinkley & McInerney, 1998; McInerney, 1992, 1995a; McInerney, Roche, McInerney, & Marsh, 1997; Simpson & McInerney, 2004) have undertaken provides an expanded model of achievement motivation based on a social cognitive approach. Their models include eight motivational pursuits to evaluate and explore achievement motivation as well as four self-perception scales to enhance the applicability of the instrument. This broader framework defines the way students engage in academic pursuits. For example, in extrinsic goals, the receipt of praise and/or rewards may be more salient for the individual.

Maehr’s Personal Investment model includes the factors of extrinsic goals, social goals, mastery goals and performance goals as well as Sense of Self scales, which allowed for a more comprehensive profiling of the motive to achieve during adolescence. This multidimensional approach, initially suggested by Maehr was used by McInerney and colleagues in their ISM (Inventory of School Motivation) scale. McInerney’s ISM was designed to measure adolescent motivation in the school context. Later McInerney’s GAGOS scale was used to capture the hierarchical structure of adolescent motivation through mastery, performance and
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While these instruments were independently valuable, measures of self-concept that specifically pertained to the subject domains of English and maths were not included. These two subject domains importantly act as a comparative gauge for all adolescents in these key-learning areas in New South Wales’ high schools. This led to the incorporation in the SMOSA, of Marsh’s academic self-concept measures of English self-concept, maths self-concept and general academic self-concept measure (Simpson, Vickers, Kristovics, & Marsh, 2005a; Simpson, Vickers, Kristovics, & Marsh, 2005b).

The impact of self-efficacy is not new to Achievement Goal Theory as it forms the basis of the call for an expansion of the Achievement Goal Theory models (Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002). Perceived capability appears to be one of the underpinning mechanisms for the suggested expansion to a triarchic or four factor model (Elliott & Dweck, 1988; Midgley, Kaplan, & Middleton, 2001). The strong link to self-efficacy in the literature also highlights the need to include self-perceptions of capability rather than capacity (intelligence level) (Schunk, 2000). Capability refers to “a person’s or a group’s freedom to promote or achieve valuable functioning” (Alkire, 2002, p. 184). It is this definition that is sought when assessing adolescent’s achievement motivational pursuits in the academic domain. The twelve constructs that will form the basis of the SMOSA are: eight motivational measures (task, effort, competition, leader, social concern, affiliation, reward, praise); three competency measures (English self-concept, maths self-concept, general academic self-concept); and a newly designed measure of Perceived Academic Capability (PAC).
**Self theories - Introduction self-concept, self-efficacy and self-esteem**

Perceptions of self have been stressed in a wealth of research as being able to explain many behaviors, including behaviours in the area of academic achievement and motivation (Anderman & Maehr, 1994). The work of Bandura (1997), through his social Cognitive theoretical framework, suggests that the function of self evaluation organises, motivates and directs the individual’s behaviour. Research on self perceptions has increasingly found support for individuals’ motivation and performance being enhanced by positive perceptions of self (Maehr & Braskamp, 1986). Like achievement motivation, a significant amount of self-perception research has emerged with varying theoretical frameworks.

However, including measures of self perceptions in this research presents a dilemma as to which construct appropriately relates to achievement motivation during adolescence and how best to measure that construct. Conceptual confusion has been emphasised between several terms, used interchangeably in the literature. The three terms of self-concept, self-efficacy and self-esteem have been used as measures of self-perception within the literature, and each of them has been inextricably linked to achievement motivation (Bong & Clark, 1999). Although there is considerable overlap, these three terms are distinct. Skaalvik and Bong (2003) suggest “it seems reasonable to assume, on the basis of limited available evidence, that there is at least considerable overlap in self-concept and self-efficacy and that perception of competence is the major common denominator between the two” (p. 69).

**Self-concept**

The organisation of students’ cognitions regarding their academic achievement has been strongly linked to the role of self-concept. Self-concept has been claimed to
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be the individual’s fundamental frame of reference and the foundation from which all actions stem (Skaalvik, 1997). Appraisals of the evaluation of the self with reference to significant others, social comparisons, and self-attributions naturally lead to self-concept inquiry (Skaalvik). Markus and Wurf, (1987) suggested that, “Self-concept does not just reflect on-going behavior but instead mediates and regulates this behavior. In this sense the self-concept has been viewed as dynamic-as active, forceful, and capable of change. It interprets and organises self-relevant actions and experiences; it has motivational consequences, providing the incentives, standards, plans, rules and scripts for behavior, and it adjusts in response to challenges from the social environment” (p. 299).

Contemporary research highlights the value of self-concept in achievement motivation. According to Marsh and Craven (2002) “self-concept is one of the oldest, most important, most controversial and most widely studied constructs in the social sciences” (p.84). The history of this measure however has not been without controversy. The initial work of Shavelson, Hubner and Stanton (1976) challenged the structure of self-concept as being a unidimensional measure and instead suggested that a hierarchical, multidimensional approach would provide a better understanding of this complex area of investigation. Shavelson, et al’s model suggests that the best fit is achieved through a hierarchical structure that initially splits self perceptions into either academic or non-academic self-concept dimensions. The academic structure was divided into the academic domains of maths, English and General Academic self-concept, while the non-academic domains were social, emotional and physical self-concepts (Shavelson, et al). Over the last thirty years research into self-concept has aimed at clarification of this
construct and current theory suggests it should be examined through specific domains (Marsh & Craven, 1997a).

Research into the study of self concept and achievement by Marsh and colleagues resulted in a model in which near-zero correlations between the academic domains of English and maths were found. The Internal/External Frame of Reference model (Marsh, 1990a; Marsh & Hau, 2004b) is particularly relevant during adolescence. The Internal Frame of Reference refers to the comparison process of one academic domain to another at the individual level, for example, comparison of one’s performance in maths with their performance in another academic domain, such as English. The External Frame of Reference posits that student’s compare their academic achievement in, for example, maths, with that of their peer’s achievements in the same academic domain. This process of comparison with others would have either a positive or negative effect on the student’s self-concept in that particular academic domain (Marsh, 1990a; Marsh & Hau, 2004b).

Therefore, Marsh and colleagues (1990a; Marsh & Hau, 2004b) proposed that the combination of the Internal/External Frame of Reference model should provide evidence for effects, which may counteract each other, on the reported moderate to high correlations of the achievement scores. This focus lends support to the underpinning mechanism driving self-concept research as having a social cognitive framework via the cognitions involved within the social context.

Marsh and colleagues’ comprehensive work highlighted that Self-concept is hierarchical and age specific. The development of his ASDQII (Academic Self Description Questionnaire for Adolescents) represented a psychometrically sound instrument to gauge adolescent self-concept that has been well supported in the literature (Byrne, 1998; Marsh, 1989, 1990a, 1990b; Marsh & Craven, 2002; Marsh
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Self-concept is a valuable indicator linking domain-specific measures of self-concept to achievement motivation and in turn student’s performance outcomes (Marsh, 1989). The relationship of achievement motivation to self-concept is sometimes evaluated through specific motivational goals. One such goal traditionally investigated in this area has been a performance-approach goal where a positive relationship with academic self-concept has been found (Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002). The domain specificity of self-concept has been recognised as a crucial underpinning mechanism when investigating achievement motivation. However, inclusion of self-efficacy with reference to aspects of perceived capability may broaden or add to the research, investigating components of self allowing for a more comprehensive account of achievement motivation (Simpson, Vickers, Kristovics, & Marsh, 2005a; Simpson, Vickers, Kristovics, & Marsh, 2005b).

**Self-efficacy**

Additionally, self-efficacy has been used to explain a wide range of behaviors, including academic achievement (Anderman & Maehr, 1994; Bandura & Locke, 2003). Bandura (1997) is well known for his research into self-efficacy as well as his theories on Social Learning and Social Cognitive Theory. He wrote “based on their understanding of human ability and belief about their own capabilities or potential, people initiate actions in their life to suit given purposes or goals without being consciously aware of how their choices orchestrate the neurophysiological events underlying that purpose or goal” (p.3). That is, outcomes emanate from actions and how one behaves largely determines the outcomes one experiences. As Bong and Clarke
(1999) have succinctly suggested “[s]elf-efficacy, compared to self-concept, deals
primarily with cognitively perceived capability of the self” … whether or not one has
the capability to carry out a course of action that leads to successful accomplishment of
goals is the focus of efficacy judgments” (p. 141). Self-efficacy refers to personal
judgments of the capability to organise and implement courses of action to achieve
required goals (Zimmerman, Bandura, & Martinez-Pons, 1992).

Several researchers have suggested that perceived capability is a major factor in
achievement motivation and the performance of an individual (Bandura & Locke,
2003; Bong & Clark, 1999; Covington, 2000). Ability, however, has been variously
discussed with reference to capacity, (intelligence) as well as capability, that is, how
capable one believes oneself to be at a given task. The term ‘capability’ will be used
as a referent for the perceived ability to perform and the term ‘ability’ will refer to
intelligence in this thesis unless otherwise qualified.

A large part of Bandura’s work and theory has been based on self-perceptions
where the roles of cognition and social influence are included within the framework
(1997). Bandura emphasised that the role of self and the choices made by an
individual, will impact on their potential accomplishments. Bandura (1997, p. 4)
stated, “If people have a perception or belief that they have no power to produce
results, they will not attempt to make things happen” and, therefore, will not be
motivated towards achievement.

Finally, it has been argued that self esteem has a strong influence on one’s
actions (Harter, 1999b). This global form of self has been variously argued as
driving an individual’s choice. However, the choices people make on whether to
engage in a task hinges not only on student’s interpretation of their academic ability,
but also on their perception of capability in the given task (Schunk, 2003). That is,
how motivated one is in the academic environment appears to be related to how
cOMPetent one feels they are to achieve within that context. Perceptions of self need
to be included in research investigating the motive to participate and achieve.

Self-esteem

When Bandura evaluated the concepts of self-efficacy and self-esteem, he
recognised that these two terms have often been used interchangeably, as though they
represented the same phenomenon. He stated: “They are different; self-efficacy is
concerned with judgments of personal capability, whereas self-esteem is concerned
with judgments of self-worth” (Bandura, 1997, p. 4). There is no fixed relationship
between beliefs about one’s capabilities and whether one likes or dislikes oneself.
Individuals may judge themselves as lacking competence in a given activity without
suffering any loss of global self-esteem, especially when they do not invest their self-
worth into that activity. For example, just because someone does not believe they are
good looking, does not mean they will devalue themselves in the academic arena.

As Bandura (1997) suggests “self-liking does not necessarily beget performance
attainments” (p. 11). Conversely, individuals may regard themselves as highly
competent in an activity but take no pride in performing it well. People need a lot
more than high self-esteem to do well in any given pursuit. Perceived personal
efficacy predicts the goals people set for themselves and their performance
attainments, whereas self-esteem affects neither personal goals nor their
performance outcomes (Bandura, 1997).

Self-esteem is a global structure of self-worth or value (Bandura, 1997).
However research has questioned the unidimensional structure of self-esteem and
suggests that it does not provide an explanation for any given behaviour and instead
a better definition would require a multifaceted and complex explanation (DuBois,
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Burk-Braxton, & Tevendale, 2002; Marsh, 1994b; Shavelson, Hubner, & Stanton, 1976). Arguments have focused on whether self-esteem as a global construct can adequately address the differing levels of self-evaluation within the person, that is, self-esteem may have limited explanatory power in predicting which particular outcome will occur in a specific context. This suggests that self-esteem should be examined within the domain specificity of subjects in high school. Because one’s self-esteem as a global construct can have many reference points (Harter, 1999a), domain specific measures of self (Bandura & Locke, 2003) have been suggested to be better indicators of an individual’s academic outcomes, motivation and achievement (Marsh & Craven, 1997a).

**Summary of self theories**

A distinctive feature emerges when reviewing research on achievement motivation within the academic context, relating to explicit emphasis on ‘competence’ being linked to performance. The term competence initially implies “the quality of being competent; adequacy; due qualification or capacity” (Macquarie University, 1985, p. 382). However, competence is more nuanced than this limited definition suggests, especially when reviewing the relationship that emerges within an achievement motivational context. The term competence has been referred to as capability, ability, beliefs, and as to how one evaluates oneself on past performance. This evaluation also touches on another definitional framework of competence variously used in the literature. That is, competence or ability being defined in terms of capacity, such as in reference to levels of intelligence. As the above reference implies, competence as capacity can be viewed either as an ‘entity’, or as a property that can undergo incremental change. Entity theorists believe that intelligence is fixed; while Incremental theorists believe intelligence may increase
Achievement motivation (Robins & Pals, 2002). Therefore, if a student perceived his or her academic capability as fixed it is unlikely that the effort to achieve incremental improvements would be undertaken and self-perceptions relating to his/her lack of competence would be reinforced through a self fulfilling prophecy.

Achievement motivation and perceptions of self both have emphasised the multidimensionality of their structure. Bandura (1997) suggested that self-concept is a view of oneself formed through a presumption of direct experience and previous evaluations made, which may impact on future performances and/or guide individuals in choosing whether to participate in the activity. Self-concepts are measured by having people rate how competent they perceive themselves to be in given domains, for example English or maths, through descriptive statements of different attributes which they apply to themselves. The measures directly relate to the students’ past performance outcomes, for example, “I am good at English”. Therefore, self-concept is an evaluation based on previous performance in a given domain and, as such, is a valuable indicator. However, it may not capture the aspects related to self perceptions that Maehr and Bandura accentuate in their research explaining components of self linked to achievement pursuits. Bandura (1997) suggests “Self-concept loses most, if not all, of its predictiveness when the influence of perceived efficacy is factored out. Such findings suggest that self-concept largely reflects people’s beliefs in their personal efficacy” (p. 11).

have suggested that the complexities of self-concept are related to cognitive responses that are influenced through social comparison. Therefore, self-efficacy measures perceptions of capability and self-concept measures academic competence. Both need to be included when trying to evaluate a profile of self perceptions. However, the value of a global measure of students’ academic perceptions such as self esteem could also be captured in Marsh’s academic self description questionnaires, through his general academic self-concept measure.

**Multidimensionality of motivation and self through Social Cognitive Theory**

Contemporary debate regarding the expansion of the two goal theoretical perspectives to evaluate achievement motivation has seen researchers call for a variety of multidimensional measures. A revised multidimensional model initially advocated by Maehr, and more recently McInerney has been used to explain the varying goals that student’s pursue within the motivational context. Both have incorporated in their scale, Maehr’s (Maehr & Braskamp, 1986) Personal Investment Theory (PIM) and McInerney’s (McInerney & Sinclair, 1991) Inventory of School Motivation (ISM) respectively, as measures related to self perceptions based on Achievement Goal Theory. This thesis argues that rather than expanding achievement motivation into a triarchic or a four factor model, expansion of the model to include measures of perceived competency (through the domain specific frameworks of self-concept, a measure of perceived academic capability and a global academic self-concept measure) in conjunction with eight motivational pursuits may provide a more comprehensive model to explain achievement motivation (these models will be discussed in further detail in the next chapter).

Within a social cognitive framework, the mechanism of social comparison used in measures of self-efficacy and self-concept allows for the evaluation and
understanding of adolescents’ perceptions within these dimensions. Studying both the multidimensional nature of achievement motivation and self perceptions should provide a more comprehensive instrument to evaluate the dynamic process involved in an adolescent’s profile across grades and sex. Using this expanded multidimensional model to profile motivation incorporating measures of mastery, performance, social and extrinsic goals in conjunction with four measures of self perceptions, will assist educators in their understanding of the unique process of achievement motivation during adolescence.
Chapter 3

Literature Review – Part Two

Multidimensional nature of achievement motivational pursuits

Achievement Goal Theory encompasses substantial bodies of research on mastery goals and performance goals (Dowson & McInerney, 2004; Hinkley & McInerney, 1998; Wentzel, 1989). As previously discussed, by limiting enquiry to these two goals, many valuable insights into the complex nature of adolescent motivations are undervalued. Broadening the investigation to include dimensions that have been highlighted in SDT such as extrinsic goals and measures of self would lead to a more informative and comprehensive model. Further, it is argued that the use of a multidimensional instrument graphing adolescent profiles, underpinned by a social cognitive approach will enhance our understanding of this complex phenomenon. For example, to understand that students may be motivated in their efforts toward a task only when they are assisting others through mentoring, would provide the investigator with knowledge of the optimal path to initiate engagement for that student. This focus may lead the student to undertake positive learning strategies through the initial engagement of mentoring others in the social concern pursuits. Under the typical dichotomous framework or even the four factor model of approach and avoidant goals, this mechanism would not have been identified. The proposed scale to be used in the present research will be broad enough to capture the varying motives of adolescence, and as suggested social concern pursuits are paramount at this time of development.

Some researchers have suggested that social goals may not be independent but work in conjunction with other academic goals to influence achievement through initiating engagement (Wentzel, 1999a). Other researchers (Urdan & Maehr, 1995)
have claimed that the value of social goals has not been recognised due to the predominance of mastery and performance goals and have called for social goals to be included in much the same way as the other achievement goals. This is particularly relevant during adolescence when social goals need to be acknowledged and explored systematically within the achievement motivational context. As Urdan and Maehr (1995) point out, research has shown that social goals are particularly important during adolescence, because of the changed social networks that are incurred by the transition from primary school to high school. “Making new friends may take on increased importance during early adolescence, making the relationship between social goals and achievement most salient during this stage of life” (Urdan & Maehr, 1995, p. 235). Social goals, as well as mastery and performance goals, can be conceptualised in terms of the approach-avoidance distinction such as the need for affiliation (approach) or the fear of rejection (avoidance) (Elliot & Thrush, 2001). However, there is little research on the developmental patterns associated with social goals, and Urdan and Maehr (1995) have encouraged longitudinal research examining both age and gender in social goal orientation.

The inclusion of extrinsic goals has also been called for in the literature (Weiner, 1990). SDT includes extrinsic goals, that is, the internalisation of these goals, as one of the main dimensions used to evaluate progress towards facilitative learning. Weiner’s (1990) analysis of the history of motivational research assessing the contemporary devaluing and exclusion of extrinsic motivational goals suggested this practice was restrictive. Instead, he suggested that inclusion would provide an understanding of practices within the school context to better explain the complex relationship of motivation. While it is recognised that the goal of engagement and learning should be the focus of schooling, for some students, the use of rewards or
praise may be the only way to persuade some students to participate at school.

According to CET, however, extrinsic goals as a pathway to facilitate learning should decline during high school. Given the context of schooling with an increased emphasis on higher grades (extrinsic goals) these goals need to be included when examining the process of motivation across high school to ascertain the possible change in their direction and salience.

The role of performance goals and mastery goals is acknowledged within an Achievement goal framework and this thesis argues that a multidimensional approach to assess student motivation should be incorporated. While Harackiewicz and colleagues (Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002; Harackiewicz & Elliott, 1993) emphasise the value of performance goals in achievement motivation, there is a further need to clarify how varying goals change differentially across grades. When referring to achievement motivation in the sports context, there is an emphasis on personal bests being achieved; on individual improvement, that of working towards the individual’s potential, and not expending energy on a focus of beating others. This focus should be translated to the academic context, where value is placed on the process rather than the final outcome of succeeding. Similarly, achieving academically involves progressive improvement to reach one’s optimal potential. This appears to be a more realistic pursuit that everyone in a class can attain, rather than one of trying to set a standard of beating others and being first which means that the final value is an unknowable end-state and a goal that is difficult for students to pursue. This approach of personal bests has been used in the sports domain with success and equally applies within the educational context of a classroom.
The goal of schooling should not be geared towards having one winner, but instead motivating students towards being involved in the learning process and working towards their own optimal potential. Having a tool that can identify individual motivational pursuits and can act as a profile to gauge motivation across students generally, would be beneficial when trying to understand what motivational pursuits are salient for individuals. Whether different factors emerge as being the most salient at differing grade levels or whether males and females have different factors present requires investigation.

**Personal Investment Model**

The initial work by Maehr (1989) into the field of motivation and the development of his Personal Investment Model proposed four broad goal systems presumed to be universal; task goals, ego goals, social solidarity goals and extrinsic rewards goals. Maehr’s model drew on the work of McClelland and summarised the motive to achieve as limited if a unitary structure was used for the purpose of evaluation. Maehr suggested that “it also seems wise to consider a profile of motive patterns, rather than concentrating on the existence of one particular motivational characteristic (Maehr & Braskamp, 1986, p. 23). McClelland’s work also included the affiliative motive and leadership motive with a focus on motivation as a process: “The motivational process culminates in the observation that action is taken or a course is pursued … The study of motivation thus involves the definition of critical junctures and the identification of factors that determine which plans are followed” (Maehr & Braskamp, p. 47). The role of cognitions was based on a number of components such as sense of competence, sense of autonomy, and sense of purpose (incorporated in Maehr’s Personal Investment Model) which may variously impact on the motivational pursuits of the individual (Maehr & Braskamp, 1986; McInerney,
Roche, McInerney, & Marsh, 1997; Maehr & Simmonds, 2004). This initial model paved the way for McInerney and associates (McInerney, Roche, McInerney, & Marsh, 1997) to operationalise a multidimensional measure in the school context based on Achievement Goal Theory. As Maehr stated:

“One of the issues that has captivated significant attention in recent years is the differential effects of different purposes on how individuals invest in a course of action. Much of that work has focused primarily on four goals or purposes: Task/Mastery, Performance, Social and Extrinsic goals. Each of these goals has been given significant attention in the literature and each seems to have quite interesting and differential effects upon the kind of choices individuals make, as well as the actions and outcomes that follow”.

(Maehr & Simmonds, 2004, p. 7)

As noted, understanding achievement motivation through a multidimensional profile presents an interesting and challenging venture. As Maehr and Braskamp (1986) suggested, “Personal causes of motivation might best be viewed in terms of a profile of motives. To predict how a person will invest himself or herself in a given situation, one should consider the varying strengths of motives in that person” (p. 26).

The role of experience was also included in Maehr’s model with the inclusion of cognitions and evaluations of situations in his sense-of-self scales. As he suggested, cognitions mediate motivation (Maehr & Braskamp, 1986). Maehr’s motivational factors relate to the dimensions used in both Achievement Goal Theory and SDT. Self Determination Theory’s emphasis on intrinsic, extrinsic (rewards) and self-efficacy align with Maehr’s goals of mastery, rewards and his sense of self scales. His goals of mastery and ego are synonymous with Achievement Goal Theory’s primary factors of mastery and performance goals. In addition, social solidarity (otherwise known as social goals) was included in his multidimensional model and a call for inclusion of social goals in Achievement Goal Theory has been made by several researchers (Maehr & Braskamp, 1986; McInerney, Marsh, & Yeung, 2003;
Maehr’s Personal Inventory Investment Model posits that multiple goals, which include cognitions best, explain achievement motivation. He incorporated four sense of self scales in his model, which encompassed the organised collections of perceptions, beliefs and feelings related to their perceptions of self (McInerney, 1995b).

**McInerney’s Inventory of School Motivation - ISM**

McInerney’s ISM (Inventory of School Motivation) was designed to reflect the dimensions of Maehr’s Personal Investment Model to investigate school motivation in cross cultural settings (McInerney, 1995a). The ISM comprised four higher-order factors of mastery, performance, social and extrinsic goals for motivational pursuits (McInerney, Yeung, & McInerney, 2001). These higher-order factors were divided into eight motivational orientation scales; task, effort, competition, social power, affiliation, social concern, praise and token with adaptation of the items so they could be specifically used for adolescents within the school context (McInerney, Roche, McInerney, & Marsh, 1997; McInerney, Yeung, & McInerney, 2001). Within this framework, each higher-order factor was divided into two lower-order factors. For example, mastery goals were divided into task and effort pursuits; performance goals into competition and leader pursuits; social goals into affiliation and social concern and extrinsic goals into reward and praise pursuits (McInerney & Sinclair, 1991; McInerney, Yeung & McInerney, 2001; McInerney, Marsh & Yeung, 2003). In addition, four self perception scales were included within this model; for positive and negative self esteem, self reliance and sense of purpose.

**McInerney’s General Achievement Goal Orientation Scale - GAGOS**

In addition, McInerney has designed an achievement motivational scale called the General Achievement Goal Orientation Scale (GAGOS), which is a multidimensional
measure specifically designed for adolescents. This scale was developed by McInerney and colleagues to gauge achievement motivation within the school context (McInerney, Marsh, & Yeung, 2003). McInerney’s GAGOS motivational instrument explicitly uses the term motivation in each of the motivational items (McInerney, Marsh, & Yeung). For example, an item under the GAGOS’ General social goals is “I am most motivated when I work with others” (McInerney et al., p. 338).

The GAGOS’ 33 items have been tested in previous research to reflect general motivation in four targeted areas; namely, General mastery, General performance, Global Motivation and General social (McInerney, Marsh, & Yeung, 2003). Each of the specific and general scale items attempts to evaluate the nature and quality of adolescent student motivation during high school (Dowson & McInerney, 2003). The GAGOS scale was based on the ISM format, however the GAGOS did not include measures of self perceptions or extrinsic goals The GAGOS and ISM have been validated in previous research (McInerney, Marsh, & Yeung). These two scales specifically addressed adolescent motivation in the classroom context with a focus on achievement. Combining the goals identified in the ISMR and including referent items from McInerney’s GAGOS allows for an expansion of the intent of motivational pursuits during adolescence by encapsulating the strengths of each scale. By then evaluating how the items may best represent the meaning of each factor and then discarding duplications, a 34-item scale for the 8-lower-order motivational pursuits (4 high-order factors) emerged in the present study.

**Mastery goals**

Central to a mastery goal is the notion that individual effort leads to success and learning, which is intrinsically valued (McInerney & McInerney, 1998). A mastery goal reflects a student’s orientation toward developing new skills, trying to
understand work and sensing a level of self improvement (McInerney & McInerney, 1998; Hidi & Harackiewicz, 2000). Students who adopt a mastery goal focus are more likely to engage in deep cognitive processing, such as thinking about how newly learned material relates to previous knowledge. This may in turn lead to an understanding of more complex relationships (Ames, 1992). Students, who are mastery focused work towards greater understanding, enjoy the sense of challenge along the way, and have an internalised view or sense of personal achievement that is not dependent upon external or extrinsic rewards and, therefore, their achievement is facilitative from a learning perspective.

A mastery or intrinsic focus qualifies both the context of the task and amount of effort or commitment in the task that the individual undertakes independently (Ames, 1992). For example, a mastery goal outlining the task component focuses on students seeing improvement or interest in their schoolwork. The effort component relates to both the degree of engagement relative to the level of achievement and that the challenge of the task is interesting (Schunk, 2000). Mastery goals stand in contrast to extrinsic goals in CET (Ryan & Deci, 1989). Extrinsic goals have been associated with praise (also known as recognition) and/or rewards (or tokens) in the form of grades. Condry and Chambers, (1978) found that students who were mastery focused used more efficient, logical methods in decision making when confronted with complex intellectual tasks than those who were extrinsically oriented. Lepper (1988) also found that mastery focussed students used adaptive strategies to understand new information, even when this required more effort, because it enabled the students to process the information more deeply.
Performance/Ego goals

In contrast to a mastery goal, a performance goal is referenced to others, in either competing against them or in wanting to be the leader of a group (Simpson, Vickers, Kristovics, & Marsh, 2005b). Success is demonstrated by performing better than others, by surpassing norms, or by achieving success with apparently, little effort (Ames, 1992). A performance goal is based on one’s desire to perform and compete successfully or to seek power through leadership and the two pursuits under the performance goal have been differentially termed ego goals (Maehr & Braskamp, 1986). Students with a performance goal focus tend to use surface-level strategies, such as the rote memorization of facts and immediately asking the teacher for assistance when confronted with difficult academic tasks (Ames, 1992, p. 295).

The focus of a performance goal is on the academic comparison between the individual and others, on beating them, coming first or being in charge (Zusho & Pintrich, 2001a). Therefore, a performance goal may be divided into either competition, whereby social comparison is important particularly in the area of beating someone or, alternatively, leadership, where the student’s motivation is primed by the need to achieve and attain a position of status (McInerney, 1995b; McInerney, Roche, McInerney, & Marsh, 1997; McInerney, Yeung, & McInerney, 2001).

Debate in the literature has resulted in a call for an expansion of Achievement Goal Theory to a triarchic model. As mentioned previously, most of the literature refers to performance-approach goals as only being facilitative when mastery goals and competence beliefs are also high (Pintrich, 2000b). However, whether competing with others or being in charge through leadership, both relate to social comparison. As suggested by Marsh (1994a) the focus on ‘beating others’ or ‘being
in charge’ may inhibit the development of the more facilitative practices involved in learning, such as those associated with mastery goals.

**Social goals**

Several theorists have called for the inclusion of social goals when investigating motivation through Achievement Goal Theory (Maehr, 1989; McInerney, Roche, McInerney, & Marsh, 1997; Urdan & Maehr, 1995, McInerney, Hinkley, Dowson, & Van Etten, 1998; King, 2000). Supporting this view, Maehr (1989) and McInerney and colleagues (McInerney, Roche, McInerney, & Marsh, 1997; McInerney, Simpson & Dowson, 2003) stress that social goals critically impact on effort, even after academically oriented goals are taken into account. Students pursue multiple goals within the classroom context and for some social goals dominate their learning and engagement (Wentzel, 1993). As Gagne and Deci suggest “Satisfaction of the needs to be connected to others and to be effective in the social world support people’s tendency to internalise the values and regulatory processes that are ambient in their world” (2005, p. 377). In their investigation into the motive to achieve Wentzel (1999a) and Maehr (1989) have highlighted the prominence of social goals.

Research by McInerney and colleagues (McInerney, Marsh, & Yeung, 2003; McInerney, Simpson, & Dowson; McInerney & Sinclair, 1991; McInerney, Yeung, & McInerney) suggest that two primary social goals are important when addressing motivational enquiry during adolescence. These are the social goals of affiliation (student’s perceived importance of friendships at school in their learning) and social concern (perceived importance for students of being concerned for other students’ schoolwork and a willingness to help them in their learning) (McInerney, Marsh, & Yeung; McInerney, Simpson, & Dowson, 2003; McInerney & Sinclair; McInerney, Yeung, & McInerney). These two pursuits have been explored through the work of
King (2000) who has identified similar pursuits, that of prosocial goals and social responsibility goals. King’s prosocial goal is similar to McInerney and colleagues’ goal of affiliation and King’s social responsibility goal is synonymous with McInerney and colleagues goal of social concern.

The investigation of social goals within achievement motivation would provide a better understanding of the explanatory context through a social cognitive framework. However, the reluctance to include this perspective as students progress through high school, may be due to the suggested positive pursuit toward autonomy (that is self regulation) expected when working towards facilitative learning (Ryan & Deci, 2000). Contemporary enquiry has been biased towards the expansion of Achievement Goal Theory to a triarchic or four-goal model in much of the literature. The resources invested in these models have sidelined other important issues such as the social focus, and particularly during adolescence is an extremely important component of achievement motivation.

Importantly, these two social pursuits may have a differential impact on the outcomes within school (McInerney, Marsh, & Yeung, 2003). Prosocial classroom behaviour contributed significantly to performance outcomes even after taking academic capability into account (Wentzel, 1991). A link with social concern pursuits and academic gains has been identified during early adolescence. Wentzel’s (1993) research found sharing, helpful behaviour towards their peers assisted the individual student’s own academic success. Other researchers have suggested that social goals are an important aspect of adolescent’s learning and engagement through self regulation (Gagne & Deci, 2005). When students feel they belong, they can invest resources into learning at school (Osterman, 2000). For some students, affiliative pursuits are salient because the inclusion within a group of peers at school
Achievement motivation is a major priority (McInerney, Simpson & Dowson, 2003; King, 2000). However, the pattern of the development of this pursuit may change across the course of grades 7 to 11 and the nature of change has not been adequately assessed within a multidimensional profiling of motivational patterns of development. As discussed in SDT, the aspect of relatedness which involves developing satisfactory connections to others in one’s social group is critical for some adolescents (Anderman & Midgley, 1997).

Extrinsic goals

Research relating to extrinsic goals has predominantly been investigated through the polarised construct of an intrinsic versus extrinsic framework. However, a focus on the polarised nature of intrinsic versus extrinsic goals does not evaluate these motivational goals adequately (Biddle & Brooke, 1992). During early adolescence, extrinsic goals may be more pronounced than towards the end of adolescents’ schooling, (around grade 11) when this pursuit would be expected to lose its power for school engagement. Declines are expected progressively across adolescence towards extrinsic goals when the student is working towards facilitative learning in achievement motivational pursuits (Butler, 1988; Covington, 2002).

Weiner’s (1990) analysis of the history of motivational research suggested that contemporary devaluing and exclusion of extrinsic motivation was limited. Instead he suggested that a thorough analysis of achievement motivation would have to include this factor to better understand practices in the school context to enable interpretation of the complexities of motivation. Rewards in the form of grades or marks appear to be the focus for educational institutions, educators and parents whenever students’ progress is assessed. There is an emphasis on grades during high school (McInerney, 1995b; McInerney, Roche, McInerney, & Marsh, 1997;
McInerney, Yeung, & McInerney, 2001) and educators and parents strive toward motivating their students/children to achieve through these performance outcomes (Ryan & Deci, 2000).

Extrinsic rewards vary by level but also vary by dimension within this domain (Deci, Koestner, & Ryan, 1999). Extrinsic goals are related to external criteria such as the receipt of some tangible reward or may alternatively equate to praise or acknowledgment (Deci, Koestner, & Ryan, 1999; Maehr & Braskamp, 1986; McInerney, Simpson, & Dowson, 2003; McInerney & Sinclair, 1991). An extrinsic goal has been studied in several ways with varying outcomes dependent upon the type of extrinsic goal identified, such as praise pursuits or rewards pursuits (Deci, Koestner, & Ryan, 1999; McInerney & Sinclair, 1991). Two factors of extrinsic goals have been variously associated with differential effects of undermining versus enhancing intrinsic motivation (Deci, Koestner, & Ryan, 1999).

McInerney’s (1998) research findings suggested that self-satisfaction for achievement and praise were considered more important motivators than rewards. While praise has been included in the umbrella term of an extrinsic reward throughout the majority of the research, the effect of praise or positive feedback may be viewed differently to that of tangible rewards (Gagne & Deci, 2005). A meta-analysis conducted by Deci, Koestner and Ryan (1999) suggested that dependent, on the type of reward, intrinsic motivation is either enhanced or undermined by the form of extrinsic motivational pursuits. Their research found that positive feedback (verbal rewards) enhanced intrinsic motivation when it was communicated as a source of information/feedback compared to being administered as a form of control. In contrast, Deci, Koestner and Ryan (1999) found that reward (tangible) pursuits undermined intrinsic motivation.
In contrast, Hattie’s (2000) meta-analysis of extrinsic goals suggested that the use of both forms of extrinsic goal were unfavorable to learning and that both praise or acknowledgment may be just as detrimental to learning as reward goals (Hattie, 2000). Research by Juvonen and Nishina (1997) supported Hattie’s findings by suggesting that praising students was not related to improved performance or to gains in self-esteem. Instead they suggested that developmental changes in student’s perceptions of their capability influenced the amount of effort the students’ applied academically. Advocates for the dissemination of praise or acknowledgement suggest that only when praise is seen as a form of platitude, that is manipulative or controlling, is it negatively perceived (Deci, Koestner, & Ryan, 1999).

It is clear that conjecture in the literature exists and, therefore, whether disparate patterns emerge between praise pursuits and reward pursuits requires further explanation. This point is a contentious one but inclusion of this goal through the lower-order pursuits appears necessary when profiling achievement motivation across adolescence. Inclusion of reward pursuits and praise pursuits therefore may provide a more complete understanding of achievement motivational profiles during adolescence. Identification of when (at what grade) motivational factors lose their power for engagement and also whether the relative salience varies among those factors, between males and females, needs to be addressed.

Self perceptions

The importance of perceptions of competence relative to achievement motivation and actual performance outcomes across varying domains has been recognised (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). The desire to increase one’s sense of competence or capability is central to achievement motivational theory, enquiry and research (Maehr, 1989). However, Bong and Clarke (1999) suggested
that, “Self theories have long been plagued with the lack of more clearly differentiated literal meanings and correspondingly differentiated operational definitions of self constructs” (p. 140).

The link between self-perceptions and achievement motivation has been primarily investigated along two main structures, namely, self-concept and self-efficacy. Although, research suggests that efficacy beliefs contribute significantly to the level of motivation and outcomes (Bandura & Locke, 2003), there is research to support that self-concept (Marsh & Craven, 2002) may add significantly to the understanding of achievement motivation in the academic context. Perceived capability/competence is a primary motivator in adolescents’ behaviours and actions. (Bandura, 1997) However, the association of achievement motivation with students’ self-perceptions has presented a conundrum to researchers, as to which form of self perception best explains the link with achievement motivation. McInerney’s (2003) notion that an individual is the product of a complex set of interacting motivational goals, and self perceptions also supports the inclusion of self perceptions within a single scale. However, the inclusion of the domain specificity of self-concept may provide a more comprehensive evaluation of the self-perceptions of adolescents in the academic context of school, rather than a reliance on self efficacy alone.

**Self-concept**

Over the last three decades, Marsh’s work has focused on developing and testing scales that measure varying domains of self-concept, both academically and physically across various groups (Marsh, 1989). Marsh has established psychometrically sound instrumentation, namely his Self Description Questionnaires, for age specific groups that have been tested and verified across the literature (Byrne, 1998). His research findings reinforced the specificity of subject domains in relation
to perceptions of competence in the academic environment. The development of Marsh’s ASDQIIIs to measure the academic domains of adolescents’ self-concept (Marsh, 1994b) has been well supported in previous research.

*Self-efficacy*

The role of self-efficacy has been strongly linked to learning, motivation and performance under Bandura’s (1997) Social Learning Theory. Previously the mastery component of motivation has been viewed as facilitative towards learning and argued that students are not innately predisposed to being efficacious, but neither are they predisposed to being unmotivated. The aspiration to increase one’s sense of competence or capability appears to be at the heart of achievement motivational research and theory (Maehr, 1989). How capable or competent students believe themselves to be academically can colour their perceptions of how well they will perform regardless of their levels of ability (Bandura, 1997; Schunk, 2000). As Markus and Wurf have iterated, “representations of what individuals think, feel or believe about themselves are among the most powerful regulators of many important behaviors” (1987, p. 308). Therefore, the necessity for the inclusion of self perceptions, especially those that relate to competence and/or capability, is warranted in an investigation that is trying to comprehensively map patterns of achievement motivation during adolescence.

*Summary*

Over the last decade, research into identifying the mechanism describing academic achievement concluded that neither a cognitive nor a motivational model is independently adequate (Covington, 2000). Individual differences occur in achievement motivation and, ultimately, achievement motivational goals influence students’ level of engagement at high school. A certain level of maturity and
understanding is required for students to apply more effort when pursuing academic success and achievement (Ames, 1992; Butler, 1999; Middleton & Midgley, 1997). To this end, the newly designed SMOSA will include task pursuits, effort pursuits, competition pursuits, leader pursuits, affiliation pursuits, social concern pursuits, reward pursuits, leader pursuits, general academic self-concept, English self-concept, maths self-concept and PAC, to provide a comprehensive (12-factor), yet parsimonious (53-item) model of adolescents’ achievement motivation.
Chapter 4

Literature Review - Part 3

Patterns of change across adolescence in achievement motivational pursuits

The importance of achievement motivation during adolescence

When describing the ever changing adolescent, the Carnegie Council of Adolescent Development’s report stated:

“Adolescence is one of the most fascinating and complex transitions in the life span: a time of accelerated growth and change second only to infancy …. Its beginning is associated with biological, physical, behavioural and social transformations that roughly correspond with the move to middle school or junior high”.


Adolescence is the time when self appraisals of competence and capability are undertaken by individuals and these self evaluations are strongly related to their motivation to participate in learning. When negative evaluations emerge and are not challenged, adolescent’s future goals, aspirations and ultimately their career trajectories may be affected (Anderman, Anderman & Griesinger, 1999; Carnegie Council on Adolescent Development, 1989). The types of motivational goals pursued during adolescence are also important indicators for educators and motivational psychologists to assist adolescents during this time. Anderman and Maehr (1994) highlighted the susceptibility and importance of motivation during adolescence when they suggested that, “Adolescents either do not have it, have too much of it, or invest it in the wrong activities…. adolescence is indeed a period when motivation is a serious issue” (p. 287).

While the journey towards achievement during adolescence should be a time of choice and academic maturity, for some individuals this potential may not be realised, and as stated by the Carnegie Council of Adolescent Development (2000, p. 20),
adolescence “is a turning point towards a diminished future”. Therefore, these highly formative years present a challenge to educators and teaching institutions, to take up the responsibility for providing opportunities that lead to adaptive forms of learning during this period.

**Developmental theories during adolescence**

Adolescence begins between the ages of 11-12 and extends through the teen years (Santrock, 2002). No overarching theory exists that explains motivation. Valuable information however, has emerged which acknowledges that patterns of development in achievement motivation differ during adolescence. The social construction of identity or self that emerges during adolescence may assist in understanding how perceptions of self affect the motivational pursuits employed during this critical period.

During adolescence, tasks are explored through various dimensions of identity (Blustein & Phillips, 1990). Adolescents’ establishment of self (in other words, a sense of who they are, what they are capable of and where they are going in life) undergoes development (Blustein & Phillips, 1990; Marcia, 1966). As Marcia (1966) stated adolescence signals the commencement of the formation of an individual’s identity, which she defined as: “a self-structure, an internal, self constructed, dynamic organization of drives, abilities, beliefs, and individual history. The better developed this structure is, the more aware individuals appear to be of their own uniqueness and similarity to others and of their own strengths and weaknesses in making their way in the world. ... The identity structure is dynamic, not static with elements continually being added and discarded”. 

(Marcia, 1966, p. 159)
Several researchers (Nicholls, 1984; Butler, 1999; Stipek & Gralinski, 1996) have expanded Marcia’s focus on identity formation as being related to adolescents’ cognitions, specifically their self-perceptions. Adolescent development is primed by the appraisal of cognitions where low levels of self competence may equate to lower levels of effort and participation in a given task. Work by Nicholls (1989) suggested there was a lack of differentiation between ability and effort during early childhood; however during early adolescence the capacity to differentiate between these factors became established.

Self perceptions have been evaluated and expanded in Weiner’s theory of attribution, whereby if a student perceives a lack of ability or that the situation is too difficult, they will not partake in the task. Along the same theme, Bandura’s social cognitive framework suggests that self efficacy and performance outcomes relate to the individual’s comparison of self across domains, as well as with others in specific domains. This evaluation may impact on the formation of their identity as being competent. The relationship between self efficacy and performance outcomes may be the most crucial development in an adolescent’s academic profile.

Given that Achievement Goal Theory is based on a social cognitive perspective, which incorporates students’ perceptions and various goal pursuits; assessment of the changes that impact on students’ perceptions and their goal pursuits may be mapped over time using this theoretical framework. A comprehensive motivational profile in goal pursuits that looks at the developmental changes during adolescence has not been identified in the literature. During adolescence a systematic, longitudinal approach is warranted on these critical constructs. The multidimensionality of achievement motivational pursuits needs to be mapped to identify any emergent differences between factors that are not identified by limiting
Achievement motivation

the investigation to mastery and performance goals. Rigby, Deci, Patrick and Ryan (1992) suggest that “a dichotomy may be constructed and reified” (p. 166) which may be applied to the premise that mastery and performance goals may not fully explain Achievement goals.

The Differentiated Concept of Ability (DCA) suggests that a lack of effort and engagement within the school context may be responsible for the lack of motivation in some adolescents (Butler, 1999). When students perceive that they lack the ability to compete in a task or that the situation is too difficult they may not participate, resulting in diminished effort and application at school, even though they may appear competitive in other aspects of their life, such as sport.

The emphasis on self during adolescence is highlighted in most of the developmental work as a critical element in the motivation to achieve. Bandura’s (1997) social cognitive theoretical framework suggests that self-efficacy, performance outcomes and students’ comparison with self and others can impact on the formation of their competence beliefs. This developmental relationship may be the most important component in an adolescent’s profile during high school.

The process of development involves students shaping and reshaping aspects of their self during childhood; however, during early adolescence the process of defining one’s self and their capabilities becomes crucial (Skaalvik & Valas, 1999). During late adolescence tasks are associated with the exploration of different dimensions of self, which culminates in a commitment to a central self schema that becomes more consistent (Marcia, 1966). The self is a social cognitive construction, which is subject to change with age. Students’ perceptions of their emerging capabilities lead to changes in the structure and content of the self (Harter, 1996). Therefore, the pattern
of change related to the different aspects of self that emerge and develop across adolescence requires exploration using a multidimensional approach.

Developmentally “only at ages 11-12 do children acquire the differentiated concept of ability and the understanding that current normative outcomes reflect individual differences in ability that place limits on the efficacy of effort and on future outcomes relative to others” (Butler, 1999, p.147). Therefore, this period of early adolescence is a time when adolescents may base their performance on perceived cognitive limitations (that is they are not bright enough) rather than understanding that the application of effort can improve their performance outcomes. If students believe they are limited in their capacity then they may not apply effort without guidance and support. As one researcher suggested, with this belief mechanism there is an obvious risk in putting effort into a task and then failing (Anderman & Maehr, 1994). Ultimately, to try only to fail equates to being ‘dumb’ and therefore trying at school carries risks – risks to students’ self-esteem and risks in how students will be valued within a school setting. This evaluation cannot be avoided (Anderman & Maehr, 1994).

The patterns related to motivational declines suggest that a lack of effort and engagement within the school context may be responsible for the lack of motivation in some adolescent youth. Theoretically, the development of adolescents’ academic (self) identity has been explained through a Differentiated Concept of Ability (Nicholls, 1984; Stipek & Gralinski, 1996; Butler, 1999). Students’ evaluations are based on whether they perceive they are smart enough to achieve and not on whether increased effort will improve their performances. Unless eliminating the need for increased effort to improve performances is challenged during adolescence, students may limit their potential to achieve.
Self evaluations develop with age and may be referenced to perceptions of adolescents’ ability (intelligence as a fixed trait) and effort beliefs. Adolescents’ perceptions need to be challenged when they fail to acknowledge that the application of effort will have a positive effect on performance outcomes. Students who have low perceived capability may lack the impetus to attempt the task and, are likely to equate their failure to lack of intelligence rather than to the lack of effort applied in the given task (Stipek & Gralinski, 1996). Adolescents who view achievement outcomes as based on capacity alone, risk failure and perhaps through a lack of understanding do not acknowledge that with the application of effort anyone can achieve improvement in a task. There is an obvious risk of falling into a form of self-fulfilling prophecy and underperformance when this position is maintained.

A similar evaluation has been suggested by Marsh and colleagues (Marsh & Hau, 2004b) through their Internal/External Frame of Reference Model. According to this model, students evaluate their ability to compete, comparing their own individual performances in one domain (for example, English) with their performances in another (maths) through an Internal Frame of Reference. The External Frame of Reference aspect relates to students’ evaluations of their ability in a given domain with other students in the same domain. The Internal/External Frame of Reference Model was used to explain the near-zero correlations between maths self-concept and English self-concept that emerged in the literature. Research into self-concept provided an explanation for the complex relationship that exists between a student’s perceptions of competence and their performance outcomes. As Marsh and colleagues have found, students’ beliefs in their competence in a given academic domain is more strongly associated with that domain’s performance than with other academic domains.
When students focus on social comparison they are at risk of evaluating their ability rather than the effort required to achieve, outlined in the use of the Differentiated Concept of Ability model (Jagasinski & Nicholls, 1987). In effect they are evaluating beliefs based on past performances rather than what they may be capable of, if they applied effort to the task. Jagasinski and Nicholls (1987) compared competence beliefs against the differentiation between high and low effort conditions, and found that high competence beliefs were associated with high effort in the task. Additionally, longitudinal research by Jacobs et al, (2002) found that “[a]dding competence beliefs as an explanatory variable to the model for task values revealed that changes in competence beliefs accounted for much of the age-related decline in task values” (p. 509).

The negative effects of social comparison information on students competence has been also shown in Marsh’s ‘big fish little pond effect’ to impact on adolescents, even in successful environments (Marsh & Hau, 2004a, 2004b). In this instance, capability was no longer indicated by self-referenced cues of improvement in performance or effortful accomplishments through a mastery goal focus but instead the evaluations of students’ social comparison cues accounted for their beliefs (Bateman, Bransford, Goldman, & Newrbrough, 2000). The focus on performance goals in high school, of being the best in an environment that is more competitive and generally has more competitors, may limit students participation and beliefs of their individual potential (Marsh & Hau, 2004b).

Pursuing a task and applying effort rests on a student’s beliefs in their capability of achieving satisfactory outcomes. This claim suggests that task, effort and perceived capability should therefore be positively correlated. Achievement motivation is a process and the profiles presented during adolescence may change, presenting
different patterns as individual’s progress through high school. Therefore mapping adolescent profiles using a multidimensional framework to better understand this dynamic process appears timely (Zusho & Pintrich, 2001). Gauging adolescent profiles will ultimately provide educators with a tool to enable them to identify and support students who are at risk of disengaging through a lack in motivation; those with low effort pursuits, low task pursuits and low Perceived Academic Capability.

Providing a tool to map a multidimensional goal profile may better explain the developmental differences that emerge (by degree or direction) during adolescence. Social Cognitive Theory encompasses the perceptions of self and motivational pursuits. Therefore this frame of reference will map the pattern of change across grades and sex, to identify the salient pursuits among the 12 dimensions.

Achievement motivation is a complex phenomenon and past research suggests that both competitive practices and social comparison may have detrimental effects on students’ reactions to their accomplishments (Anderman & Maehr, 1994). Perhaps the emphasis on social comparison at the commencement of high school (grade 7) when students are in a larger social network may partially explain the reason for the documented declines in motivation at this time. However, limited research has investigated a multiple goal approach to motivation across high school to map the patterns of change across high school.

A multiple goal structure has been advocated by Pintrich (2000) in his longitudinal analysis across three time collections of data. He tested combinations of high and low levels for performance-approach goals with mastery measures for personal goals on students in years 8 and 9, that is, his combined goals were high performance/high mastery; high performance/low mastery; high mastery/low performance and low performance/low mastery. The distinction between ranking
either low or high on these measures however, was achieved through a median split on the 7-point Likert-type scale at 4.6 for the performance measure and 4.8 on the mastery measure. Pintrich’s findings suggested that high mastery/high performance and high mastery/low performance groups did not differ significantly and only the low mastery/high performance goals had a maladaptive pattern of motivation, affect or strategy use.

While these findings are important, three factors arise from Pintrich’s work that suggests caution when interpreting them. Firstly, the outcomes may have varied, had the median split been performed on levels that were related to the context of the responses, where low was set at perhaps 3.9 and below, and the high was set at 4.1 and above for each measure. Scores between 4 and 4.6 were rated as a low performance goal, however a value of 4 (midpoint of a 7-point Likert scale) was referred to as the midway on the questionnaire. Values between 4 and 4.6 should have been evaluated on the high side to relate the intent of the questions on the original scale.

Secondly, a measure of perceived competence was not incorporated, as suggested would be beneficial by Wang, Chatzisarantis, Spray and Biddle (2002) as well as Jacobs et al., (2002). When changes in competence beliefs were factored out of the analysis by Jacobs, et al., much of the lower effect of task values was negated (Jacobs, et al., 2002). Research by Wang et al. suggests that the combination of the three dimensions, high performance, high mastery and high self competence was associated with the most adaptive functioning. Therefore, Pintrich’s findings may be an artifact of the way the research was designed and the inclusion of a measure of competence beliefs may actually have accounted for the findings.
Thirdly, the literature already acknowledges that students may be motivated in a given task through high performance and high mastery goals. However, the research also suggests that in the long term this combination is not seen as facilitative, and the question remains as to how much improvement is really gained by inclusion of the high performance measure.

In the sporting domain this aspect has already been well-researched and sportspersons are not trained or motivated to beat others. Instead they are motivated to work towards their own personal bests, an accomplishment that may be achieved by all individuals. Education should be inclusive and be geared towards improvement and success, rather than having an emphasis on winning, because then there is only one winner and many losers, with little encouragement for students who are not mastery focused. The process involved in challenging oneself is emphasised in the literature for mastery focused students who persevere (apply effort pursuit) even in the face of defeat (Urdan, Pajares, & Lapin, 1997). Instead of the profiles during adolescence being viewed and assessed through a dichotomous framework, the multidimensional nature of achievement motivation needs to be mapped in order to understand how features change as a factor of grade and/or sex and identify what profiles emerge during adolescence.

A comprehensive achievement motivational profiling of adolescents’ pursuits using a broad multidimensional measure has not been undertaken using systematic, longitudinal data and this is warranted. Acknowledgment is made of Jacobs, et al., (2002) and Pintrich’s (2000) work of tracking motivation across grades, however, the use of a 12-factor scale to understand the change in motivational pursuits during high school would add to the understanding of adolescents’ motivational pursuits. In particular, the emphasis in much of the achievement motivation literature focuses on
mastery and performance goals, which has limited the understanding of adolescents’ motivational pursuits.

Declines in some motivational pursuits may be just as strongly related to improved performance as increments in other pursuits during adolescence. Therefore, research identifying changes by degree and/or direction using a multidimensional construct such as the SMOSA would provide information on the nature of change across adolescence for each of the 12-factor motivational pursuits and self-perceptions. Including social goals in a profile that maps the development of achievement motivation for adolescents would acknowledge the importance of this construct (Wentzel, 1989).

As previously suggested self-related constructs can assume increased importance during the developmental period of early adolescence (Harter, 1999b). However, whether the increased importance in self-perceptions continues across high school for adolescents has not been investigated.

To understand adolescent achievement motivation four factors emerge in much of the literature that require both clarification and inclusion to enable mapping of a profile during adolescence. Firstly, the scale used needs to include relevance to the school context, which has been suggested as an important determinant in achievement motivation, particularly relevant during the period of early adolescence. Secondly, a majority of the literature stresses concerns over the declines in motivation that occur during adolescence, so the nature of change needs to be clearly identified among the disparate factors. Thirdly, the use of a multidimensional profile may better clarify and perhaps challenge the notion that declines in motivation do not necessarily relate to negative outcomes. Therefore as previously discussed, the profile should include self perceptions and the use of a multidimensional framework however; using the lower-
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order factors for each of those motivational domains is also suggested, to ascertain whether these lower-order factors differ during the developmental period of adolescence. The fourth issue arises from the concern of males underperformance academically, compared to females (Nelson, 2004; van Houtte, 2004). Assessing whether sex differences emerge across dimensions and/or grade may help clarify motivational trends on whether differences emerge between males and females during high school. To have a contemporary, comprehensive profile pertaining to adolescents, will assist in further elucidation of the sex differentiation debate.

The school context

Motivation in the school context has a critical impact on academic achievement. Research suggests that the profile of achievement motivation is dependent upon the individual school environment. While there are differing contexts within each school, state government regulations dictate the general teaching practices within schools and these practices differ between each state in Australia. For this reason dissemination of the common features in New South Wales schools will be outlined.

Common practice in public high schools has been an emphasis on comparative and competitive academic performances, with increased assessment up to formal examinations at both the grades 10 and 12 (McInerney, Simpson & Dowson, 2003). Therefore, public high schools in New South Wales increasingly use competitive goals and extrinsic goal attainments through ability groupings during high school. Competitive and social comparisons occur, based on grades, marks, and whether one has sufficient marks to gain entry into University from grade 12, the final year of high school education in New South Wales’ (Eccles & Midgley, 1989; McInerney, Simpson & Dowson).
The performance/assessment tradition used during high school has been claimed as not only detrimental for adolescents in their motivational pursuits but also detrimental for their performance outcomes (Barratt, 1996; Cumming, 1996; McInerney, Hinkley, Dowson, & Etten, 1998). This competitive goal structure may have detrimental effects on students’ motivation by lowering measures of self perceptions and self-worth (Zusho & Pintrich, 2001). The change in focus during high school towards one of competition has been used as one explanation for the sudden drop in adolescents’ motivational levels after the transition from primary school (Zusho & Pintrich), marking a shift from an intrinsic to an extrinsic focus between grades 6 and 7. The school transition in the United States occurs at a similar time and has been evaluated as impacting on students’ motivational levels (Eccles & Midgley, 1988; 1990).

The increase in performance goals during high school in New South Wales starts in grade 7 through competitive practices and governmental policy evidenced as part of their “Strengthening the Foundations for Lifelong Learning” (Department of Education and Training NSW, 2001). All students are required to participate in state-wide tests completing the English Language and Literacy Assessment (ELLA) test and the Secondary Numeracy Assessment Program (SNAP) test. Both tests have optional retesting in grade 8 and 9 and a majority of schools participate in the retesting of the ELLA and SNAP program during grade 8 (Department of Education and Training NSW). In addition, since 2000, several specialised programs reaffirming achievement through performance have emerged, such as the Minister’s Award for Excellence in Student Achievement, which was awarded to 40 students in 2001 (p. 38) and the Minister’s Young Designers Awards recognizing students in Design and Technology courses in grade 7 and grade 8.
The Higher School Certificate incorporates a very competitive assessment as the pre-requisite for University, namely University Admission Index (UAI). All students applying for University entrance have their results from grade 12, graded and calculated on a percentile ranking state-wide. There is an emphasis on the performance attainment and competition reflected by the UAI score (McInerney, Simpson, & Dowson).

The transition to high school for adolescents is a critical time because changes in motivation coincide with the disruption of students’ social networks at a time when concerns with peer relationships are also emerging (Bateman, Bransford, Goldman, & Newrbrough). Therefore, a developmental mismatch occurs between the young adolescent and the classroom environment with an increasing risk of negative motivational outcomes. Larson (1982) also found a decline in students’ satisfaction with their school and their teachers across grades six to eight coinciding with the transition into high school.

This transition has been viewed as the causal mechanism responsible for the declines in motivation (Eccles & Midgley, 1989). However, this may not fully account for the reported declines because research by Harter, Whitesell, and Kowalski (1992) found declines in perceived cognitive competence between sixth and seventh grades occurred for all children in their sample regardless of whether they made the school transition or not. This then raises issues of when and in what form these declines in achievement motivation occur for adolescents during high school, justifying the need for clarification and profiling.

Declines in achievement motivational pursuits during adolescence

A majority of research suggests that there is generally a decline in achievement motivation during adolescence (Anderman, Maehr & Midgley, 1999; Kurita &
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Zarbatany, 1991; Murphy, & Alexander, 2000; Marsh, 1994; Midgley & Edelin, 1998). There is cause for concern regarding these reported declines because of the detrimental impact this may have on performance-based outcomes and future aspirations (Anderman, Maehr, & Midgley, 1999; Eccles & Wigfield, 2002; Kurita & Zarbatany, 1991; Midgley & Edelin, 1998; Murphy & Alexander, 2000). The gravity of this situation has been emphasised by researchers who stated, “Research clearly indicates that students’ achievement values are significant predictors of academic performance as well as their intentions to take future courses and subsequent enrolment in those courses” (Anderman et al., 2001, p. 92).

Therefore, given the emphasis on the declines in achievement motivational pursuits and self perceptions reported and also the disparity in the literature as to the ascription and continuation of the nature of these declines during adolescence, it appears timely to systematically map these factors to assess what patterns do emerge. Although simultaneous pubertal changes occur during adolescence and are acknowledged, research has suggested that these are not responsible for the reported declines in motivation and instead advocate that contextual/environmental factors within high school play an instrumental role (Anderman & Maehr, 1994; Eccles & Midgley, 1989). Researchers (Anderman & Maehr, 1994; Midgley & Edelin, 1998; Nicholls, 1984) have suggested that increased competition in high school and students’ perceptions of their capabilities as referenced to other students are possible reasons for the decline in students’ motivational pursuits. Declines in achievement motivational pursuits do not occur in a vacuum, and a broader context is required that includes both social and cognitive factors to better gauge and understand the patterns that may emerge in adolescence.
The reported declines in adolescents’ perceptions of self and motivation at a time when there is a heightened self-focus reinforces the importance of investigating developmental or age effects at this time. Midgley and Edelin’s review of literature over 20 years starting in the 1980’s suggested that many students “experienced a deterioration in perceptions of self, affect, motivation, and performance during early adolescence and in particular, when they move to middle-level schools” (1998, p. 195). Although some researchers (Kurita & Zarbatany, 1991) agree that declines in motivation occur in adolescence, their research identified that these declines only occurred until grade nine and a plateauing then occurred. Other researchers also suggested that a possibility of increased motivation may eventuate in late adolescence (Bouffard, Vezau & Bordeleau, 1998; Butler, 1999).

**Declines in self perceptions**

Developmental research in the area of self perceptions has been well documented in comparison to motivational enquiry. While motivational declines generally have been evidenced during adolescence, a different pattern emerges across the literature for self-concept whereby Academic self-concept has been found to increase and be differentiated with age (Byrne & Worth Gavin, 1996). Marsh (1989) reviewed age and sex effects in multiple dimensions of self-concept across pre-adolescence to late adolescence and found that declines generally occurred during preadolescence but that there was a consistent U-shaped quadratic effect, whereby self-concepts of students declined up to grades 8 and 9, but then increased around grades 10 and 11. Marsh’s findings suggest that self-concept is multifaceted, hierarchically ordered, and becomes increasingly differentiated with age.

Research has focused in a limited way on adolescents’ development across grades 7 to 11, and assessment of the changes in achievement motivational pursuits
over time using a multidimensional framework is required. In essence, it may be possible that change in the varying motivational pursuits occurs and that differing patterns emerge across grades between the measures. This is an empirical enquiry worthy of examination. While research to date has generally identified declines in motivation during adolescence, a more thorough analysis is required of the possible variation that may exist among the motivational pursuits to ascertain whether some may recover across grades. Whether the suspected changes occur by degree and/or direction across the course of adolescence requires the use of a multidimensional measure to better assess the complexity of this phenomenon.

This thesis challenges the premise that all declines in motivational pursuits during adolescence equate to a less facilitative pattern of learning. Instead the use of a multidimensional scale would be more beneficial to understand and explain some of the finer nuances that may emerge during adolescence. To infer negative connotations to all motivational declines would only limit our understanding of the possible growth that may occur with some declines. Not all declines are negative during adolescence. Some act as facilitators towards learning. For example, a decline should occur in affiliation pursuits if students are developing independent learning practices. Achievement motivational declines may only be associated with less facilitative learning when they relate to mastery goals, students’ self-perceptions and mentoring of others (social concern). This is due to the increased need for autonomy and self-efficacy that should progressively emerge during adolescence (Bateman, Bransford, Goldman & Newrbrough, 2000). Adolescents should become more self-regulated and autonomous with age as they progress towards facilitative learning (Ryan, 1993; Ryan & Deci, 2000). Therefore, we would expect that the motivational goals of the externally referent goals of extrinsic, performance and affiliative pursuits should
Achievement motivation during adolescence to reflect facilitative learning profiles by later adolescence.

Towards a multidimensional profile of achievement motivation during adolescence

While the profiles of adolescents’ motivational pursuits in the broad domains of mastery and performance goals have been well researched, this has been to the exclusion of other important goals that may similarly impact on their academic achievement during this developmental period. For example, the limited research into social goals appears surprising, given that early adolescence has been recognised as a period when there is an increased emphasis on the impact of affiliations and students’ peers (Maehr, 1984; McInerney, Roche, McInerney, & Marsh, 1997; Bateman, Bransford, Goldman & Newrbrough, 2000). In addition, extrinsic motivational goals need to be included, since these describe adolescents who apply the effort and want to improve in their work to receive praise or reward. The receipt of praise or extrinsic rewards may change during adolescence as a factor of age and declines in these achievement goals may facilitate independent, autonomous learning. The salience of extrinsic goals may vary during adolescence, with predominance in early adolescence compared to late adolescence, and/or between the types of extrinsic goals where each may not deviate to the same extent as the other.

Understanding motivation as a concept related to cognitions allows motivation to transcend the purely dispositional or needs based models previously used (Covington, 2002). Investigating achievement motivation through a social cognitive approach allows for the possibility of change in each of the pursuits. To better understand that motivational change may occur - especially as an age related factor - the inclusion of self perceptions is required. When self perceptions are included in research on adolescents’ motivational goals, evaluations of one’s capability and true
potential emerges. “The basic contention of Achievement Goal Theory is that depending on their subjective purposes, achievement goals differentially influence school achievement via variations in the quality of cognitive self-regulation processes” (Covington, 2000, p. 174).

Lower-order factor structures

This thesis argues that the use of lower-order factors within a given measure can add considerable understanding to an interpretation of the findings. Gorsuch (1983) stresses the importance of assessing the relationship between the lower-order factors within a measure rather than relying on the associated higher-order constructs. This argument relates well to the common practice in Achievement Goal Theory of using the higher-order constructs of mastery and performance goals. Maehr’s and McInerney’s use of a more refined scale to investigate achievement motivation may, as Gorsuch suggests, provide greater elucidation particularly when mapping the patterns of change across grades, to assess whether males and females are differentially affected by these lower-order motivational pursuits. To investigate the higher-order construct of a mastery goal and not evaluate the difference that may emerge between the lower-order factors of task pursuits and effort pursuits, may limit the nature of the findings. In addition, other lower-order factors within the multidimensional goal domains may interact with these constructs, and this aspect would be eliminated if the lower-order factors were not incorporated in the enquiry. By focusing on the higher-order constructs, reductions in the explanatory power and contributions of the lower-order pursuits, made independently or in conjunction with other lower-order pursuits, would be omitted and therefore a comprehensive account of this phenomenon would not surface (Gorsuch, 1983).
Broadening the range of motivational pursuits as suggested by Maehr and McInerney to include the lower-order factors and aspects of self perception should be considered. According to Maehr’s Personal Investment Model (Maehr & Braskamp, 1986) eight goal orientations and four self-perception scales are required to explore the development of achievement motivation. McInerney’s (1992; 1995; McInerney, Roche, McInerney & Marsh, 1997) refinements to his investigation of achievement motivation within the school context using the Inventory of School Motivation (ISM) has differentially identified the eight goal orientations as; task, effort, competition, leadership, affiliation, social concern, rewards and praise. Maehr and McInerney suggested four sense-of-self scales would provide a better key to understanding self perceptions during adolescence. These models did not include the domain specificity of Self concept. A comprehensive model may be achieved if the inclusion of four different self-perception measures were used.

This research posits that inclusion of the three academic self-concept scales; general academic self-concept (self-esteem at school), maths self-concept, English self-concept (Marsh, 1989) would provide valuable information on the domain specific nature of English and maths perceptions and also assess how students’ competence beliefs about their general academic ability may be changed. In addition, a measure specifically designed to evaluate self-efficacy (Perceived Academic Capability) (Simpson & McInerney, 2004) would provide further information if this measure was specifically geared to identify how capable students perceive themselves to be in the classroom context. These measures have been independently linked across diverse bodies of literature and believed to provide a more comprehensive model of achievement motivation during adolescence. Mapping the profile of development across adolescence would enhance our understanding of the differences
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that may emerge by degree or direction and would represent a unique profile to better
gauge and understand the nature of adolescents’ achievement motivation.

*Mastery goals in adolescence*

Research suggests that the most important goal that adolescents need to pursue
is the development of a mastery goal (Anderman, Maehr & Midgley, 1999; Jacobs et
al., 2003; Ames & Archer, 1988; Anderman, Eccles, Yoon, Roeser, Wigfield &
Blumenfeld, 1999). Importantly, adolescents’ level of engagement and thus the
attainment of a mastery goal is related to their perceptions of capability or
competence (Anderman, Hicks, & Midgley, 1998; Bandura, 1989, 1997; Bandura &
Locke, 2003). While development of a mastery goal may be the optimal achievement
during adolescence, for some students, the attainment of that goal may not be realised
due to limitations in their self perceptions. In fact, one’s perceived capability may be
more important than the objective reality of feedback from performance-based tests
(Schunk, 2000). Therefore, providing a broad systematic tool that can gauge the
salience of various achievement motivational pursuits and self-perceptions for
students would provide a better understanding of the goals that individuals pursue.
Research suggests that motivation declines during adolescence (Eccles & Midgley,
1989; Maehr, 1989). Differences may emerge between the dimensions across grades
in the rate of decline and/or increase may be achieved in some of the factors of
motivation as has been reported in self-concept research.

Task pursuits and effort pursuits represent the desire to achieve outcomes
derived from the process of learning, such as feelings of satisfaction and competence
or actual intellectual development through application to the task. These two pursuits
are described under the common term mastery goals. A “task goal orientation
represents the belief that the purpose of achieving is personal improvement”
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(Anderman, Hicks, & Midgley, 1998, p. 2), whereas effort pursuits are the student’s perception of the need to persevere and overcome challenges as they arise (Simpson & McInerney, 2004). Task and effort pursuits are conceptualised as cognitive goals to learn or master challenges associated with academic performance (Wentzel, 2000). Students who perceived emphasis on task goals in the classroom exhibited more positive attitudes toward learning and used more effective learning strategies than students who perceived an emphasis on competitive pursuits (Ames & Archer, 1988).

Declines in mastery goals during adolescence have been associated in particular with negative patterns of change in self-regulation, self-efficacy and positive and negative affect in school and grades (Midgley, Kaplan, & Middleton, 2001; Midgley & Urdan, 2001). Declines in intrinsic or internalised motivation have been noted in research until grade 9 by Kurita and Zabatany (1991) and Eccles and Wigfield (2002) also found gradual declines in students’ attitudes toward school and academic subjects with advancing grade level. Research conducted (Simpson & McInerney, 2002) on the Motivational pursuits across grades 7, 8 and 9 found reported declines for task and effort pursuits in an Australian High School sample. Effort pursuits declined between grades 7 and 8, whereas students’ task pursuits continued to decline up to and including grade 9.

Several reasons have been given for the reported declines in achievement motivation. Some researchers have suggested that the transition to a new environment impacts on adolescents (Anderman & Maehr, 1994; Anderman, Maehr, & Midgley, 1999; Eccles & Midgley, 1989; Eccles & Wigfield, 2002). Others have suggested that there is a developmental explanation related to the emergence of a differentiated concept of ability around the same time as that transition (Butler, 1999; Nicholls, 1984; Stipek & Gralinski, 1996). As discussed the work of Nicholls and Butler have
identified that an adolescent’s differentiated concept of ability relates to their perceived intellectual capacity within the school context. In this framework, adolescents who believe that ability is a fixed trait where some have it and others do not, may self sabotage through this belief and consequently not apply effort in their learning endeavours. Therefore the differentiated concept of ability may be one of the most detrimental factors associated with early adolescence. Butler suggested that in a performance-based climate such as high school the receipt of rewards and praise may encourage ego involvement. Using a multidimensional profile to ascertain whether levels of effort pursuits are lower during early adolescence and whether these levels recover during later adolescence or, alternatively, whether the pattern among individual students varies across grades, is an important inquiry. Identifying the patterns of change across adolescence may provide a broader explanation for the apparent disparity emerging across grades in some factors of achievement motivation, particularly around grade 9. In addition, graphing these measures and assessing the reliability and validity of the SMOSA will provide a profile on varying motivational pursuits, for students progressing through high school.

*Performance goals in adolescence*

Competitive emphasis increases rather than decreases with grade level (Anderman & Maehr, 1994). While education within high schools in New South Wales appear to be focused on performance-based strategies, this has not generally been viewed as advantageous when working towards facilitative learning nor has it been conducive to students working towards their optimal potential. The differentiated concept of ability may be a developmental phenomenon that is internally generated by the student, however, the school context and governmental policies reinforce the notion of separation and scaling of students in class, based on their ability and performance-
based outcomes. The state-wide comparisons of the SNAP and ELLA assess students’ numeracy and literacy in grades 7 and 8.

During adolescence, self-evaluations to compete and compare can be debilitating, particularly as the focus is geared to outperforming others. Critically, adolescence is a developmental period when emphasis on performance-based strategies may clash with students’ self evaluations. Development of a performance goal shifts attention away from learning as the central tenet to that of winning or beating others (Midgley, 2001). Instead of being intrinsically orientated and working on personal bests as part of the learning process, external comparisons become the focus. Although students who pursue performance goals may apply effort, they are not always engaged in the process of learning to improve their knowledge.

American-based research by Anderman and Young (1994) found that performance-based goals were negatively correlated with academic competence in science-based domains. Research conducted (Simpson & McInerney, 2002) on motivational pursuits across grades 7, 8 and 9 found declines for competition pursuits and leader pursuits in an Australian adolescent sample. However, only competition pursuits continued to decline across the three grades, whereas leader pursuits only declined between grades 7 and 8. The division of the type of performance goal pursuits may assist in explaining whether competition pursuits or leader pursuits have different patterns of development across the course of adolescence. The performance-approach goals of competition and leader may be more important in late adolescence than for early adolescence.

Social goals in adolescence

As previously stated, there has been an over-emphasis on mastery goals and performance goals within the achievement motivational literature, which has
overshadowed the role other goals may make towards engagement and facilitative learning. While both these goals are acknowledged as important inclusions when constructing a motivational profile, the lack of attention invested in social goals particularly when assessing adolescents can only be seen as limiting. It has been suggested that students may hold non-academic goals, such as social goals, which will motivate them to achieve academically (Hinkley & McInerney, 1998). As suggested, “it is imperative for educators to understand the motivational functions of school-based affiliations” (Juvenon & Nishina, 1997, p. 182). Adolescents’ social goals are an important component involved in the complex structure of their motivational profiles (McInerney, Simpson, & Dowson, 2003). Urdan and Maehr (1995) concluded their appraisal of arguing for the inclusion of social goals, with “Particularly in the case of early adolescent students, an understanding of school engagement will not be forthcoming unless social goals are considered” (1995, p. 236).

Early adolescence, in particular has been recognised as a period when there is increased concern about social acceptance by peers and a concern with social goals in general (Bateman, Bransford, Goldman, & Newrbrough, 2000; Maehr, 1989; Maehr & Braskamp, 1986; McInerney, 1992, 1995b; McInerney, Roche, McInerney, & Marsh, 1997; McInerney, Simpson, & Dowson, 2003; Simpson & McInerney, 2002; Simpson & McInerney, 2004; Simpson, Vickers, Kristovics, & Marsh, 2005a; Simpson, Vickers, Kristovics, & Marsh, 2005b; Wentzel, 1999a). Several theorists have called for the inclusion of social goals when investigating motivation (King, 2000; Maehr, 1989; McInerney, Hinkley, Dowson, & Etten, 1998; McInerney, Roche, McInerney, & Marsh, 1997; Urdan & Maehr, 1995; Wentzel, 1989, 1991, 1997, 1999a, 1999b). Affiliation with peers for some adolescents may be the most salient
feature of school, whereas inclusion within a group is the major priority (King, 2000). Supporting this view, Maehr (1989) and McInerney and colleagues (McInerney, Roche, McInerney, & Marsh) stress that adolescents’ social goals critically impact on their motivational pursuits.

Affiliation and social concern pursuits are two areas that motivational researchers have indicated as primary social goals (McInerney, 1995b, 2000; McInerney, Marsh, & Yeung, 2003; McInerney & Sinclair, 1991). As Urdan and Maehr (1995) have suggested “[a]s students reach early adolescence, a number of factors converge to make social concerns particularly salient” (p. 236). Social concern pursuits or the mentoring of others may be viewed as more facilitative towards learning compared to affiliative practices. These two social goals present different relationships to the endeavours associated with independent facilitative learning.

Several studies have reinforced the use and separation of the social goals of social concern and affiliation during adolescence (Maehr & Braskamp, 1986; McInerney, Marsh, & Yeung, 2003). Cross-sectional research (Simpson & McInerney, 2002; Simpson & McInerney, 2004) conducted on affiliation pursuits and social concern pursuits using an Australian high school sample, found declines that were similar to the other goals of mastery and performance. In this adolescent sample affiliation pursuits were significantly and negatively correlated with maths grades and English grades, yet were positively correlated with absenteeism. Thus support was found for the premise of the negative association of affiliation pursuits and grades as suggested in previous literature. However, social concern pursuits were not significantly associated with any criteria across the three grades, and supported separation of these two social goals (McInerney, Simpson, & Dowson, 2003).
A multidimensional approach was used in a multicultural sample (McInerney & Swisher, 1995) predicting students’ school retention, academic performance, valuing of school and affect towards school, and these were all significantly correlated to social concern. Reinforcement for separation of the two social goals (affiliation pursuits and social concern pursuits) into the lower-order structure was found. Their findings suggested that social concern pursuits were more facilitative than affiliation pursuits.

*Extrinsic goals in adolescence*

The situational context of the classroom or school environment has been linked to the reason for declines in motivation during high school, particularly at the initial transition from grade 6 to grade 7 (Eccles & Midgley, 1989). To date research has not systematically assessed the impact of the patterns of change in extrinsic goals across high school, particularly using longitudinal research and therefore several questions remain unanswered. For example, during adolescence are reward pursuits or praise pursuits more salient? Do these two forms of extrinsic goals vary in the pattern of their development across grades? Does the receipt of rewards or praise pursuits differ across grades by degree and/or direction?

Identifying the developmental patterns that emerge for the extrinsic goals during adolescence may provide useful information about the nature of the changing role of differing extrinsic goals. Separating the two extrinsic goals of praise pursuits and reward pursuits may assist in assessing whether similar patterns emerge across grades for these pursuits. Differences may emerge between the receipt of high grades compared to the receipt of praise and these lower-order factors may develop differentially for boys and girls. Research suggests that focusing on performance outcomes, such as an emphasis on getting the highest grades, was negatively related
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To achieve in maths and reading during adolescence (Anderman et al., 2001). Ideally, declines should occur in the need for extrinsic goals during adolescence and concentration should be on the role of understanding and learning at school rather than getting good grades.

Differential findings related to the use of the lower-order factors of extrinsic goals have emerged. An age effect was apparent when these two forms of extrinsic motivation were used in research. Deci, Koestner and Ryan (1999) found in their meta-analysis that “verbal rewards enhanced both free-choice behaviour and self-reported interest, but further analyses indicate that the enhancement in free-choice intrinsic motivation by verbal rewards applied only to college students and not to children” (p. 639). Hattie’s (2000) meta-analysis on the effects of the receipt of praise and rewards from the teacher reported that neither were positively related to adolescents’ perceptions of their self worth or value. Perhaps in partial support of this claim given the link with achievement and self evaluations, research using diverse cultural groups found that praise pursuits and reward pursuits were significant negative predictors of academic achievement (McInerney & McInerney, 1998). However, research (Simpson & McInerney, 2002) conducted across grades 7, 8 and 9 on Australian high school students found significant declines across grades 7 to 8 and 8 to 9, for reward pursuits, yet praise pursuits were significantly lower only between grades 7 and 8. Identifying whether the developmental patterns of these two extrinsic goals differ during adolescence may provide useful information.

Grade related shifts from predominately intrinsic motivation in 3rd grade to more extrinsic goals by grade 9 have been reported, and more specifically the shift from an intrinsic goal for school to an extrinsic focus between grades 6 and 7 (Eccles & Midgley, 1989). Differences between reward pursuits and praise pursuits were found
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in a meta-analysis by Deci, Koestner and Ryan (1999). A disparate association occurred in extrinsic goals with rewards being more detrimental for children compared to college students and praise pursuits enhancing motivation for college students but not for children (Deci, Koestner, & Ryan, 1999). When and if these patterns of change emerge during adolescence needs to be assessed.

**Self perceptions in adolescence**

Inclusion of self-related constructs when investigating adolescents’ motivational profiles may assist understanding the patterns of change in magnitude or direction, associated with their development. Marsh’s work on the differential distinctiveness hypothesis suggests that “the levels of differentiation between different self-concept factors observed in young children were likely to be magnified with age, such that those factors that were relatively most differentiated with young children would become much more differentiated with age whereas age-related differentiation would be smaller for those self-concept factors that were initially less differentiated” (Marsh & Ayotte, 2003, p. 690). Marsh (1989) found that during adolescence students’ self-concept may place significant restrictions on the amount of effort and hence, the types of motivational pursuits they engage in academically.

When working towards a facilitative learning approach, research has suggested that students’ perceptions of their academic competence and capability may impact on the degree of effort they apply, directly influencing their level of motivation and performance in that endeavour (Wentzel, 2000; Covington, 1992; Schunk, 1991). The role of self-efficacy, maths self-concept, English self-concept and general academic self-concept are important cognitive influences during adolescence that have been researched.
Perceived Academic Capability

Jacobs et al.’s, (2002) research in the United States assessed the profiles for students from first grade until the twelfth grade with a three-year gap, across three cohorts. The first cohort completed questionnaires in grades 1, 2, 3, 7, 8 and 9, the second cohort in grades 2, 3, 4, 8, 9 and 10 and the third cohort in grades 4, 5, 6, 10, 11 and 12. Although they suggested that task values should be included in most research regarding competence beliefs, they found that changes in competence beliefs accounted for much of the age-related declines in task values (Jacobs, et al.). Jacobs et al., found “decline was the dominant trend for task value beliefs in all three domains” (p. 519) encompassing the three domains of sports value, language arts and math values across grades 2 to 12. Although steeper declines in elementary school were found for language art values, the decline for maths values was steepest during high school. The value of self-efficacy as a measure of one’s capability has been established in the literature (Bandura, 1997). A defining feature of Jacobs et al’s research was that students’ competence was not purely based on past performance but more so, on the beliefs held by the students about their capability. Students need to feel capable and autonomous to maintain their intrinsic motivation (Gagne & Deci, 2005, p. 336). Surprisingly, few studies have focused on the way in which one’s capability to achieve changes during early adolescence, that is by mapping the patterns of change across grades in high school as Jacobs et al., had done. This research will use a multidimensional measure incorporating motivational pursuits and a measure of Perceived Academic Capability to map the patterns of change across grades in high school using an Australian sample.
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Maths self-concept

Adolescents’ maths self-concept has been highly correlated with students’ academic achievement in maths (Marsh & Craven, 1997). Recent research (Marsh & Yeung, 1997; Marsh & Craven, 2004) has focused on the causal ordering of Achievement motivation and maths self-concept and found that a reciprocal effects model provided the best explanation. Significant positive relationships in the causal ordering of prior maths grades on maths self-concept but also maths self-concept on maths grades emerged (Marsh & Craven, 2004). Their findings, suggested that the effect of previous maths self-concept on subsequent achievement was stronger than prior achievement on maths self-concept, although significant relationships emerged both ways.

Attitudes towards maths self-concept decline with age until the later high school years. Adolescence appears to be a time when maths self-concept is a priority. Research by Jackson, Hodge and Ingram (1994) found maths self-concept was rated higher among high school students than college students. Comparatively, maths self-concept was the only self-concept measure that did not improve in college. From a pedagogical perspective, the reasons for obtaining low maths scores were associated with a lack of ability rather than being related to a need for increased effort (Bempechat, Graham, & Jimenez, 1999). Marsh (1989) reported that “despite claims that self-concept does not vary with age, more recent research reviewed here provides strong support for the increase of self-concept during late adolescence and reasonably good support for its decline during preadolescence” (p. 426). In particular, a quadratic u-shaped effect emerged in maths self-concept between grades 7 to 11 on the ASDQII. During grades 7 and 8 there were declines evidenced with a levelling out between grades 8 and 9 and then increase in grades 10 and 11 (Marsh, 1989).
English self-concept

English self-concept is more highly correlated with English academic outcomes, than students general academic self-concept or their maths self-concept (Marsh, 1989, 1994b; Marsh & Craven, 1997a). Work by Marsh and colleagues (Marsh & Yeung, 1997; Marsh & Craven, 2004) have reinforced the reciprocal effects model of English self-concept and academic achievement. The paths leading from English achievement to subsequent English self-concept were positive and statistically “stronger than those leading from self-concept to achievement” (Marsh & Yeung, p. 49). Work by Jacobs and colleagues (2002) found that a significant quadratic effect emerged across grades 1 to 12 with increases only emerging around grades 9 and 10 in students’ language, arts competence beliefs. Systematic declines had been found from first grade up to grade 9 in this form of verbal competence belief. Differences in English self-concept and maths self-concept emerged with overall higher levels in English self-concept than maths self-concept across several samples (Jackson, Hodge, & Ingram, 1994; Marsh, 1989, 1994b).

General academic self-concept

General academic self-concept has been highly correlated with students’ academic achievement (Marsh & Craven, 1997) although domain specific measures of self concept have been found to have stronger correlations with their associated domain specific outcomes. For example, maths self-concept is more strongly associated with maths performance outcomes. Research on general academic self-concept by Coles, et al., (2001) across grades 3 to 11 found that initial increases occurred up to grade 9 and then a plateauing emerged between grades 9 and 11. Research by Jackson, Hodge and Ingram (1994) using general academic self-concept found that college students had more favourable responses than high school students.
This level of self-concept has been referred to as academic self-esteem (Marsh, Parada, & Ayotte, 2004).

**Differences between males and females in motivational pursuits and self perceptions**

Ascertaining whether different developmental patterns emerge in achievement motivational pursuits between males and females across grades is a worthwhile contemporary investigation. Research investigating the development of achievement motivation during high school has reported differences between males and females that may be explained along stereotypical preferreded pursuits. Trends have been reported in the media in relation to females improving their performance outcomes compared to males (Nelson, 2004; van Houtte, 2004). These claims have been driven by the reported underperformance of males compared to females in a variety of subjects during students’ final year of schooling (Nelson, 2004).

In an effort to understand these reported differences, research findings (Marsh & Ayotte, 2003) indicate that “gender differences emerge at an early age and are surprisingly robust from preadolescence to adulthood” (p. 687). Traditional sex stereotypes have been evidenced as impacting on children’s identity as early as preadolescence (Marsh, 1989). The impact of stereotypical sex pursuits are intensified through social constructions. The gender intensification hypothesis has been used to explain the increased emphasis of sex differentiation during early adolescence (Huston & Alvarez, 1990). This hypothesis outlines that with the onset of puberty, social and cognitive influences increase young adolescents’ awareness of their sex role (Huston & Alvarez). However, more contemporary enquiry (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002) has suggested that the claims of the gender intensification hypothesis increasing during adolescence may not apply. Their research findings suggest that “gender differences in children’s and adolescent’s
competence beliefs and values in this sample decreased rather than increased with age” (Eccles & Wigfield, 2002, p. 525). As Jacobs et al. suggest, the disparate patterns of task values and self competence measures previously reported between males and females are decreasing. This reduction between males and females may equate to a lessening of the gender intensification hypothesis previously reported during adolescence.

Given the conjecture within the literature that certain domains are said to intensify during adolescence and other research suggesting that these previously reported disparate patterns are decreasing, it is timely to investigate which achievement motivational pursuits and self-perceptions differ between males and females across grades and whether significant differences emerge overall. The limited research points to apparent declines for adolescents in motivation during high school, however a systematic investigation using a multidimensional approach has not been undertaken.

Sex differences in achievement motivational goals

Several theorists have suggested that females choose to achieve in areas in which task, effort, affiliative or social goals are present (Eccles, 1987; Wentzel, 1989). Supporting this notion, females were more oriented towards social goals in Australian high school samples, where females reported higher levels of social concern than males (Hinkley, McInerney, & Marsh, 1999; Simpson & McInerney, 2004). In Hinkley, McInerney and Marsh’s study, support was found for the hypothesis that females would be more highly motivated in mentoring other students (social concern pursuits) than males and that the effects of mastery goals were mediated by social concern pursuits. In addition, females endorsed relationship and responsibility goals more than males (Patrick, Hicks, & Ryan, 1997) and females typically valued English
more highly than males, with females being more responsive to task goals than males (Nicholls, 1984).

Across differing domains, males were oriented more towards leadership goals than females (Ryan, Hicks, & Midgley, 1997; Simpson & McInerney, 2004) and males valued sports, maths and computers more than females (Zusho & Pintrich, 2001b). Systematic effects of sex emerged where males were higher on performance goals than females (Hinkley, et al. 1999). Females had lower competition pursuits in ego-involved settings than males (Anderman & Anderman, 1999; Butler, 1999). In addition, a meta-analysis conducted by Deci, Koestner and Ryan (1999) found that females reported praise pursuits as more controlling and undermining of intrinsic motivation, compared to males who viewed them as more informational and enhancing of intrinsic motivation.

Several explanations have been given to assist in understanding why achievement motivational pursuits may vary as a factor of sex. Support for the link between performance-based goals and affiliation pursuits was found in research by Urdan (1997b) whereby he suggested a positive relationship between performance-approach goals and affiliations for males which was not found for females. Similarly in a study by Bouffard et al., (1995) the emphasis on performance goals was found for males and surprisingly, the use of performance goals was positively associated with the use of metacognitive strategies for them. Bouffard and colleagues concluded that, “although adhesion to a learning [mastery] goal has a positive impact on self-regulation both for girls and boys, for the latter, adhesion to performance goals can also be helpful” (p. 317). Although the notion of besting others may assist males more than females through initiation of engagement for some males, the pursuit of this
dimension of motivation is not suggested as replacing a mastery goal focus when understanding the work.

Male and female differences in self perceptions

Adolescence is a time of increased focus for males and females on their self and in their abilities, particularly in the academic domain (Butler, 1999). Differences have also been found across self perceptions between males and females, among different domains within high school. Sex differences have been noted in students’ self-efficacy or capability beliefs as well as their general perceptions of academic competence and males usually display higher levels than females, however, some disparities have emerged. In part, this may be a factor of males typically overestimating their performance on future tasks, while females generally underestimate their capabilities (Zusho & Pintrich, 2001b). Sex differences in specific self-concept dimensions, consistent with sex stereotypes were found in both a college sample and a high school sample (Jackson, Hodge, & Ingram, 1994).

Research suggests that there is no difference between males and females in maths performance before high school, but that males value maths and have higher self perceptions in maths ability than females during adolescence (Anderman et al., 2001; Marsh, Parada, & Ayotte, 2004). Females reported higher task values and self-perceptions of capability in English than males during high school (Anderman et al., 2001; Fredericks & Eccles, 2002; Huston & Alvarez, 1990; Marsh, Parada, & Ayotte, 2004). Males had more positive attitudes about their capability in maths than females (Marsh, 1989). In addition, males rated their ability to perform more highly than females, although the gender gap decreased across grades (Anderman, et al). Females reported significantly lower general academic self-concept scores than males in an early adolescent sample (Marsh, Parada, & Ayotte, 2004). Longitudinal research
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(Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002) across grades 1 to 12 found that “boys’ self-perceptions were declining more rapidly than girls’ perceptions in both of the academic domains … The gender gap in math decreased because the self-
competence beliefs of boys declined at a faster rate than those of girls” (p. 524).

While males may be more willing to advocate their competence in subjects during high school, the disparity in performance reported in the literature, of females outperforming males in Year 12 in New South Wales is cause for concern (Nelson, 2004). This phenomenon highlights the need for a delineation of these constructs in a systematic mapping of adolescent profiles using a multidimensional measure incorporating measures of self perception.

Reasons underpinning these disparities during early adolescence have been partially explained by contextual effects related to the transition to high school around grade 7. However, this does not explain the continued declines across high school or why males and females view certain subjects differently. In addition, the transition between middle school and upper school, as occurs in the United States, does not occur in New South Wales. Investigating developmental patterns of change in an Australian sample, therefore, may provide information to challenge the aspects that research previously attributed to environmental change. To qualify this point, Eccles and her colleagues (Eccles & Midgley, 1989) suggested that declines in motivation and student’s self-perceptions were related to changes in the context of schooling in the transition from primary school into middle school. In particular they found that females moving into a traditional junior high school setting showed a decline in self-perception, however, females remaining in a kindergarten to grade 8 setting did not. To clarify this point, this research will map the patterns of change across grades while
maintaining continuity of the environment in high school. Students generally progress across grades 7 to 12 in the same school, in New South Wales.

Providing a robust, multidimensional measure would determine if and when (at what grade level) these differing motivational pursuits and self-perceptions vary. Few studies have indicated at what grade achievement motivational pursuit’s change and whether a linear pattern appears for all factors or whether recovery occurs in the latter part of adolescence. Alternatively, does a quadratic effect emerge for some dimensions and not others? Research by van Houtte (2004) and comments by Nelson (2004) suggest that the gap is widening between males and females across grades in performance. However, other research suggests that for some factors the gender gap is narrowing (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Therefore, mapping the profiles for males and females using a multidimensional measure may provide valuable information on the patterns that do emerge in motivational pursuits and self perceptions for adolescents.

Gender and achievement

In recent years, the press has emphasised claims of the comparative underachievement of males to females (Nelson, 2004). Males are achieving at significantly lower levels than females in all areas across both primary school and high school (Nelson, 2004). This claim suggest that in Australia, males' literacy achievement in grade 12 falls behind females by 19%, with females outperforming males in 90% of all subjects in their final year of school (Nelson, 2004). Research also suggests that males were not keeping pace with the educational gains made by females, and males’ self perceptions were also declining (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002).
A broader framework is required to map the motivational pursuits and self-perceptions of adolescents, to ascertain where possible disparities occur between males and females. Identifying at what grade and in which factors disparate patterns emerge between males and females, would provide valuable information on the progress across high school of adolescents’ motivational profiles. The link with some motivational factors and underperformance for males compared to females (Nelson, 2002) may provide insight into the contemporary phenomenon of males’ underperformance in academic domains.

Summary

The aim of the present research is to identify and examine the multidimensional achievement motivational pursuits that emerge across grades during adolescence. Specifically, identifying the nature of adolescents’ achievement motivation and self-perception profiles across each grade during high school, and whether these profiles present different patterns for males compared to females will be investigated. Aspects of motivation were hypothesised to initially decline across grades for both males and females. This pattern however, would expect to have a levelling effect, and, for some of the key achievement motivational pursuits and self-perceptions, increases may occur. For positive development in achievement motivation a gradual recovery would be evidenced in intrinsically related goals and self-perceptions of capability and self-concept. Females were also hypothesised to have a more educationally adaptive pattern of development for both motivational and self-perceptions across grade, whereby females would recover earlier than males.

The distinctive contribution of the present investigation is to provide much needed continuity in the research by using a single measure on a large sample, with assessment across sequential grades using a multidimensional measure of
achievement motivational pursuits and self-perceptions. This will provide greater clarification of how multiple dimensions of achievement motivation vary by sex and grade than previously available. The issue of variation across sex and grade in motivational pursuits and self-perceptions has diverse theoretical, practical and methodological implications for researchers concerned with motivational, developmental and gender differences. The findings will assist in programs designed to enhance these important components of facilitative learning within the school context.

This interesting yet challenging endeavour will provide a comprehensive account of adolescent achievement motivation across grades in high school. During adolescence motivational pursuits may vary by degree and/or direction therefore presenting differing profiles. To provide this information, a tool was specifically designed for adolescents to enable identification of the salient achievement motivational pursuits across grades and sexes. Providing a comprehensive account of adolescent motivation using cutting edge statistical analysis (MLwiN) would provide a tool to gauge adolescents’ achievement motivational pursuits. This investigation puts forward a newly designed measure (the SMOSA) to assess adolescents’ most salient motivational pursuits, their perceptions of competence in specific subject domains and their levels of capability across grades. It also provides educators with the information needed to compare a students’ individual profile against grade specific referents and identify any variation in the students’ pattern of responses compared to their grade and sex equivalent peers.
This thesis suggests that investigating motivational pursuits through a multidimensional model, that includes motivational pursuits and self-perceptions would provide a more comprehensive understanding of the patterns of change during adolescence in this complex phenomenon. Given that motivation is a multidimensional construct, clarification is needed on whether systematic declines emerge across grades and the varying dimensions.

Contemporary research has not mapped the patterns of change by degree and/or direction across adolescence to assess whether variation occurs among different motivational pursuits using a comprehensive model. A majority of the research findings has relied on cross-sectional analyses. The limited longitudinal research on achievement motivation has been conducted by Pintrich (2000b) and Jacobs and colleagues (2002) and neither research has used a multidimensional approach. Therefore a comprehensive account of the multidimensional profile during adolescence is required, to map the patterns of change across grades and sex.

The use of a comprehensive profile to evaluate achievement motivation including the lower-order factors across grades would provide clarification of how these factors function (Gorsuch, 1983). Mapping the pattern of change in the lower-order factors during adolescence may find that they vary across grades and that the profiles between males and females also present differing patterns of development. Reliance on higher-order constructs to explain this complex phenomenon may be limiting. Important information provided by the contribution of the lower-order
factors may be lost when aggregation of these factors is only viewed through their higher-order constructs.

A more comprehensive model would allow for clarification of the claims made regarding the use of a broader framework to explore achievement motivation. For example, reward pursuits and praise pursuits, (lower-order factors) have been evaluated under the higher-order construct of extrinsic goals with claims made by Hattie’s meta-analysis (2000) that minimal difference exists between these factors. However, a competing meta-analysis discounts these claims (Deci, Koestner, & Ryan, 1999). Through profile analyses comparing the lower-order factors under the higher-order constructs may be investigated to assess whether differences emerge, across grade and/or between males and females during high school.

With this aim in mind, this investigation undertakes three separate studies. Firstly, the psychometric soundness of the a-priori multidimensional 12-factor model assessed the reliability and validity of the instrument, through confirmatory factor analysis and tests of invariance across grades and sex. Secondly, analysing this model using multi-level analyses, allowed for identification of the possible differences that emerged by degree and/or direction in each of the factors. Thirdly, assessment of the lower-order factors within the higher-order constructs of mastery goals, performance goals, social goals and extrinsic goals tested the multidimensional model through profile analyses. Previous research has not investigated how the patterns of change in achievement motivation may vary, not only as a factor of grade through adolescence, but also as a factor of sex.

Using a multidimensional construct to investigate the patterns of development in achievement motivation would provide greater explanatory power and assist in
clarifying the complex nature of change by degree and/or direction during adolescence.

In summary this thesis tested:

a) The psychometric properties of the newly designed instrument (SMOSA) through confirmatory factor analysis;

b) The psychometric properties through invariance tests across grades, as well as sex.

c) Whether differences emerged in each of the 12 factors of the SMOSA across grades;

d) Whether differences emerged between males and females in each of the 12 factors of the SMOSA;

e) Whether males and females varied at differing grades (interaction effects) in each of the 12 factors of the SMOSA.

f) Whether differences existed among the lower-order factors of the higher-order constructs of; mastery, performance, social and extrinsic goals using profile analyses.

**Overall Aims**

The purpose of this chapter is to outline the related aims, hypotheses, research questions and rationale of the present thesis. The overarching aims of this research were presented in three studies. The first study assessed the psychometric soundness of the SMOSA. The second study investigated the patterns of change during adolescence in each of the twelve factors and also assessed whether males and females varied across high school. The third study investigated four separate profile analyses, to determine whether differences emerged between the two lower-order factors for each of the commonly used higher-order constructs.
Study 1: Psychometric properties of the measurement instrument

Aims

The objectives of Study 1 were to identify, develop and evaluate the psychometric soundness of the measurement instrument (SMOSA) used to investigate the multidimensionality of motivational pursuits in an adolescent population. This instrument was developed from a larger item pool that was presented to three cohorts of students who were retested across three years. The SMOSA’s instrumentation was evaluated through rigorous testing at each level to assess its reliability for use on this adolescent population.

Therefore, to evaluate the psychometric soundness in Study 1, several questions were posed;

a) Do responses to each of the instruments fit the a-priori factor structure that they were designed to measure?

b) Is the factor structure different for younger (grade 7) than older (grade 9) high school students using the first wave of data?

c) Is the factor structure different for females and males?

Statement of the hypotheses

Hypothesis 1.1.

Tests of reliability will demonstrate high reliability scores for the sub-scales measured for students in grades 7 to 9.

Hypothesis 1.2.

Tests of reliability will demonstrate high reliability scores for the sub-scales measured for students, regardless of whether they are males or females.
Hypothesis 2.1.

Confirmatory Factor Analysis (CFA) will demonstrate that the 12-factor structure will provide satisfactory goodness of fit indices for the newly-designed model.

Hypothesis 2.2.

The 12 factor structure of the SMOSA instrument will be similar for younger (grade 7) and older (grade 9) secondary school students as demonstrated by Structural Equation Modelling (SEM) tests of invariance.

Hypothesis 2.3.

The 12-factor structure of the SMOSA instrument will be similar for male and female secondary school students demonstrated by SEM tests of invariance.

Rationale for the Hypotheses

Hypotheses 1.1 to 2.3: Research into the area of the abstract concept of motivation needed instrumentation that was psychometrically sound, both in research design and also through the a-priori models investigated (Zaslow & Takanishi, 1993). This provided a sound basis for a thorough analysis of the changes in magnitude and direction of the motivational pursuits of adolescents. Measurements with strong reliability and validity aid the investigation and interpretation in any field of enquiry, and as suggested by Blumenfeld achievement motivation research requires such clarification (1992). This study rigorously evaluated the newly developed 12-factor model of the SMOSA to ensure that a sound empirical basis could be examined and applied to adolescents. It was predicted that using the SMOSA would provide reliable and valid measures for high school students, and that the factor structure would not differ as a feature of students’ grade level, (grades, 7 to 9) or sex, based on the results from the first collection of data.
Study 2: Structure and nature of adolescents’ motivation and self perceptions across grades and sex

Aims

The aim of the present investigation was to clarify and expand knowledge about the emerging differences in motivational pursuits by degree and direction for adolescents across high school. This was achieved firstly, as a factor of grades (7 to 11) and secondly, as a factor of sex and researched by:

a) identifying a psychometrically sound, multidimensional motivational instrument for use with adolescents;

b) critically examining the structure and nature of motivational pursuits of students during high school, to assess whether variation existed between grades (either through a linear or quadratic effect) and/or sex.

To this end, the ordering effect of grades (7 to 8 to 9 to 10 to 11) was evaluated through polynomial contrasts using MLwiN analyses. Both the linear and quadratic effects of grades were assessed at each level of the analysis. Simply, changes during adolescence within each given factor may not be linear for all students across grades; therefore non-linearity was assessed, if and when it occurred, through quadratic evaluation. Finally, profile analyses evaluated the lower-order factors of the higher-order constructs. In addition, both simple and complex levels of analyses were incorporated in this investigation.

Research Hypotheses

It was proposed that a multidimensional profile incorporating mastery goals (task and effort), performance goals (competition and leadership), social goals (affiliation and social concern) and extrinsic goals (reward and praise) (McInerney, 1992; 1995; McInerney, Roche, McInerney & Marsh, 1997) would lead to a more comprehensive
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description of the patterns of change in adolescents’ achievement motivational pursuits during high school. In addition, four self-perception inventories were incorporated into the model, to gauge changes in adolescents’ motives to achieve during high school. The newly-developed 12-factor modelled instrument (SMOSA) which embraces eight discrete forms of achievement motivation with the three measures of self-concept, (maths self-concept, English self-concept and general academic self-concept) and a newly evaluated measure of self-efficacy, provided an inclusive model to measure achievement motivation. This was deemed both relevant and necessary, when attempting to identify the changes in direction and/or degree for each of the proposed motivational pursuits during high school.

While there has been abundant research investigating the patterns of development in self-concept across adolescence, there has been surprisingly little research investigating the patterns of development in the associated motivational profiles of adolescents. Most research suggests that declines in achievement motivation generally occur during adolescence (Anderman, Maehr, & Midgley, 1999; Kurita & Zarbatany, 1991; Marsh, 1994a; Midgley & Edelin, 1998; Murphy & Alexander, 2000). Concern has been raised regarding the emphasised declines in motivation (Anderman, Maehr, & Midgley, 1999; Eccles & Wigfield, 2002; Kurita & Zarbatany, 1991; Marsh, 1994a; Midgley & Edelin, 1998; Murphy & Alexander, 2000; Wentzel, 1989). Clarification is therefore required to explain the disparities that have emerged in the literature regarding the ascription and continuance of declines during adolescence.

Therefore, the need arose, to systematically investigate the patterns of change by degree and direction in achievement motivational pursuits and self-perceptions using a comprehensive measure. Examining the relationships between the lower-order
factors provides greater clarification of their impact on students’ motivational pursuits. Assessing the patterns of change by degree and/or direction in the development of motivation across grades and/or sex, using a multidimensional measure provides insight into this complex phenomenon.

**Task pursuits**

Task orientation is a positive component of facilitative learning. It is one of the two pursuits that represent a mastery goal whereby increases in task orientation would equate to a more adaptive pattern of engagement at school. A task orientation is evidenced when students are motivated, by seeing improvement and progress in their work.

**Hypothesis 3.1.**

There should be gradual declines in task pursuits from grade 7 and then a plateauing should occur between grades 9 and 10 with gradual recovery in grade 11.

**Hypothesis 3.2.**

Males should have lower task pursuits than females.

**Hypothesis 3.3.**

Differences should emerge between males and females. Males should have a less facilitative or adaptive pattern of learning than females; recording lower levels of task pursuits uniformly across grades 7 to 11.

**Rationale for hypotheses 3.1 to 3.3.**

Declines in mastery goals until grade 9 have been noted by several researchers (Eccles & Wigfield, 2002; Simpson & McInerney, 2002; Simpson & McInerney, 2004; Zusho & Pintrich, 2001b). Jacobs et al., (2002) found systematic declines in task values in language art, math values and sport values across grades 2 to 12. Significant sex differences in task values favoring females have been found
Achievement motivation (Anderman et al., 2001; Wentzel, 1989). Therefore, the patterns of change in task pursuits across grades and between males and females and their relative interactions, were systematically evaluated.

**Effort pursuits**

The pursuit and application of effort is a positive component of facilitative learning. Persevering when challenges are presented equates to a positive aspect of learning and understanding. Effort is one of two pursuits recognised as a mastery goal (McInerney, Marsh, & Yeung, 2003; Simpson & McInerney, 2004). Increases in effort pursuits, whereby the student applies more effort (tries harder when challenged) equates to more adaptive patterns of engagement in high school. An effort pursuit is the perceived importance for students to see that effort and perseverance is associated with learning.

**Hypothesis 4.1.**

There should be gradual declines evidenced in effort pursuits from grade 7 and then a plateauing should occur with gradual recovery between grade 10 and grade 11.

**Hypothesis 4.2.**

Males should have lower effort pursuits compared to females.

**Hypothesis 4.3.**

Differences by degree and direction should emerge across high school in effort pursuits between males and females. Lower levels of effort pursuits will be found for males compared to females across grades 7 to 11.

**Rationale for hypotheses 4.1 to 4.3.**

Declines in mastery goals have been noted by several researchers (Eccles & Wigfield, 2002; Simpson & McInerney, 2002; Simpson & McInerney, 2004; Zusho & Pintrich, 2001b). However, most prior research has not separated mastery goals into
its lower-order constructs of task pursuits and effort pursuits to investigate differences across grades. In addition this enquiry’s use of multilevel modelling enhanced previous findings on the patterns of change, across grades and/or sex in the lower-order factors of mastery goals. The use of contrast effects investigating the linear and quadratic effect of grades makes for a more elegant enquiry allowing for isolation of the relevant points of this investigation. The use of multilevel modelling allows for imputation of missing values based on the pattern of scores represented by the individual as well as the group. Previous research’s limitations in trying to identify the nature of effort pursuits across grades and, between males and females is thoroughly assessed using these advanced statistical techniques. Research has noted that effort pursuits declined between grades 7 and 8; whereas students’ task pursuits within the same sample continued to decline up to and including grade 9 (Simpson & McInerney, 2002). While mastery goals have been higher for females compared to males (Nicholls, 1984), there is limited research across grades on the nature of these declines when separated into their lower-order factors.

**Competition pursuits**

A competition orientation has been regarded in the literature as less facilitative in learning because of the use of surface-level compared to deep-level strategies (Anderman & Maehr, 1994). It is one of the two pursuits that represent a performance goal. Increases in a competition pursuit would equate to a less adaptive pattern of engagement according to Achievement Goal Theory. A competition pursuit is the perception that students see competitiveness in their schoolwork as important for their learning.
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**Hypothesis 5.1.**

There should be gradual declines in competition pursuits occurring during adolescence until grade 11.

**Hypothesis 5.2.**

Males should report higher levels of competition pursuits than females.

**Hypothesis 5.3.**

Differences by degree and direction should emerge in competition pursuits across grades between males and females. Males will have higher levels of competition pursuits across grades 7 to 11.

**Rationale for hypotheses 5.1 to 5.3.**

Declines in performance goals have been noted in research however, there are limitations on the pattern of development for competition pursuits across grades and whether males and females vary in their profiles of development. Research has reported that competition pursuits continued to decline across the three grades, whereas leader pursuits reported declines only between grades 7 and 8 (Simpson & McInerney, 2002). Performance goals have been found to be higher for males compared to females although there is limited research across grades on the nature of these declines (Anderman, Maehr, & Midgley, 1999; Butler, 1999; Hinkley & McInerney, 1998). Identifying when (at what grade) differences in performance goals are most significant between males and females is necessary.

**Leader pursuits**

A leadership orientation has been regarded in the literature as less facilitative in the process of learning and is the second orientation represented in a performance goal. Therefore, increases in a leadership orientation would not equate to a more adaptive pattern of engagement according to Achievement Goal Theory. A leader
pursuit is the perceived importance for students to see leadership within a group as an important component motivating them in their learning.

_Hypothesis 6.1._

There should be gradual declines evidenced in leader pursuits during adolescence across the grades.

_Hypothesis 6.2._

Males should report higher levels of leader pursuits compared to females.

_Hypothesis 6.3._

Differences by degree and direction across high school should emerge in leader pursuits between males and females. Males will have higher levels of leader pursuits across grades.

_Rationale for hypotheses 6.1 to 6.3._

Declines in performance goals generally have been noted in research however, there are limitations in the research in identifying the nature in leader pursuits across grades and whether males and females vary in this pursuit. Research by Simpson and McInerney (2002) found that competition pursuits continued to decline across the three grades, 7, 8 and 9, whereas leader pursuits found declines only between grades 7 and 8. Performance goals in general have been found to be higher for males compared to females although there is limited research reporting on sex differences in these lower-order pursuits (Anderman, Maehr, & Midgley, 1999; Hinkley & McInerney, 1998). The literature identifies leader pursuits more strongly in males as compared to females (Ryan, Hicks & Midgley, 1997; Simpson & McInerney, 2002).

_Affiliation pursuits_

Affiliation pursuits are an important component of achievement motivation particularly relevant during early adolescence. Early adolescence has been recognised
as a period when there is an increased emphasis on the impact of affiliations and students’ peers (Bateman, Bransford, Goldman, & Newrbrough, 2000). Affiliation pursuits are the second orientation that represents a social goal. Initial increases in affiliation pursuits may equate to adaptation within a much larger environment in grade 7, during early adolescence. However, increases in affiliation pursuits do not equate to facilitative learning during the course of schooling, especially in later adolescence. In order to become more facilitative in learning, this motivational pursuit should decline as students’ progress across high school. Autonomy and independence have been linked to self-regulation as factors that facilitate learning where the need for external influences should show gradual decline across high school (Ryan & Deci, 2000).

**Hypothesis 7.1.**

There should be gradual declines evidenced in affiliation pursuits across grades 7 to 11 during high school.

**Hypothesis 7.2.**

Females will have higher levels of affiliation pursuits compared to males.

**Hypothesis 7.3.**

Differences in affiliation pursuits by degree and direction should emerge across grades between males and females presenting disparate patterns of development.

**Rationale for hypotheses 7.1 to 7.3.**

Declines in social goals have been noted in research, however there are limitations in the research identifying the nature of change across grades and how males and females vary in this pursuit. Social concern pursuits continued to decline across three grades, whereas affiliation pursuits only reported declines between grades 7 and 8 (Simpson & McInerney, 2002). Social goals have been found to be
higher for females compared to males although Wentzel (1989) questions this claim. There is limited research across grades regarding the nature of change in affiliation pursuits. Affiliation has been identified in the literature as being a female-based orientation compared to males (Hinkley, McInerney & Marsh).

**Social concern pursuits**

An orientation towards social concern may be a component of facilitative learning. It is one of the two pursuits that represent a social goal. Social concern pursuits or the mentoring of others may be viewed as facilitative towards a better understanding of learning. However working with a group of friends, as in affiliation pursuits, would not be seen as positively geared towards the endeavours of independent learning, and would therefore be seen as less facilitative. The link to academic gains during early adolescence has been found in social concern pursuits where Wentzel’s (1993) research found sharing, to be a helpful behaviour towards their peers, and assisted the individual student’s own academic success.

**Hypothesis 8.1.**

There should be gradual declines evidenced in social concern pursuits during adolescence across the grades.

**Hypothesis 8.2.**

Females will have higher levels of social concern pursuits compared to males.

**Hypothesis 8.3.**

Differences across grades should emerge in social concern pursuits between males and females, with males having lower levels of social concern pursuits than females.

**Rationale for hypotheses 8.1 to 8.3.**

Declines across grades in social goals have been noted in research (Simpson & McInerney, 2002). However, the patterns of change have not been mapped across
grades nor examined the differences between males and females across grades. A comprehensive assessment is required. Research on social concern pursuits identified continued declines across grades 7, 8 and 9, whereas affiliation pursuits only had declines between grades 7 and 8 (Simpson & McInerney, 2002). Social goals have been found to be higher for females (Hinkley & McInerney, 1998) compared to males although Wentzel (1989) questions this claim.

**Rewards pursuits**

An orientation towards rewards may be viewed as facilitative towards initial engagement during early adolescence, however, the literature indicates an undermining effect overall occurs for intrinsic motivation (Deci, Koestner, & Ryan, 1999; Ryan & Deci, 2000). It is one of the two pursuits that represent an extrinsic goal. The receipt of tangible rewards has been linked to undermining intrinsic motivation in most of the literature (Deci, Koestner, & Ryan, 1999) Therefore, reward pursuits should be less conducive to learning. There is a need for the development of autonomy and self-regulation in later adolescence and this motivational orientation should decline as students progress through high school (Deci, Koestner, & Ryan, 1999). Self-regulation has been linked to facilitative learning and the need for external reinforcement through extrinsic goals should show gradual decline across high school (Ryan & Deci, 2000).

*Hypothesis 9.1.*

There should be gradual declines evidenced in reward pursuits across grades during high school.

*Hypothesis 9.2.*

Males will have higher levels of reward pursuits compared to females.
Hypothesis 9.3.

Differences will emerge across high school in reward pursuits. The interactions of sex and grade should show a disparate pattern in reward pursuits, with females having lower levels across grades than males.

Rationale for hypotheses 9.1 to 9.3.

Declines across grades in extrinsic goals have been noted in research (Simpson & McInerney, 2002). However, the research mapping the patterns of change across grades and whether males and females vary during high school is limited. Therefore, a comprehensive assessment is required. Reward pursuits continued to decline across the three grades, whereas praise pursuits only had declines between grades 7 and 8 (Simpson & McInerney, 2002). Extrinsic goals have been found to be higher for males compared to females (Deci, Koestner, & Ryan, 1999).

Praise pursuits

While an orientation towards praise may be an initial component of facilitative learning for young adolescents, this may not be the case in late adolescence. A praise pursuit is the second motivational orientation representing an extrinsic goal. In a meta-analysis by Deci, Koestner and Ryan (1999), the difference between these two extrinsic goals was pronounced. Their meta-analysis suggested that only when a praise pursuit was controlling was this viewed as undermining of intrinsic motivation and when the content of the Verbal reward was informational, intrinsic motivation was enhanced. Therefore, a more adaptive pattern of engagement during early adolescence may be obtained with praise pursuits compared to reward pursuits because of the relationship with self-regulated engagement. Sex differences emerged on the interpretation of praise (verbal rewards) with females, who viewed their receipt as more controlling and therefore undermining of intrinsic motivation,
whereas males viewed the content of praise as informational and enhancing of intrinsic motivation.

_Hypothesis 10.1._

There should be gradual declines in praise pursuits across grades in high school.

_Hypothesis 10.2._

Males should report higher praise pursuits than females during high school.

_Hypothesis 10.3._

Differences by across grades during high school should emerge between males and females in praise pursuits. Males will have higher praise pursuits than females across high school.

_Rationale for hypotheses 10.1 to 10.3._

Declines across grades in extrinsic goals have been noted in research (Simpson & McInerney, 2002). Research however, has not mapped the patterns of change across grades to investigate how males and females vary during high school. Reward pursuits continued to decline across the three grades, whereas praise pursuits only had declines between grades 7 and 8 (Simpson & McInerney, 2002). Extrinsic goals have been found to be higher for males compared to females (Deci, Koestner, & Ryan, 1999). In addition, as mentioned females view praise pursuits as controlling in line with a performance contingency and therefore undermining of intrinsic motivation. Conversely males view the performance contingency of verbal rewards as informational and therefore, enhancing of intrinsic motivation.

_Hypotheses for self perceptions_

Importantly, self-concept is a multidimensional construct rather than an overarching single theme. Work piloted by Marsh and colleagues forged the development of a battery of Self-description questionnaires, specifically sensitive to
the stages of preadolescence, early adolescence and late adolescence. Particularly relevant to the study of adolescents’ academic self-concept in the domains of English, maths and general academic, was the ASDQII, which has been strongly supported and validated by research (Marsh, 1994; Marsh, 1996).

Marsh and Craven (1997) have stressed the roles of specific domains as more useful predictors of a wide variety of behaviours when investigating self-concept. For example, students’ maths self-concept has been more highly correlated with students’ academic achievement in maths than either their English self-concept or English performance; similarly their English self-concept is more highly correlated with English academic outcomes, than their Math self-concept or performance (Marsh & Craven, 1997). The literature attests to the value of supporting investigations into these constructs as separate factors due to the domain specificity of self-concept. Therefore, when investigating students’ profiles during high school, these indicators may provide valuable information on both the patterns of change in these constructs across grades as well as sex.

Developmentally, as students’ self-concept of ability becomes better established and more stable with age, students’ performance may increasingly be affected by how they are motivated (Juvenon & Nishina, 1997; Skaalvik & Valas, 1999). Skaalvik and Valas also suggest that because the tendency to make both external and internal comparisons may increase with age, more research is needed at different age levels during adolescence. Marsh and Yeung (1997) indicated that in high school, achievement is affected by self-concept and that the self-concept-achievement relationship may undergo changes during this period (Skaalvik & Valas, 1999). Self-concept is a valuable indicator linking domain-specific measures of self-concept to achievement through directly related constructs and performance outcomes. The
relationship of achievement motivation to self-concept is sometimes evaluated through specific pursuits or motivational goals.

**English self-concept**

Although males generally overestimate their perceived competence in various domains, females generally report higher self-concept in English than males, during high school (Anderman, Eccles, Yoon, Roeser, Wigfield & Blumenfeld, 2001; Fredericks & Eccles, 2002; Huston & Alvarez, 1990).

**Hypothesis 11.1.**

There should be gradual declines evidenced in English self-concept during early adolescence (from grade 7) up to and including grade 9, and then a plateauing should occur (between grade 9 and 10) with gradual recovery in grade 11.

**Hypothesis 11.2.**

Males will have lower levels of English self-concept compared to females.

**Hypothesis 11.3.**

The interactions of sex and grade should show disparate trends of English self-concept with females having higher levels across grades. Therefore, differences in degree and/or direction should emerge towards English self-concept between males and females.

**Rationale for hypotheses 11.1 to 11.3.**

Attitudes towards English (verbal) self-concept should decline with age during preadolescence. Marsh reported improvement in verbal/reading self-concept during late adolescence with recovery emerging by grade 10 on the SDQII. During grades 7 and 8 there were declines evidenced for males although slight improvement occurred for females (Marsh, 1989). Females reported higher verbal/reading self-concept than
males across all grades during high school and disparate patterns were reported for males and females (Marsh, 1989).

**Maths self-concept**

Maths’ motivation had a significant effect on maths self-concept in the youngest cohort of research conducted by Skaalvik and Valas (1999). Marsh’s ASDQII was designed to assess the value of the multidimensional nature of Academic self-concept measures during adolescence. One aspect of this measure is maths self-concept. Research to date has found that males report higher levels of maths self-concept compared to females and that generally a quadratic U-shaped effect occurred during high school (Marsh, 1989).

**Hypothesis 12.1.**

Gradual declines will be found in maths self-concept during early adolescence (from grade 7) up to and including grade 9, and then a plateauing should occur (between grade 9 and 10) with gradual recovery in grade 11.

**Hypothesis 12.2.**

Males should report a higher level of maths self-concept than females.

**Hypothesis 12.3.**

Differences by degree and/or direction across the course of high school should emerge towards maths self-concept between males and females. Lower levels of maths self-concept will be found for females compared to males across grades during high school.

**Rationale for hypotheses 12.1 to 12.3.**

Attitudes towards maths self-concept decline with age until the later high school years (Eccles & Midgley, 1989). Marsh found strong support for the increase of maths self-concept during late adolescence with a quadratic u-shaped effect emerging
between grades 7 to 11 on the ASDQII. During grades 7 and 8 there were declines evidenced with a levelling out between grades 8 and 9 and then increase in grades 10 and 11 (Marsh, 1989). Males reported higher maths self-concept consistently across grades compared to females (Anderman et al., 2001; Jackson, Hodge, & Ingram, 1994; Marsh, 1989)

*General academic self-concept*

General academic self-concept is part of the ASDQII that is rarely used due to its univariate nature. However, recent research by Marsh, Parada and Ayotte (2004) used this unidimensional measure of self-concept, and suggested that the “unidimensional perspective [is] still prevalent in mental health research and assessment” (p. 27). In that article the researchers referred to it as self-esteem. In the current investigation, this scale was included because of the number of studies that have evaluated self-esteem as being related to adolescent motivation academically (Harter, 1999a, 1999b; Harter, Whitesell, & Junkin, 1998). Whether similar patterns present across high school between the newly constructed PAC measure and Marsh’s general academic self-concept measure, presents an interesting evaluation that needs to be assessed using CFAs (presented in Chapter 7). Whereas, statements such as “I get good marks in most school Subjects” were part of general academic self-concept scale, and viewed as statements relative to previous performance, PAC’s scale statements were related to adolescents’ perceived academic capability, for example “I think that I can do quite well at school”. Therefore, the following hypotheses are used to assess both scales.
Hypothesis 13.1.

There should be gradual declines evidenced in general academic self-concept during early adolescence and then a plateauing should occur with gradual recovery by grade 11.

Hypothesis 13.2.

Males should report higher levels of general academic self-concept than females.

Hypothesis 13.3.

Differences by degree and/or direction should emerge in general academic self-concept between males and females across the grades. Lower levels of general academic self-concept will be evidenced for females compared to males across grades during high school.

Rationale for hypotheses 13.1 to 13.3.

General academic self-concept was reported as a positive component of self-concept with males having higher levels compared to females across grades (Marsh, 1989).

Self-efficacy - PAC (Perceived Academic Capability)

Hypothesis 14.1.

There should be gradual declines evidenced in PAC during early adolescence and then a plateauing should occur with gradual recovery by grade 11.

Hypothesis 14.2.

Males should report higher levels of PAC than females.

Hypothesis 14.3.

Differences by degree and/or direction across grades during high school should emerge in PAC between males and females. Lower levels of PAC should be reported
Achievement motivation

for females compared to males across the ordered grades however, females should show greater recovery by grade 11.

**Rationale for hypotheses 14.1 to 14.3.**

As this is a new scale the hypotheses are based on a review of the literature related to perceived competence. Males rated their competence higher than females in their ability to perform, although the gender gap decreased across grades (Anderman, et al). Research undertaken by Cole and colleagues (Cole et al., 2001) found that both males and females recovered in the latter part of high school, however, females’ rate of recovery was greater than males.

**The relationship between learning facilitation and sex across the 12-factor scale**

The research hypothesised that overall, females would have a more educationally adaptive pattern of development in all facets of the 12-factor model across grades compared to males. The patterns of change towards increased levels in mastery goals, English self-concept, PAC and social concern pursuits would be facilitative. However, decreased levels of extrinsic goals, performance goals and affiliation pursuits would also equate to facilitative learning according to the literature. There would be evidence of recovery and/or higher levels of the more facilitative pursuits occurring earlier for females compared to males.

**Study 3: Profile analyses compared the lower-order factors under the higher-order constructs**

**Aim**

The aim of this study was to assess the value of using a multidimensional construct, by testing whether disparate patterns that emerged between the respective lower-order factors of the higher-order constructs of mastery goals, performance goals, social goals and extrinsic goals. In addition, whether disparate patterns
emerged across grades, sex or in the (grade X sex) interactions between the higher-order constructs, were assessed. Profile analyses were undertaken through the MLwiN 2.02 statistical program testing. Tests of parallelism of profiles and ‘levels’ hypothesis was undertaken to assess the research questions that follow (fully outlined in Chapter 6, Methodology for the profile analyses in the section) (Tabachnick & Fidell, 2001).

Three separate analyses were undertaken within this study for each of the four higher-order goal constructs. Firstly, assessment of whether differences emerged between the lower-order factors was evaluated for each of the four higher-order constructs. Standardising the scores meant that parallel profiles could be appropriately undertaken through comparison of relative values. Secondly, assessment was undertaken on whether the lower-order factors varied as a function of the natural ordering effects of grades (linear and quadratic assessment) and the relative interactions. The flatness hypothesis (movement across grades, increase or declines) was applied at this level. The third assessment tested whether sex and its possible interactions report disparate patterns between the lower-order factors. This assessment was tested through the levels hypothesis in profile analysis. Testing whether the lower-order factors present parallel groupings across grades between males and females is the test of parallelism of profiles and the primary hypothesis tested in profile analysis (Tabachnick & Fidell, 2001).

**Research questions and rationale**

Four research questions emerged progressively in this investigation relating to the higher-order constructs of mastery goals, performance goals, social goals and extrinsic goals. The argument predominantly rests on Gorsuch’ claims, that relying on higher-order constructs of a measurement (hierarchical ordering) may be at a cost of
explanatory power, that is, some of the explanatory power relative to the lower-order factors may be lost in the investigation when reliance is placed on the higher-order constructs. Unless the two lower-order factors present the same pattern of development then there is a chance of cancelling out important information on differences that would be lost in a single higher-order evaluation. A majority of research in achievement motivation has relied on the higher-order constructs of mastery goals and performance goals, and to a lesser extent the other higher-order constructs of social goals and extrinsic goals. This has been to the exclusion of assessing the effect of the lower-order factors for each, and as Gorsuch suggests these lower-order factors may provide greater explanatory power.

Given this investigation used a broader multidimensional measure, dividing the higher-order constructs to map the patterns of change during adolescence in achievement motivation, it would be remiss not to include an investigation on whether differences emerged between each of the lower-order factors. Therefore, when mapping the profiles of adolescents, assessment was also required on whether differing patterns emerged between each of the lower-order factors presented under their higher-order construct, across grades and also whether these patterns vary between males and females and the grade X sex interaction for each measure.

Therefore a series of profile analyses were undertaken to investigate four (4) research questions. The profile analyses assessed whether the lower-order factors of the higher-order constructs of mastery goals, performance goals, social goals and extrinsic goals were significantly different across grades, sex, or the possible interactions (grades X sex).
Research question 1

Differences will be assessed on the lower-order factors of task pursuits and effort pursuits under the higher-order construct of a mastery goal; to ascertain whether different developmental trajectories emerge between task pursuits and effort pursuits across grades and/or between males and females and their relative interactions.

Research question 2

Differences will be assessed on the lower-order factors of competition pursuits and leader pursuits under the higher-order construct of a performance goal; to assess whether different developmental trajectories emerge between competition pursuits and leader pursuits across grades and/or between males and females and their relative interactions.

Research question 3

Differences will be assessed on the lower-order factors of affiliation pursuits and social concern pursuits under the higher-order construct of a social goal; to assess whether different developmental trajectories emerge between affiliation pursuits and social concern pursuits across grades and/or between males and females and their relative interactions.

Research question 4

Differences will be assessed on the lower-order factors of reward pursuits and praise pursuits, under the higher-order construct of an extrinsic goal; to ascertain whether different developmental trajectories emerge between reward pursuits and praise pursuits, across grades and/or between males and females and their relative interactions.
Chapter 6

Methodology

Introduction

The primary aim of this chapter was to systematically present the methodology employed in the present investigation. This thesis the collection of data over three time waves using three cohorts of students. Therefore, a cross-sequential design was employed in these analyses (Jacobs, et al., 2002). This design was used to provide a comprehensive investigation of the development of achievement motivational pursuits across grades 7 to 11 and analysed whether different patterns emerged between males and females across grades.

Three individual studies addressed the specific aims, hypotheses and research questions, outlined in chapter 5. Study 1 tested the reliability and validity of the measurement instrumentation used. Study 2, firstly assessed whether the effect of cohort differences emerged among the three collections of data. Then, secondly after normalisation and standardisation of the instrument was completed; the patterns of change in the twelve factors of the SMOSA were mapped assessing grade, sex and their interactions (grade X sex) and the effect of Time. Study 3 investigated the four sets of profile analyses to evaluate whether the two lower-order factors for each of the higher-order constructs of mastery goals, performance goals, social goals and extrinsic goals presented different patterns of development across grades, sex, or (grade X sex) interactions.

This chapter presents the methodology employed in these three studies. A detailed description of the characteristics of the participants; the development and validation of the instrumentation used for the self-report, survey-style investigation; the procedure used in the administration of the questionnaire and an outline of the
design for each individual study used, explains the procedures involved in the data analyses. An outline of the statistical procedures used in each specific design is also presented with detailed information on specific aspects relating to the preparation of the data and statistical analyses employed.

**Background of Australian high school students**

This thesis collected data from students attending eleven schools in the state of New South Wales, Australia. The structure of schooling in New South Wales mandates that children from age 6 to 15 must go to school. Children generally commence schooling in Kindergarten at approximately 5-6 years of age and attend Primary School from grade 1 to grade 6, with natural progression into high school in grade 7 where they complete their schooling in grade 12 (Department of Immigration and Multicultural and Indigenous Affairs, 2004). Therefore, the only natural transition in New South Wales’ schools is between grades 6 to 7 from primary school to high school. This transition coincides with early adolescence, generally around 11-12 years of age.

In the public schooling system in Australia, students in Primary School generally have one teacher per year, where students are taught in the same classroom and socialised with the same group of peers. This comparatively smaller social environment in primary school contrasts to the high school setting. Grade 7 marks the transition into high school that requires adaptation to a larger structural and social milieu that students need to master (McInerney, Simpson & Dowson, 2003). This transition incorporates a different system where classes are divided into individual periods with different teachers and differing groups of peers in changing classrooms occurring up to eight times daily.
Research participants

The three waves of data were collected in New South Wales, Australia, and coincided with the period of growth and change after the transition to grade 7 in high school. The data was exclusively obtained through the public schooling system.

Three cohorts of students starting with grades 7, 8 and 9 were followed on three time collections of data (approximately 1 year apart) across eleven high schools during 1999, 2000 and 2001. The overall mean age of students \((N= 2131)\) in Time 1 of this longitudinal study was 13.33 (SD = 0.99) years. For each grade represented in Time 1 of three Cohorts, the mean age of students \((N= 725)\) in grade 7 (Cohort 1) = 12.13 (SD = 0.57), mean age of students \((N = 688)\) in grade 8 (Cohort 2) = 13.12 (SD = 0.56) and mean age of students \((N= 718)\) in grade 9 (Cohort 3) = 14.10 (SD = 0.57).

In Time 2 of this longitudinal study the overall mean age of students \((N= 2026)\) was 14.29 (1.11) years. For each grade represented in the Time 2 cohort of the three grades, the mean age of students \((N = 684)\) in grade 8 (Cohort 1) = 13.2 (SD = 0.63), the mean age of students (660) in grade 9 (Cohort 2) = 14.29 (SD = 0.64), the mean age of students (682) in grade 10 (Cohort 3) = 15.34 (SD = 0.75). In Time 3 of this longitudinal study the overall mean age of students \((N= 1676)\) was 15.09 (1.31) years. For each grade represented in the Time 3 cohort of the three grades, the mean age of students \((N = 613)\) in grade 9 (Cohort 1) = 14.41 (SD = 0.61), mean age of students (599) in grade 10 (Cohort 2) = 15.51 (SD = 0.92), mean age of students (464) in grade 11 (Cohort 3) = 16.40 (SD = 0.83).

There were 2131 (48.5% were male and 51.5% were female) students in the first wave of data collected during 1999. The participating students were from three consecutive grades; 7, 8 and 9, attending eleven high schools (five rural schools in northern New South Wales, 36.8%, and six urban schools, 63.2%, in Sydney’s South
Western region). Nine of the participating schools were co-educational and two were single-sex schools (one boys’ school and one girls’ school). Both single sex schools were located in the urban part of the South Western Sydney metropolitan area. This sample had a good multicultural representation. Ninety-nine different cultural backgrounds were reported. These were broadly categorised into seven groups; Australian Aboriginal = 14.6%, Anglo-Australian = 40.5%, Middle Eastern = 18.1%, Asian = 14.1%, European 9.8%, Islanders = 2.2% and other 0.6%.

**Instrumentation**

Achievement motivation was measured using a newly adapted instrument, the SMOSA, which incorporated motivational pursuits and self-perceptions subscales within a single scale. Two motivational instruments, the Inventory of School Motivation (ISM) and the General Achievement Goal Orientation Scale (GAGOS) were used to create the achievement motivational pursuit factors. The items in the scales were designed to capture motivational pursuits within the school context, and these two scales had been specifically designed for use with adolescents measured on a five-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5). To explore self-perceptions within the school context, an abbreviated version of Marsh’s ASDQIIs was used to test the domain specificity of English, maths and general academic self-concept and a newly created self-efficacy measure gauging adolescent’s perceptions of academic capability in the school context was also used. The three self-concept scales consisted of five items with a five-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5) to be in line with the other responses of the ISM. For these scales the wording of the five items was strictly parallel except for the general academic self-concept scale where the expression “most school subjects” for the school esteem scale was used (Marsh & Yeung, 1997).
This scale was developed from the Sense of Self Inventory components in the ISM that specifically used ‘ability’ within the wording of the items.

The motivational component of the instrument was established, by firstly, taking items from the ISM (McInerney, et al., 1997) which is an exploratory instrument constructed around a number of dimensions drawn from Achievement Goal Theory and Social Cognitive Theory (McInerney, 1992; 1995; McInerney, Roche, McInerney & Marsh, 1997). The ISM has been used by McInerney and colleagues (McInerney, Marsh, & Yeung, 2003; McInerney, Roche, McInerney, & Marsh, 1997; McInerney, Simpson, & Dowson, 2003; McInerney & Sinclair, 1991) in a number of studies to define scales that are relevant to examining motivation particularly in cross-cultural contexts and has been primarily concerned with deriving a set of motivational items from an 81-item scale.

The full ISM scale includes eight motivational factors; task, effort, competition, social power, affiliation, social concern, praise and token. The ISM’s initial pool of 51 items measuring motivation was represented by 4 items for task, 7 items for effort, 8 items for competition, 7 items for power, 8 items for affiliation, 5 items for social concern, 7 items for token and 5 items for praise. Four self-perception scales were also included in the ISM administration; Sense of Purpose (6), Self Reliance (12) and Positive and Negative self-esteem (12) measures, 30 items in total and these motivational items were adapted from Maehr’s Personal Investment Model (PIM). McInerney has suggested “the use of any combination of items may be used, although a number of validated scales have been useful in previous research across various samples” (McInerney, Marsh, & Yeung, 2003). When administering inventories to students in classrooms there is value in having a comprehensive yet parsimonious
measure. What is required is a measure that can simultaneously capture adolescent’s motivational pursuits and their self perceptions during high school.

Therefore, adaptation of the ISM was obtained in the present study by integrating one item from McInerney’s GAGOS instrument that was simultaneously administered. The nature of the items in the ISM varies from those in the GAGOS scale, because the items in the ISM do not specifically mention the word ‘motivation’ but only infer this. The items in the GAGOS instrument, specifically asked respondents to indicate whether they were most motivated” in each item within the specific factors identified (McInerney, Marsh & Yeung, 2003, pp. 338-339). For the purpose of clarity relating to intent within the factors of the scale, an item that best represented the definitional framework of each of the ISM factors was included from the GAGOS scale. Seven of the initial ISM scales had at least one GAGOS item included in the newly created measure of the SMOSA, with the exception of effort, where no equivalent measure specifically addressing motivation that related to students motivation was available within the administered data set.

Essentially, in the newly developed scale (SMOSA) this research made the first item from the GAGOS scale a referent within each of the motivational pursuits, because it defined the motivational context in line with the definitional framework being assessed for that factor. Items were then included from the ISM that inferred motivation within the broader context of each factor’s definitional framework, thus establishing a new eight-factor motivational scale that not only inferred motivation but also explicitly asked this within the individual factor structures. By combining these two motivational scales (the ISM and GAGOS) into a single scale and only keeping the items that specifically mentioned motivational intent or inferred this under each specific factor produced a parsimonious (reduction in the items from 84
Achievement motivation items to 34) yet comprehensive (8 motivational factors) measure to gauge achievement motivation in an adolescent population. This single scale was created from instruments that were designed and theoretically underpinned through a socio-cognitive framework set up by Maehr and which have been tested and validated through a number of previous studies. Testing the psychometric soundness of this newly established instrument will be undertaken. The newly designed motivational pursuits’ measure used 34 items from the original 84 items. There was a trade-off for the comprehensive approach in the ISM with the more economical approach of his GAGOS instrument. In addition, features related to adolescent’s self-concept in the domain specific subjects of maths and English, two domains that are paramount during high school were not included within either of these measures.

However, review of the literature found that self-perceptions have been inextricably linked with motivational factors under the social cognitive framework (the ISM and Maehr’s Personal Investment Model incorporated self measures within their scale design). Therefore, the question emerged in this research whether a model with self-perceptions and achievement motivational pursuits would provide a psychometrically sound instrument. As Maehr’s research has outlined, the major determinants that impact on an adolescent’s direction, intensity and duration of behaviour are best explained through the student’s “thoughts about self and the emerging importance of purposes and goals” (1989, p. 301). Therefore, it appears timely that a comprehensive, yet parsimonious instrument to gauge adolescent motivation in the school context be used.

Evaluating measures of self-perceptions for inclusion in this research meant that measures of self-concept and self-efficacy were necessary. Self-concept has long been valued in assessing domain specific self-perceptions in the school context given
its high reliability and validity across many samples (Byrne, 1996; Marsh & Yeung, 1997; Marsh, Parada & Ayotte, 2004). English self-concept and maths self-concept have been found to have high correlations associated with their respective equivalent outcome measures (Marsh & Yeung).

The importance placed on the performance outcome measures of numeracy and literacy during early adolescence is highlighted in New South Wales high schools with administration of state-wide assessments (SNAP and ELLA) during grades 7 and 8. The emphasis placed on the state-wide literacy (ELLA) and numeracy (SNAP) evaluations supports the inclusion of the domain specific measures of self-concept. The abbreviated form of the adolescent self description questionnaire (ASDQIIIs) specifically designed for assessment of maths self-concept, English self-concept and general academic self-concept was chosen due to its reported high reliability and validity structure (Marsh, Parada, & Ayotte, 2004). The only change in the item structure was the elimination of the negatively worded items within each sub-test as suggested in several scale construction texts. There has been suggestion that reported ambiguity may be a factor in the understanding of negatively worded items (Hills, 2003; Kline, 1973). Therefore, each of the three factors; maths self-concept, English self-concept and general academic self-concept was reduced to five items for inclusion in the SMOSA.

There is an emphasis in the literature on the referent of perceived efficacy or capability being linked to engagement in high school (Harackiewicz, Barron, Pintrich, Elliott, & Thrash, 2002; Harter, 1999b; Hidi & Harackiewicz, 2000; Schunk, 2003; Skaalvik & Hagtvet, 1990; Skaalvik & Valas, 1999). While Marsh’s measure captures aspects of self-perceptions regarding the domain specificity of English, maths and general academic beliefs, these are primarily based upon perceptions relating to past
academic performances. Although general academic self-concept has been used to a lesser degree in Marsh’s contemporary research, how student’s perceive their general competence at high school through performance-based evaluations may provide additional information that is not addressed when assessing differences in the domain specificity of self-concept or self-efficacy. The patterns of change in students’ general academic self-concept may be different from other self-perception measures especially during adolescence.

Additionally, when investigating self perceptions several theorists (Bandura & Locke, 1993; Bandura, 1997; Bong & Clark, 1999; Jacobs, et al., 2002) have argued for the inclusion of a measure based on how efficacious students perceive themself to be in the school environment. Eccles and colleagues have included self-efficacy in their research. In addition, Bong and Clark (1999) suggest that self-concept and self-efficacy evaluate differing components of self perceptions. “Self-concept is a complex construct, incorporating both cognitive and affective responses towards the self and is heavily influenced by social concern” (Bong & Clark, 1999, p. 150).

Therefore, to provide a more comprehensive account of adolescent’s self-perceptions, assessing both student’s self-efficacy through perceptions of the capability to achieve, as well as their English self-concept, maths self-concept and general academic self-concept may account for the diversity in self-perceptions across grades and delineate subtle nuances that may emerge between male and female responses.

Due to the wealth of research linking self-efficacy to the motivational context, a newly developed measure of perceived capability was also included in the SMOSA. The newly constructed subscale was calibrated from the ISM’s initial 30-item pool on self perceptions. Selection was based on identifying questions in the ISM on student’s perceived capability at school. A total of nine items were initially extracted from the
30-item pool to measure self-efficacy but on careful review, four items were believed to best represent the measure of Perceived Academic Competence (PAC).

**Table 6.1 Summary description of the 12 factors of the SMOSA**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Goal</th>
<th>Description of Orientation</th>
<th>Item Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task – 5 items</td>
<td>Mastery</td>
<td>An orientation toward the task of learning and seeking a challenge in one’s work.</td>
<td>“I am most motivated when I see my work improving”.</td>
</tr>
<tr>
<td>Effort - 5 items</td>
<td>Mastery</td>
<td>A willingness to put forth effort to understand and learn</td>
<td>“I try hard to ensure I am good at my schoolwork”.</td>
</tr>
<tr>
<td>Competition</td>
<td>Performance</td>
<td>Importance for students to see that competitiveness in their schoolwork is a part of their learning</td>
<td>“I am most motivated when competing with others”.</td>
</tr>
<tr>
<td>Leadership</td>
<td>Performance</td>
<td>Student’s perception of seeing that group leadership is important in their learning</td>
<td>“At school I like being in charge of a group”.</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Social</td>
<td>Student’s perception of seeing that belonging to a group when doing schoolwork is important in learning</td>
<td>“I can do my best work at school when I work with others”.</td>
</tr>
<tr>
<td>Social concern</td>
<td>Social</td>
<td>Student’s perception of seeing that being concerned for other’s schoolwork and a willingness to help is important to their own learning</td>
<td>“I like to help others do well at school”.</td>
</tr>
<tr>
<td>Praise - 4 items</td>
<td>Extrinsic</td>
<td>Perceived importance for students to see that recognition for their schoolwork is important for their learning</td>
<td>“At school I work best when I am praised”.</td>
</tr>
<tr>
<td>Token - 4 items</td>
<td>Extrinsic</td>
<td>Student’s perception of seeing that tangible recognition for their schoolwork is important in their learning</td>
<td>“I work best in class when I get some kind of reward”</td>
</tr>
<tr>
<td>Maths - 5 items</td>
<td>Self-Concept</td>
<td>Competence in Mathematics</td>
<td>“Work in mathematics is easy for me”.</td>
</tr>
<tr>
<td>Eng - 5 items</td>
<td>Self-Concept</td>
<td>Competence in English</td>
<td>I am good at English.</td>
</tr>
<tr>
<td>Gen - 5 items</td>
<td>Self-Concept</td>
<td>Competence in school subjects generally.</td>
<td>“I get good marks in most school”</td>
</tr>
<tr>
<td>PAC - 4 Items</td>
<td>Self efficacy</td>
<td>The self-perception of one’s ability and/or capability to achieve academically.</td>
<td>“I think that I can do quite well at school”.</td>
</tr>
</tbody>
</table>

The findings of the above resulted in the formation of the SMOSA, which is a self-report style questionnaire of 53 items in total, with each item measured on a 5-
point Likert type scale. The range of responses was from strongly disagree (1) to strongly agree (5). See Table 6.1 for a description of the 12 SMOSA measures, which includes; the individual scale, the overall goal identified and being assessed relative to previous research, the definition of the 12 factors and an example item from each subscale. One-factor congeneric models will initially test the psychometric soundness of each of the factors of the new 12-factor modelled instrument (SMOSA) prior to Confirmatory Factor Analysis with Invariance checks across grades and sex.

Procedure

This research’s data collection was part of a much larger study funded by an Australian Research Council (ARC) grant undertaken by McInerney, McInerney and Radda, investigating the goals of schooling. The instrumentations employed in the original study were motivational inventories, (ISM which incorporates self perception items and GAGOS – 114 items), Academic self-concept (ASDQ11s – 18 items), the Facilitating Conditions Questionnaire (FCQ – 69 items) to evaluate the perception of peers, parents and teachers influence during adolescence and the Pattern of Adaptive Learning questionnaire (PAL – 42 items) were simultaneously administered to assess the family and parental socialisation practices that are suggested affect student’s social and contextual variables. Open-ended questions specifically related to the values of schooling and student aspirations were also administered along with questions on descriptors of each of the participants. This base study included administration over the three times waves in New South Wales, Australia and also in two Navaho schools in Nevada, United States of America. However, this research focused on identifying the patterns of development in achievement motivational pursuits and self-perceptions during adolescence from an Australian perspective, and
therefore only the data collected in Australia between 1999 and 2001 were used and analysed.

_Ethics Approval_

Permission was obtained from the Department of Education and Training (DET: SERAP Number: 97200) and the University’s Human Ethics Committee to conduct the study (No. 98/101) prior to administration of surveys or contact with the students that participated in the research. Parental or guardian consent was sought by forwarding consent forms to each of the student’s carers prior to participation in the study. Disclosure of details of the purpose of the study was repeated at the beginning of each survey session.

Survey sessions were conducted with intact class groups or, where the numbers were small (as in the rural centres) in full school groups. No teachers were involved in the administration of the surveys; only independent researchers administered and monitored the collection of data. All consent forms were completed prior to student’s participation. During administration at each time collection all students were told that their participation in the survey was voluntary and that no individual responses or any individual information would be disclosed to the schools, teachers or parents.

At the beginning of each session, participants were assured of anonymity in their responses and informed that the purpose of the collection of the data would be for research purposes only. Each testing procedure began with a brief explanation about the purpose of the study and advice on how to use the rating scale (Instructions were also presented on each of the questionnaires). Due to the size of the questionnaire, students were encouraged to complete the instrument at their own pace; however, to assist in the administration; each item was read out aloud to the intact class groups by one member of the research group employed to assist in
administration. All participants were encouraged to seek assistance from a member of
the research group if they required help in any aspect related to interpretation of the
items in the questionnaire. The completion of the questionnaire usually took the
group of participants approximately 30-35 minutes.

Collection of data occurred across a three time wave series, with a break of
approximately one year between each administration. During the first year of the
study (1999), three cohorts of students from grades 7, 8 and 9 were asked to complete
questionnaires in Time 1 of the first wave of data. Time 2 (2000), the second wave of
data tracked these same students into grades 8, 9 and 10, and Time 3 (2001), the third
wave of data tracked these same students into grades 9, 10 and 11 to complete the
three time collections of data, across the eleven nominated schools. The only
exception was one small urban school that was closed by the New South Wales’
Department of Education due to declining numbers, prior to collection of the third
wave of data. Therefore, 132 students were eliminated from the third wave of data.
The same testing procedures were followed for all three administrations of the
instrumentation.

Research design

The particular design (cross-sequential) adopted in this thesis allows for
investigation of both longitudinal change and cohort differences, resulting in the
strongest test of developmental shifts in the data analysis (Jacobs, Lanza, Osgood,
Eccles & Wigfield, 2002). Additionally, this approach may therefore, take full
advantage of a cohort-sequential design by testing for cohort effects.

Study 1

Testing the psychometric soundness of the newly created SMOSA instrument,
employed in this research was the prime objective of study one. Students (2,131)
from eleven high schools in New South Wales across grades 7 to 9 were administered a series of questionnaires in 1999. The instrumentation administered and assessed, with relevance to this thesis, included abbreviated forms of the ISM, GAGOS and ASDQIIIs. Therefore, the first wave of data acted as a pilot study to evaluate the psychometric soundness of the newly designed measure (SMOSA).

Study 2 and Study 3

Study 2 involved the administration of questionnaires to students (previously, assessed in the first administration in grades 7, 8 and 9) in 1999, who were given the abovementioned battery of tests in a single administration. The administration of questionnaires was repeated at approximately one-year intervals to each of the schools in 1999, representing the first wave of data collection; in 2000 representing the second wave of data collection and again, in 2001, representing the third wave of data collection. All eleven schools were administered the same battery of tests across the three time waves, with the exception of one urban school, which closed between data collections, 2 and 3.

Data analysis

The data in the present thesis was quantitative in nature. To answer the hypotheses and research questions outlined in chapter 5; individual analyses were undertaken using three software programs; namely, SPSS 12.0.1 for Windows, LISREL 8.54 (Joreskog & Sorbom, 2001) and MLwiN 2.02 (Rasbash, Browne, Healy, Cameron, & Charlton, 2005).

Missing data

Missing data is a factor of all research and becomes more problematic when the research design involves longitudinal analyses. Historically, missing data has been handled using either listwise (deletion of the entire case where one value is missing in
the set) or pairwise (deletion of the case when the item missing is involved in any
calculation), or a replacement of the mean value of the particular item in question.
However, these three alternatives were not used in this research. Primarily, listwise
deletion would eliminate a large quantity of very relevant information and although
pairwise deletion would lessen this effect, it would still be eliminating a substantial
quantity of valuable data given the analysis is both a between and within subjects
design. This was an important aspect of the decision to use this form of missing data
transformation in this research because of the loss of a school in the third wave of
data collection. The third option of mean replacement of missing values on each item
was also seen as less than optimal in dealing with the issue of missing values, as it
can not take into account the pattern of responses from the individual being assessed,
and therefore only give an overall assessment of the entire sample’s mean value for
that item.

This researcher’s method of choice for dealing with missing data is Full
Information Maximum Likelihood (FIML) estimation of missing values using the
maximum likelihood imputation method analysed, within the SPSS program. FIML is
a form of Maximum Likelihood method (ML). Research using this method of
comparison for treating data compared a model with missing values to one that used
the ML approach and Byrne found that the ML imputation model yielded very similar
goodness of fit measures despite 25% data loss in the incomplete model (Byrne,
2001). The systematic replacement of missing values using this technique was
employed in this research for each Time wave of the study. The robustness of ML in
relation to violations of assumptions of normality, particularly in relation to parameter
estimates (factor loadings, factor correlations, path coefficients, etc.) has been
supported and is appropriate in this thesis (Byrne, 2001). There was comparatively
little missing data across the three waves of data, 34,862 cells out of 309,149 (2,131 students in Time 1, 2,026 students in Time 2 and 1,676 students to repeated 53 variables investigated) representing approximately 11% of the total data.

**Data analysis for Study 1**

*Introduction to evaluations of the Psychometric Soundness of the Instrument*

The raw data was transformed into a covariance matrix with the use of PRELIS (Jöreskog & Sörbom, 2004) in preparation for Confirmatory Factor Analyses (CFA) using LISREL 8.54 (Jöreskog & Sörbom, 2004).

*Reliability of the measurement instruments.*

Reliability has been defined as the measurement of internal consistency of the items within a scale (Anastasi & Urbina, 1997; Hills, 2003). The analysis of the internal consistency of the measurement is based upon approximation of the means of all possible split-halves (Anastasi & Urbina, 1997; Hills, 2003). The most commonly used method to establish internal consistency is Cronbach’s Alpha. SPSS 12.0.1 will be used to analyse and establish internal consistency using Cronbach’s Alpha for each factor of the 12-factor model proposed in this research. There is general agreement that Cronbach’s Alpha should be at levels of at least .70 for research purposes (Hills, 2003).

A series of confirmatory factor analyses (CFA) were conducted to assess the factor structure of the SMOSA. Firstly, individual CFA, in the form One Factor Congeneric Models were conducted on each of the 12 factors of the SMOSA. Secondly, the full 12-factor model was analysed using CFA. Thirdly, invariance tests assessed both grades (comparing grades 7, 8 and 9) and sex (males and females) across four levels of constraint.
Factor Structure of the measurement instruments.

A series of Confirmatory Factor Analyses (CFA)’s were conducted to measure the factor structure of the 12-factor modelled instrument. The use of PRELIS (Jöreskog & Sörbom, 2002) converted the raw data into covariance matrices to enable LISREL 8.54 (Jöreskog & Sörbom, 2002) to analyse each of the CFA models. “The LISREL program is the most longstanding and widely distributed” (Byrne, 1998, p. 9) statistical program for Structural Equation Modelling and has served as the prototype for many other models. LISREL allows for the discrepancy between the hypothesised model (theoretically based) and the observed model to be estimated (Byrne, 1998). In CFA, evaluation is made on the fit of the model for the observed variables association through regression paths to the underlying a priori (or latent variable) factors (Byrne, 1998). CFAs assess the a-priori hypothesised structure statistically through measurement models (Byrne, 1998). At each level the measured variables are permitted to load on one factor only. The full imputation maximum likelihood (FIML) method of estimation was used for the instrument modelled in the present research. While, the use of computing polychoric correlations may generally be warranted with 5-point Likert type scales, there is a requirement for excessively large sample sizes to be incorporated. This research instead followed Hox and Bechgar (1999) recommendation that the use of this form of computation may not be necessary when the possible categorical nature of the variables have “at least five categories” (p. 8).

The LISREL program was employed in the present research to provide a range of Goodness of Fit indices to demonstrate the reliability of the instrument (SMOSA) used in this research for Absolute Fit, (the Root Mean-Square Error of Approximation, RMSEA) Incremental Fit (Non-normed Fit Index, NNFI) and Model
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Parsimony (RNI). The Non-normed Fit Index NNFI (Marsh, 1994b), is equivalent to the Tucker-Lewis index, (Holmes-Smith & Coote, 2002) except that it is constrained to fall between values of 0 and 1; the Relative Noncentrality Index (RNI) was included as a Parsimony Index (Marsh, 1994b); and the Root Mean Square Error of Approximation (RMSEA) as a measure of Absolute Fit (Holmes-Smith & Coote). These three fit indices will form the bases of measuring the model’s Goodness of Fit.

While the Chi-square value is presented in most research as a likelihood ratio test statistic for Model fit and will be given in this research; contemporary researchers have iterated the inappropriateness of the reliance of this measure as an indicator of Goodness of Fit, in particular where the sample size is large (Marsh, 1994b; Ullman, 2001). Therefore, given that this research has a large data set and research suggests that a large sample size is more likely to indicate rejection of the model, due to a significant difference between the model and the data, a reliance on the RMSEA, NNFI and RNI will be undertaken in the present research (Holmes-Smith & Coote, 2004).

Marsh has stated that the Tucker-Lewis Index “was the only widely used index that was relatively independent of sample size and relatively unaffected by inclusion of additional parameter estimates that were known to have zero values in simulated data” (1994, p. 10). Marsh, Balla and Hau (1996) argued that if Parsimony Indices are to be used then an unbiased index such as the RNI should be used. The RMSEA may be used as a measure of Absolute Fit of the model that is also relatively unbiased with large samples. Therefore, due to the large sample size of the present research, measures will be reported for the chi-square statistic, the RMSEA values with values of < .05 indicating good fit and values up to <.08 deemed to indicate a satisfactory fit of the model (Holmes-Smith & Coote, 2002); the NNFI and RNI where values range.
from zero to 1.00, with values > 0.90 indicating acceptable fit to the data (Byrne, 1998; Marsh, 1994b; Schumacker & Lomax, 1996).

*Multi-group confirmatory factor analysis and tests of invariance for grade*

Of particular interest in this thesis is the factor structure and psychometric soundness across the grades in high school. Therefore, testing factor invariance across the differing grade levels, while progressively constraining aspects of the factor structure to enable comparison of the competing models, will be undertaken to assess the fit of the model at each stage of constraint. As suggested by Yin and Fan (2003) “construct validity can be considered as an overarching measurement validity concept that subsumes all other facets of validity evidence. One important source of evidence for construct validity is the demonstration of stable measurement factor structure across different groups” (p. 297). Reasonably invariant fit indices are representative of invariant factor structure. The present research will inspect the comparative fit indices at differing levels of constraint, with successive elements of the model being constrained using a multi-group comparison of the grades tested. This level of analysis is necessary due to the research’s focus on identifying patterns of change across grades in high school.

The base model tested all participants of the study in Time 1, regardless of grade, allowing for factor loadings, variances, covariances and uniquenesses to be freely estimated. Then each group, grades 7, 8 and 9 were tested allowing free estimation of factor loadings, variances, covariances and uniquenesses. The multi-group analyses assessed the comparative fit indices for four models across grades 7, 8 and 9 using the first time wave of data. Model 1 held no parameter estimates constrained and freely estimated all loadings, factors variances and covariances and uniquenesses. Model 2 held the factor loadings constrained but freely estimated all
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factors variances and covariances and uniquenesses. Model 3 held factor loadings and factor variances and covariances invariant but did not constrain the uniquenesses. Model 4 held all factor loadings, variances, covariances and uniquenesses invariant across grades.

*Multi-group confirmatory factor analysis and tests of invariance for sex.*

Additionally a focus in this thesis is the factor structure and psychometric soundness between males and females. Therefore, testing the factor invariance of sex, while constraining aspects of the factor structure to compare competing models, allows the fit of the model to be assessed at each stage of constraint and assess whether responses between males and females present similar patterns. Reasonably invariant fit indices are representative of invariant factor structure. The present research inspected the comparative fit indices at differing levels of constraint, with successive elements of the model being constrained using a multi-group comparison of males and females.

The base model tested all study participants in Time 1, regardless of sex, allowing for factor loadings, variances, covariances and uniquenesses to be freely estimated. Then each group (males and females) were tested allowing free estimation of factor loadings, variances, covariances and uniquenesses. The multi-group analyses assessed the comparative fit indices for four models between males and females using the first time wave of data. Model 1 held no parameter estimates constrained and freely estimated all loadings, factors variances and covariances and uniquenesses. Model 2 held the factor loadings constrained but freely estimated all factors variances and covariances and uniquenesses. Model 3 held factor loadings and factor variances and covariances invariant but did not constrain the uniquenesses. Model 4 held all
factor loadings, variances, covariances and uniquenesses invariant between males and females.

Data analysis for Study 2

The use of multi-level modelling allows for the use of growth curve modelling as an approach. This method was particularly applicable in this research given the amount of data collected across three time collections for the 12 factors of the SMOSA as it enabled the investigator to capture competently, the developmental trajectories across grades. In addition growth curve modelling allowed for the inclusion of all respondents, even when they did not provide data for the full set of observations.

The use of MLwiN or multi-level modelling is not limited to a strictly linear change and therefore allows for a mapping of change in magnitude or direction for grade effects and/or sex effects across high school if and when they occur. The use of this form of analysis, allows for undertaking an analysis which is as Jacobs, et al, suggested “strictly limited to within-individual change, controlling for all stable individual differences, while addressing the possible non-independence of measurement due to repeated measures” (2002, p. 512).

Hierarchically structured data

Hierarchically structured data that is naturally nested may be assessed using MLwiN analysis. For example, this research data is naturally nested within three levels. The nested levels were; Time within Student within School. By using multilevel modelling the randomised variance that occurs at each level may be assessed separately with each addition of the contrast variables to allow for assessment of the possible changes that may occur between progressive models at each level. The current structure may be seen as clusters of level 1 units (Time)
within each level 2 unit, (Student) within each level 3 unit (School) and the nature of the analysis has been termed “clustered population” or “nesting of the model” (Rasbash, Steele, Browne, & Prosser, 2004). As Rowe (2005) has suggested, ignoring the clustering effects that occur in educational research may cause underestimation of the regression coefficients and standard errors. Therefore, violation of independence when using a large sample may cause a type 1 error to emerge that is; differences are assumed when these differences are not there due to misestimation of the parameter estimates and standard deviation (Rasbash, Steele, Browne, & Prosser, 2004).

Therefore, to accommodate the different levels of variance emerging within this research, analysis will be undertaken using three levels of analysis that is Time, Student and School.

*Preparation of the data for MLwiN*

Preparation of the data was undertaken through three separate transformations. Normalisation of the outcome data, Polynomial contrasts of the linear and quadratic effect of grade and Standardisation of the 12 factors to form a common metric.

Preparation of the data using these methods would allow for comparison across factors at the latter stages of analysis.

*Cohort, time and grade overlap in cross-sequential design*

Cohort 1 had data collected across the three time waves in grades 7, 8 and 9. Cohort 2 across the three Time waves in grades 8, 9 and 10 and cohort 3 had data collected in grades 9, 10 and 11. The three time waves were administered in 1999, 2000 and 2001. Three groups of students represented three cohorts at each Time collection. The first collection of data, Time 1, represented grades 7, 8 and 9 who completed the inventories on the first occasion. These three cohorts of students
progressed to grades 8, 9 and 10 at Time 2 and onto grades 9, 10 and 11 in Time 3 respectively (see Table 6.2).

**Table 6.2 Graphical representation of the research design for grades, showing the three Cohort collections of data on the three Time occasions design.**

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1999</td>
<td>2000</td>
<td>2001</td>
</tr>
<tr>
<td>Cohort 1</td>
<td>grade 7</td>
<td>grade 8</td>
<td>grade 9</td>
</tr>
<tr>
<td>Cohort 2</td>
<td>grade 8</td>
<td>grade 9</td>
<td>grade 10</td>
</tr>
<tr>
<td>Cohort 3</td>
<td>grade 9</td>
<td>grade 10</td>
<td>grade 11</td>
</tr>
</tbody>
</table>

The cross-sequential design of this research is outlined in Table 6.2. Due to the natural ordering effects of grades from 7 to 8 to 9 to 10 to 11, omnibus F analyses were not deemed appropriate, as it would not allow for the specific questions of the change between grades in magnitude and or direction to be evaluated progressively across grades. Therefore, transformation of grades through the use of polynomial contrasts breaking them down to linear and quadratic effects of grade were used in this research to investigate whether variation occurred across the natural ordering effects of grades.

The complexity of cohort, time and grade meant that simultaneously analysing these variables could create a confounding influence in the results, and in essence analysing any two of these factors would account for the third. Due to the cross-sequential design of this research where three cohorts (3 successive grades, 7, 8 and 9) of students were assessed at three successive time collections of data (3 repeated measures); the possibility of variation among the cohorts at the same grade level needed to be evaluated to check the stability of the measure (see Figure 6.2 for graphical presentation of the cross-sequential design).

While the cross-sequential design allows for between and within-subjects effects to be examined; if variation among cohorts at the same grade does not exist,
then a sequential assessment from grades 7 to 11 may be achieved by collapsing across cohorts. Therefore assessment was required at the point where cohorts overlapped with grades. These overlaps occurred at grade 8 (overlap of cohort 1 and cohort 2), grade 9 (overlap of cohort 1, cohort 2 and cohort 3) and at grade 10 (overlap of cohort 2 and cohort 3). To this end each of the 12 factors of the SMOSA were assessed to evaluate whether significant differences emerged in the p-value as well as partial effects among the cohorts at the differing grade levels. The partial effect size differs somewhat from the effect size and identifies whether real differences emerge. If significant differences are identified in t-tests or tests of ANOVA, then assessment of the effect size actually strengthened the determination of whether the significance was merely a factor of sample size. As Tabachnik and Fidell (1996) suggest “an alternative form of effect ($\eta^2$) called partial effect (partial $\eta^2$) is available in which the denominator contains only variance attributable to the effect of interest plus error” (p. 53).

**Normalisation of the outcome data for preparation of MLwiN analyses**

The common practice of summing a group of items and dividing the total by the number of items, to create mean values, does not allow for an evaluation of the impact of each item’s weighting within the mean structure of the latent variable. Instead Rowe (2005) suggests that the maximally-weighted factor-score regression coefficients obtained from fitting one-factor congeneric models to the scale’s items would provide a more appropriate value for the latent value. This then creates, a proportionally weighted scale score for the composite variables accounting for the individual and combined measurement error of the indicators. It also allows for the computation of the construct to be computed as a continuous variable (see Table 6.3, for normalisation of the data outlining the composite scale scores, adjusted scale scores and item weights
for each scale). This procedure is better known as normalising the data, whereby each of the item’s weightings is totalled for each factor, and then each item’s factor weighting is divided by that value to bring it to a single unit value.

Table 6.3 Composite scale values, each item’s weight, adjusted parameter estimates and adjusted values for each factor to achieve a normalised score to use within MLwiN.

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Item weights</th>
<th>Composite Scale</th>
<th>Adjusted parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Task</td>
<td>.300</td>
<td>.220</td>
<td>.330</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.211</td>
<td>.154</td>
<td>.227</td>
</tr>
<tr>
<td>Effort</td>
<td>.340</td>
<td>.270</td>
<td>.220</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.248</td>
<td>.196</td>
<td>.159</td>
</tr>
<tr>
<td>Competition</td>
<td>.140</td>
<td>.320</td>
<td>.220</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.146</td>
<td>.350</td>
<td>.240</td>
</tr>
<tr>
<td>Leadership</td>
<td>.170</td>
<td>.230</td>
<td>.280</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.174</td>
<td>.238</td>
<td>.293</td>
</tr>
<tr>
<td>Affiliation</td>
<td>.220</td>
<td>.330</td>
<td>.290</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.220</td>
<td>.330</td>
<td>.290</td>
</tr>
<tr>
<td>Social concern</td>
<td>.430</td>
<td>.280</td>
<td>.240</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.390</td>
<td>.250</td>
<td>.220</td>
</tr>
<tr>
<td>Praise</td>
<td>.370</td>
<td>.200</td>
<td>.290</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.380</td>
<td>.200</td>
<td>.290</td>
</tr>
<tr>
<td>Reward</td>
<td>.190</td>
<td>.220</td>
<td>.220</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.310</td>
<td>.238</td>
<td>.240</td>
</tr>
<tr>
<td>PAC</td>
<td>.210</td>
<td>.300</td>
<td>.250</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.170</td>
<td>.240</td>
<td>.200</td>
</tr>
<tr>
<td>English SC</td>
<td>.290</td>
<td>.220</td>
<td>.160</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.250</td>
<td>.190</td>
<td>.140</td>
</tr>
<tr>
<td>Maths SC</td>
<td>.250</td>
<td>.190</td>
<td>.160</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.260</td>
<td>.190</td>
<td>.160</td>
</tr>
<tr>
<td>Gen Acad SC</td>
<td>.380</td>
<td>.280</td>
<td>.160</td>
</tr>
<tr>
<td>Adjusted value</td>
<td>.290</td>
<td>.220</td>
<td>.120</td>
</tr>
</tbody>
</table>

The new value is then multiplied by the regression weight to recalculate the mean value for each item within the scale, prior to it being aggregated into a latent
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factor with appropriate mean values for imputation into MLwiN (Rowe, p. 29). This process was undertaken and applied to the data in the current research as part of the procedure prior to the MLwiN analysis.

*Polynomial preparation of inclusions for possible quadratic and linear effects*

Systematically mapping adolescent’s achievement motivation across grades and also assessing whether disparity occurs between males and females require the use of advanced statistical analyses through multilevel modelling (MLwiN). When mapping the patterns of possible change, in either magnitude or direction it is necessary to use polynomial contrasts, which allow for analysis of the specific ordering effects of grades across high school. To this end each of the 12 factors of the SMOSA will be analysed using MLwiN to ascertain the nature of the individual profiles that emerge across grades, sex and their interactions. The use of MLwiN allows for a mapping of both increase and declines in differences across grade of possible effects when and if these effects emerge in the sequential ordering of grades.

When assessing the change in magnitude and/or direction across grades where a specific natural ordering occurs, from grades 7 to 8 to 9 to 10 to 11, the common practice of using ANOVA using an omnibus F does little to address the specific question involved. A more elegant enquiry would entail polynomial contrasts in the form of linear and quadratic effects for grades. The use of an omnibus F would alternatively assess every possible combination of the grade levels rather than addressing the specific question of the specific ordering effect of the progression across grade, which forms the basis of the current enquiry. Therefore, to enable the mapping of adolescent progressively across grades, it is better to direct enquiry to the a-priori structure through the use of contrast effects in the order in which logical
Achievement motivation

outcomes may be assessed. This enables contrasts “to provide greater substantive interpretation of research results and greater power for tests of significance” (Rosenthal, Rosnow & Rubin, 2000, p.4). The applied weights for the transformations of the variables were made according to Rosenthal and Rosnow’s (1985, p. 92) recommendations (presented in Table 6.4). The following progressive set of contrasts was considered to be orthogonal because the cross-product of their coefficients summed to zero (Rosenthal, Rosnow, & Rubin, 2000).

The fixed effects of grade were added to the baseline variance components model to test whether differences in the slopes at each progressive level of the hierarchically structured (3-level nested) model occurred. The term ‘gdelin’ represented the linear effect of grade and ‘gdequad’ represented the quadratic effect of grade and the transformed values used are presented in Table 6.4 (see Rosenthal & Rosnow, 1985).

The inclusion of each variable was statistically evaluated through the required Wald statistic. The Wald statistic of 1.96 represents statistically significant value for alpha at $p < .05$ level, the Wald statistic of 2.57 is statistically significant for alpha at $p < .01$ level and 3.29 is statistically significant for alpha at at the $p < .001$ significance level (Rosenthal & Rosnow, 1985, p. 95).

| Table 6.4 Contrast coefficients used for each factor in the MLwiN equation models |
|---------------------------------|---|---|---|---|---|---|
| Grade                          | 7 | 8 | 9 | 10 | 11 | Total |
| gdelin                         | -2| -1| 0 | 1  | 2  | 0     |
| gdequad                        |  2| -1| -2| -1 | 2  | 0     |

Standardisation of the 12 factors of the SMOSA

Standardisation of the data was needed to ensure that the psychometric properties being evaluated could be assessed through a common metric to enable
comparisons to be drawn between the factors. Investigation in the form of profile analyses were also undertaken, which in the latter part of the analyses compared the commonly used higher-order constructs through their lower-order factors. Therefore, standardisation of scores for the 12 factors of the SMOSA was essential to evaluate whether real differences emerged between the lower-order factors. All missing values were left as missing and therefore were treated as missing values prior to standardisation of the measures for MLwiN analysis. Raw scores for each of the 12 factors were combined into a single file and a new column was created called “Index1”. Labelling was required for each case and undertaken through application of a code that differentiated each of the lower-order factor from zero (0) to eleven (11) within a single column to categorise the appropriate grouping variable into an independent variable. The combined scores were standardised through SPSS for the 12 factor model. To achieve this outcome all variables were standardised after dummy coding of the first lower-order factors of task pursuits to zero (0) the second variable of effort pursuits as (1) and so on, then stacking the cases into a new file using the ‘restructure’ command in SPSS.

**Data analysis for Study 3**

*Profile Analysis*

To understand the multidimensional structure of motivation, researchers have recently moved into the area of investigating the patterns of change through profile analysis (Braten & Olaussen, 2005). While a majority of profile analysis research has used cluster analysis to identify typical patterns, another use of profile analysis assesses whether differences emerge between dependent variables. As Tabachnick and Fidell (2001) have suggested “Profile Analysis is a special application of multivariate analysis of variance (MANOVA) to a situation where there are several
Achievement motivation

DVs, all measured on the same scale” (p. 391). Thus, in study 3 because the lower-order factors of the SMOSA has been transformed by standardisation through SPSS, the two commonly used lower-order factors for mastery goals; the two lower-order factors for performance goals; the two lower-order factors for social goals and the two lower-order factors for extrinsic goals were evaluated to establish if disparate patterns emerged between the two lower-order constructs.

Normalisation and standardisation of the dependent variables was achieved in Study 2 when a master file was created. After standardisation of the twelve factors to a common metric through the use of z-scores a master file was created. The master file was then divided into the sub-factors representing the four commonly used terms of the higher-order constructs of mastery, performance, social and extrinsic goals to enable a series of Profile Analyses to be undertaken in Study 3. Investigation of whether segments (difference scores) emerged between the lower-order factors under these four higher-order constructs undertaken. The lower-order factors of task and effort under the higher-order construct of mastery goals; competition pursuits and leader pursuits under performance goals; affiliation pursuits and social concern pursuits under social goals, and rewards pursuits and praise pursuits under extrinsic goals were assessed.

Profile analyses were set up for combinations of data, for example, mastery goals (task pursuits and effort pursuits), had a new column called Index1 created with the two lower-order factors given a value of 0 and 1 respectively. The standardised value of the motivational measure (SMOSA) was placed in a column, for example, mastery. This procedure was repeated for each of the four-higher-order constructs (see Table 6.5). In the analysis for each equation, “Index1” represented the combination of the lower-order factors (task and effort) under the higher-order
construct (mastery) by labelling these factors as groups or levels of the independent variable. By dummy coding the variables as presented in Table 6.5, the factor with a value of zero was compared with the other lower-order factor coded as 1 and the difference which emerged in the parameter estimates had a value of + or -. This procedure was replicated for each of the four goals.

*Table 6.5 Dummy coding of the lower-order factors to test whether differences emerge in the higher-order constructs for use within MLwiN analysis.*

<table>
<thead>
<tr>
<th>Lower-order factor</th>
<th>Higher-order construct</th>
<th>Dummy coding value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task pursuits</td>
<td>Mastery</td>
<td>0</td>
</tr>
<tr>
<td>Effort pursuits</td>
<td>Mastery</td>
<td>1</td>
</tr>
<tr>
<td>Competition pursuits</td>
<td>Performance</td>
<td>0</td>
</tr>
<tr>
<td>Leader pursuits</td>
<td>Performance</td>
<td>1</td>
</tr>
<tr>
<td>Affiliation pursuits</td>
<td>Social</td>
<td>0</td>
</tr>
<tr>
<td>Social concern pursuits</td>
<td>Social</td>
<td>1</td>
</tr>
<tr>
<td>Praise pursuits</td>
<td>Extrinsic</td>
<td>0</td>
</tr>
<tr>
<td>Reward pursuits</td>
<td>Extrinsic</td>
<td>1</td>
</tr>
</tbody>
</table>

One of the major questions asked under profile analysis is whether groups have different profiles on a set of measures (Tabachnick & Fidell, 2001). Three specific aspects are examined in the use of profile analysis; the test of parallelism, the levels hypothesis and the flatness hypothesis. The test of parallelism, asks do different groups have parallel profiles? Whether one group on average scores higher on the measure than another, is examined in the level’s hypothesis. Therefore, the comparison of the two factors at the interaction of sex will be undertaken using the level’s hypothesis. The similarity of responses to all dependent variables, independent of their group membership and whether all dependent variables elicit the same average response is the flatness hypothesis (Tabachnick & Fidell, 2001). To achieve “a flat profile, this result is often not of research interest” (Tabachnick & Fidell, p. 393). Graphs will be presented outlining the disparate patterns of development across grades for the two lower-order factors to demonstrate whether
differences emerge between males and females, incorporating the parallelism of profiles hypothesis.

The hypothesis test for parallelism was analysed using MLwiN. The primary focus of this thesis assessed the change in slopes using polynomial contrasts to identify and assess whether the slopes in the ordering effect of grade differed as a factor of sex between the two lower-order factors in the (Index1 X grade X sex) interaction. The use of this form of analysis, allowed for employment of an analysis which as Jacobs, et al, suggested “strictly limited to within-individual change, controlling for all stable individual differences, while addressing the possible non-independence of measurement due to repeated measures” (2002, p. 512). Testing whether differences emerged for males and females between the lower-order factors of each higher-order construct was assessed in the test of parallelism because in profile analysis “each segment represents a slope between 2 DVs, if there is a multivariate difference between groups then one or more slopes are different and the profiles are not parallel” (Tabachnick & Fidell, 2001, p. 399). The “Index1” variable was used in each analysis.

The use of multi-level modelling was incorporated in Study 3 through profile analyses. Three separate analyses were undertaken independently for each of the four higher-order constructs, for example, task and effort under the mastery goal construct. The first analysis assessed whether differences emerged between the two lower-order factors under the higher-order construct with the interaction of sex is the level’s hypothesis. The second analysis assessed whether disparate patterns emerged between the lower-order factors across grades (linear and quadratic effects) is the flatness hypothesis. Finally, due to the cross-sequential nature of the design of this research, the third analysis assessed the effect of Index1 X sex across grades.
Multivariate assumption checking was deemed satisfactory in this thesis due to the large sample size and approximately equal group sizes, therefore, evaluation of the homogeneity of variance-covariance matrices was not necessary (Tabachnick & Fidell, 2001).
Chapter 7

Study 1 Results: Psychometric properties of the measurement instrument

Introduction

Study 1 was designed to assess the psychometric soundness of the newly developed SMOSA instrumentation on an adolescent population. The analyses were based on the Time 1 data collected during 1999. The sample consisted of eleven high schools with a population of 2,131 adolescent students between grades 7 to 9 for Time 1 data. The following analyses included providing the means and standard deviations across grade (7, 8 and 9), sex and the total sample; assessments of Cronbach’s alpha; one factor Congeneric models for each of the twelve factors in the model; and the assessment of the multi-dimensional factor structure of the measure, plus tests of invariance across both grades and sex.

The SMOSA was hypothesised to be psychometrically strong in terms of its reliability (hypotheses 1.1 and 1.2); factor structure (hypothesis 2.1) and through tests of invariance (hypotheses 2.2 and 2.3). The first set of analyses consisted of evaluating the internal consistency of the SMOSA to test hypotheses 1.1 and 1.2. Cronbach’s alpha is a measure of reliability for the internal consistency of the measure’s sub-scales. Cronbach’s alphas were calculated on the total sample; for grades (7, 8 and 9) and sexes (males and females). Second, to answer hypothesis 2.1 that the SMOSA instrumentation was a valid measure for high school students when fitting the a-priori factor structure; one-factor Congeneric models for each of the twelve factors plus assessment of the full 12-factor model of the SMOSA, using structural equation modelling was undertaken. Third, to test the invariance across models, assessment was undertaken independently across grades (7, 8 & 9) to test hypothesis 2.2 and sex (males and females) for hypothesis 2.3. The tests of
invariance used four models with increasing levels of constraint imposed upon the parameter estimates for each progressive model. Goodness of Fit indices; TLI, RNI and RMSEA were used to assess each increased constraint level of the model (see Chapter 6 for a full explanation of these progressive models).

Descriptives of Time 1 data for reliability and validity testing

The means and standard deviations for each of the groups are presented in Table 7.1 for grades, 7, 8 and 9, males and females and the total sample. As can be seen task pursuits, effort pursuits and PAC measures were the highest reported average means (and lowest standard deviations overall) at approximately 4 (out of a possible maximum of 5) on the Likert-type scale, which equated to agreement with the positively worded statements on this scale. General academic self-concept and English self-concept were also on average above 3.5 indicating that there was also general agreement with the perceptions of self in these measures. The other measures were on the positive end of the 5-point Likert type-scale with the exception of leader pursuits, which ranged from 2.64 to 2.94, this equated to a rating of between disagree (2) to a neutral (3) response in the scale’s administration. As seen in Table 7.1, most measures reported declines across the individual measure between grades 7 through to 9, with the exception of affiliation pursuits and general academic self-concept. Females were higher than males for task pursuits; effort pursuits; social concern pursuits; reward pursuits; praise pursuits; PAC; English self-concept and general academic self-concept in the Time 1 collection of data.

Reliability analysis of the SMOSA

Overall, the SMOSA demonstrated acceptable reliability. The reliability estimates for the twelve subscales of the SMOSA for the total sample, across grades (7, 8 and 9) and sexes reported values between .70 and .92. The only exception
Achievement motivation occurred for the factor of social concern pursuits that varied between .65 and .71, with a coefficient alpha for the total sample of .68 (see Table 7.2). All other factors were deemed acceptable for research purposes, as they were above .70 (Hills, 2003) except social concern pursuits. Social concern pursuits’ total sample’s value was .68. Although this subscale’s coefficient alpha was just under the acceptable limit of .70, the scale was deemed acceptable in the current research due to the close proximity of the scale’s internal consistency to the acceptable value and it’s comparatively low standard deviation (see Table 7.1). Support for hypotheses 1.1 and hypothesis 1.2 were obtained.

Table 7.1 Means and standard deviations for the newly developed SMOSA at Time 1 for grade 7, grade 8 and grade 9, males and females and for the total sample.

<table>
<thead>
<tr>
<th>SMOSA subscales</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>males</th>
<th>females</th>
<th>total</th>
<th>no. sample</th>
<th>items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task total</td>
<td>4.30(0.61)</td>
<td>4.24(0.63)</td>
<td>4.19(0.62)</td>
<td>4.17(0.66)</td>
<td>4.31(0.58)</td>
<td>4.24(0.62)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Effort total</td>
<td>4.27(0.63)</td>
<td>4.16(0.65)</td>
<td>4.11(0.66)</td>
<td>4.11(0.69)</td>
<td>4.25(0.60)</td>
<td>4.18(0.65)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Competition</td>
<td>3.24(0.91)</td>
<td>3.19(0.85)</td>
<td>3.15(0.90)</td>
<td>3.32(0.86)</td>
<td>3.07(0.89)</td>
<td>3.20(0.89)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Leader</td>
<td>2.94(0.92)</td>
<td>2.76(0.85)</td>
<td>2.64(0.84)</td>
<td>2.85(0.89)</td>
<td>2.71(0.86)</td>
<td>2.78(0.88)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Affiliation</td>
<td>3.80(0.88)</td>
<td>3.67(0.89)</td>
<td>3.70(0.87)</td>
<td>3.75(0.89)</td>
<td>3.71(0.87)</td>
<td>3.73(0.88)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Social concern</td>
<td>3.92(0.65)</td>
<td>3.79(0.69)</td>
<td>3.72(0.69)</td>
<td>3.64(0.70)</td>
<td>3.98(0.61)</td>
<td>3.81(0.68)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Reward</td>
<td>3.68(0.98)</td>
<td>3.44(0.96)</td>
<td>3.23(0.98)</td>
<td>3.43(0.98)</td>
<td>3.47(0.99)</td>
<td>3.45(0.99)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Praise</td>
<td>3.62(0.95)</td>
<td>3.44(0.94)</td>
<td>3.33(0.92)</td>
<td>3.41(0.95)</td>
<td>3.51(0.94)</td>
<td>3.46(0.94)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>PAC</td>
<td>4.11(0.67)</td>
<td>3.99(0.70)</td>
<td>3.93(0.70)</td>
<td>4.01(0.72)</td>
<td>4.02(0.67)</td>
<td>4.01(0.69)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>English SC</td>
<td>3.62(0.82)</td>
<td>3.52(0.81)</td>
<td>3.45(0.84)</td>
<td>3.48(0.84)</td>
<td>3.58(0.81)</td>
<td>3.53(0.83)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Maths SC</td>
<td>3.51(1.02)</td>
<td>3.37(0.94)</td>
<td>3.18(0.98)</td>
<td>3.50(1.00)</td>
<td>3.21(0.97)</td>
<td>3.35(0.99)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>GenAcad SC</td>
<td>3.90(0.69)</td>
<td>3.74(0.75)</td>
<td>3.77(0.70)</td>
<td>3.77(0.76)</td>
<td>3.79(0.73)</td>
<td>3.78(0.99)</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Standard deviations are presented in brackets with the exclusion of 0 prior to the decimal placement. GenAcad SC = general academic self-concept.

Confirmatory factor structure of the SMOSA

One factor congeneric models

In response to Hypothesis 2.1, the psychometric soundness was assessed through goodness of fit indicators for each of the a-priori 12-factors. The use of structural-equation modelling in the form of Confirmatory Factor Analysis tested the
Achievement motivation

ability for each of the a-priori twelve-factors to fit the data. The Normal Theory

Weighted Least Squares chi-square statistic was reported for each evaluated model; however this was more due to convention as the chi-square statistic is greatly affected when evaluation is undertaken on a large sample size such as in this study (Byrne, 1998; Byrne & Shavelson, 1987; Byrne & Worth Gavin, 1996; Marsh, 1990b). A large sample size impacts on the chi-square statistic because large samples are more likely to have a significance value that will report a significant difference between the model and the data (Holmes-Smith, 2004).

Table 7.2 Internal consistency coefficients for the newly developed SMOSA at Time 1 for grade 7 students, grade 8 students, grade 9 students, males and females and also for the total sample with the number of items used in each subscale.

<table>
<thead>
<tr>
<th>SMOSA subscales</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>males</th>
<th>females</th>
<th>total</th>
<th>sample</th>
<th>no. items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>.76</td>
<td>.81</td>
<td>.81</td>
<td>.81</td>
<td>.78</td>
<td>.80</td>
<td>.5</td>
<td>5</td>
</tr>
<tr>
<td>Effort</td>
<td>.76</td>
<td>.79</td>
<td>.79</td>
<td>.79</td>
<td>.76</td>
<td>.78</td>
<td>.5</td>
<td>5</td>
</tr>
<tr>
<td>Competition</td>
<td>.74</td>
<td>.72</td>
<td>.78</td>
<td>.72</td>
<td>.76</td>
<td>.75</td>
<td>.4</td>
<td>4</td>
</tr>
<tr>
<td>Leader</td>
<td>.86</td>
<td>.86</td>
<td>.85</td>
<td>.86</td>
<td>.85</td>
<td>.88</td>
<td>.4</td>
<td>4</td>
</tr>
<tr>
<td>Affiliation</td>
<td>.81</td>
<td>.84</td>
<td>.83</td>
<td>.82</td>
<td>.83</td>
<td>.83</td>
<td>.4</td>
<td>4</td>
</tr>
<tr>
<td>Social concern</td>
<td>.67</td>
<td>.71</td>
<td>.65</td>
<td>.66</td>
<td>.67</td>
<td>.68</td>
<td>.4</td>
<td>4</td>
</tr>
<tr>
<td>Reward</td>
<td>.80</td>
<td>.80</td>
<td>.79</td>
<td>.79</td>
<td>.82</td>
<td>.81</td>
<td>.4</td>
<td>4</td>
</tr>
<tr>
<td>Praise</td>
<td>.81</td>
<td>.81</td>
<td>.79</td>
<td>.78</td>
<td>.82</td>
<td>.80</td>
<td>.4</td>
<td>4</td>
</tr>
<tr>
<td>PAC</td>
<td>.70</td>
<td>.72</td>
<td>.72</td>
<td>.72</td>
<td>.71</td>
<td>.72</td>
<td>.4</td>
<td>4</td>
</tr>
<tr>
<td>English SC</td>
<td>.86</td>
<td>.86</td>
<td>.89</td>
<td>.87</td>
<td>.87</td>
<td>.87</td>
<td>.5</td>
<td>5</td>
</tr>
<tr>
<td>Maths SC</td>
<td>.92</td>
<td>.90</td>
<td>.91</td>
<td>.92</td>
<td>.91</td>
<td>.91</td>
<td>.5</td>
<td>5</td>
</tr>
<tr>
<td>GenAcad SC</td>
<td>.83</td>
<td>.86</td>
<td>.87</td>
<td>.87</td>
<td>.84</td>
<td>.86</td>
<td>.5</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: Gen Acad SC=general academic self-concept.

Goodness of fit indicators for the one factor congeneric models

The goodness of fit indicators reported will be RMSEA, NNFI and RNI. The variation on levels of acceptance among goodness of fit indicators for each are reported below. For example, values for the Root Mean Square Error of Approximation (RMSEA), which is an absolute fit indicator, indicates a good fit to the data when the values are <.05, however, values between .05 and .08 may also indicate a satisfactory fit for the data. The Non-Normed Fit Index (NNFI) is a measure of
incremental fit, which indicates that values >.95 indicate a good fit however, values of between .90 and .95 indicate a satisfactory fit of the model (Holmes-Smith, 2004). The “Relative Noncentrality Index (RNI), is algebraically equivalent to the CFI in most SEM applications; as with the CFI, coefficient values range from zero to 1.00, with higher values indicating superior fit” (Byrne, 1998, p. 117).

Analyses of the one factor Congeneric models were conducted on each of the twelve factors investigated in the SMOSA instrumentation (see Table 7.3). The goodness of fit indices, included chi-square statistic ($\chi^2$), df, RMSEA, NNFI and RNI for each of the sub-scales of the SMOSA on the total sample. As can be seen in Table 7.3, reasonable fit was achieved for each factor of the 12-factor model. Importantly, social concern pursuit was the factor reporting marginal outcomes in the previous testing on reliability, yet it reported exceptional fit to the data at this level with a RMSEA of 0.046, NNFI of 0.99 and an RNI of 1.00. (See Table 7.4 for individual item factor loadings). Although, the chi-square and RMSEA values were high for the self-concept measures, these were deemed to have mediocre fit and therefore included in the next stage of assessment for the total model (Byrne, 1998).

Table 7.3 Goodness of Fit indices for one factor congeneric models including $\chi^2$, df, RMSEA, NNFI, and RNI for each of the sub-scales of the SMOSA on the total sample

<table>
<thead>
<tr>
<th>Subscales</th>
<th>$\chi^2$</th>
<th>df</th>
<th>RMSEA</th>
<th>NNFI</th>
<th>RNI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>51.74</td>
<td>5</td>
<td>0.066</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>Effort</td>
<td>44.93</td>
<td>5</td>
<td>0.061</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>Competition</td>
<td>29.64</td>
<td>2</td>
<td>0.077</td>
<td>0.97</td>
<td>0.99</td>
</tr>
<tr>
<td>Leader</td>
<td>33.29</td>
<td>2</td>
<td>0.086</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>Affiliation</td>
<td>22.67</td>
<td>2</td>
<td>0.070</td>
<td>0.99</td>
<td>1.00</td>
</tr>
<tr>
<td>Social concern</td>
<td>11.10</td>
<td>2</td>
<td>0.046</td>
<td>0.99</td>
<td>1.00</td>
</tr>
<tr>
<td>Reward</td>
<td>11.19</td>
<td>2</td>
<td>0.046</td>
<td>0.99</td>
<td>1.00</td>
</tr>
<tr>
<td>Praise</td>
<td>21.51</td>
<td>2</td>
<td>0.068</td>
<td>0.99</td>
<td>1.00</td>
</tr>
<tr>
<td>PAC</td>
<td>15.89</td>
<td>2</td>
<td>0.057</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>English SC</td>
<td>108.54</td>
<td>5</td>
<td>0.099</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>Maths SC</td>
<td>110.15</td>
<td>5</td>
<td>0.099</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>Gen Acad SC</td>
<td>138.28</td>
<td>5</td>
<td>0.099</td>
<td>0.97</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Note: Gen Acad SC=general academic self-concept. N = 2131.
Multifactorial confirmatory factor analysis of the 12 factor model of the SMOSA.

Goodness of fit indicators for the 12-factor confirmatory factor model

Figure 7.1 provides a path diagram that shows the structure of the strong reliability indicators of goodness of fit. All results supported the psychometric soundness of the multidimensional 12-factor structure of the model. As an instrument the total model’s evaluation found to have excellent fit for the 53-item, 12-factor structure of the SMOSA.

Factor loadings for the 12 subscales of the a-priori SMOSA instrument

The factor loadings for each of the 12 factors in the SMOSA (Table 7.4) supported the definitional framework of the factor structure of the scale. The range of scores for the factor loadings varied from .52 through to .86 across the 12 factors (median r = .70). Evaluation of these factors in the 12-factor, 53-items model’s goodness of fit indices and values in Cronbach’s alpha suggested these measures should be included in further assessment of invariance checks. In addition, normalisation of the data, which will be undertaken prior to aggregation of the data, will assist by weighting the individual items within each factor.

Table 7.4 Factor loadings from each of the 12 one factor congeneric models.

<table>
<thead>
<tr>
<th>Subscales</th>
<th>item 1</th>
<th>item 2</th>
<th>item 3</th>
<th>item 4</th>
<th>item 5</th>
<th># items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>0.68</td>
<td>0.66</td>
<td>0.68</td>
<td>0.60</td>
<td>0.71</td>
<td>5</td>
</tr>
<tr>
<td>Effort</td>
<td>0.68</td>
<td>0.65</td>
<td>0.62</td>
<td>0.59</td>
<td>0.69</td>
<td>5</td>
</tr>
<tr>
<td>Competition</td>
<td>0.61</td>
<td>0.68</td>
<td>0.70</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>0.71</td>
<td>0.77</td>
<td>0.81</td>
<td>0.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affiliation</td>
<td>0.72</td>
<td>0.79</td>
<td>0.77</td>
<td>0.65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social concern</td>
<td>0.69</td>
<td>0.60</td>
<td>0.56</td>
<td>0.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reward</td>
<td>0.80</td>
<td>0.69</td>
<td>0.76</td>
<td>0.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Praise</td>
<td>0.66</td>
<td>0.70</td>
<td>0.71</td>
<td>0.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>0.55</td>
<td>0.61</td>
<td>0.63</td>
<td>0.71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English SC</td>
<td>0.80</td>
<td>0.77</td>
<td>0.71</td>
<td>0.80</td>
<td>0.74</td>
<td>5</td>
</tr>
<tr>
<td>Maths SC</td>
<td>0.86</td>
<td>0.82</td>
<td>0.79</td>
<td>0.83</td>
<td>0.80</td>
<td>5</td>
</tr>
<tr>
<td>Gen Academic SC</td>
<td>0.81</td>
<td>0.76</td>
<td>0.65</td>
<td>0.77</td>
<td>0.68</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: Gen Academic SC=general academic self-concept. Each subscale of the SMOSA varied on the number of items between 4 or 5 items.
While the aggregation of the other lower-order factors into their higher-order constructs may initially be seen as facilitative, on closer examination of the intercorrelations of the latent factor correlations, support was found for the separation of the 12-factor structural approach. The nature of achievement motivation during adolescence requires a multidimensional measure to provide greater explanatory power. The multidimensional approach of the SMOSA may provide such a tool. Using a more comprehensive model that includes 12 lower-order factors (rather than the higher-construct) may provide a more elegant enquiry regarding the nature of the patterns of change across grades in high school. For example, the correlations between the performance goals of competition and leader pursuits with the extrinsic goals of praise and reward pursuits showed differing strengths emerging between the corresponding lower-order factors. Reward pursuits were correlated with competition pursuits at .65 but only .44 for leader pursuits; while praise pursuits were correlated with competition pursuits at .62 but only .43 for leader pursuits. In addition, several other factors reported disparity between the lower-order factors of the higher-order constructs. PAC and general academic self-concept were highly correlated because they measure of self perceptions of general academic competence and capability. At r=.78, variation existed for PAC between competition pursuits (r=.34) and leader pursuits (r=.13). General academic self-concept’s inter-correlation with reward (r=.34) and praise (r=.26) and competition (r=.27) and leader (r=.16) varied between the lower-order factors. In addition, English self-concept reported variation between the extrinsic goals of reward pursuits (r=.30) and praise pursuits (r=.18).

**Latent factor correlations for the 12-factor model**

Latent factor correlations for each of the one factor congeneric models were taken from the Confirmatory Factor Analysis of the 12-factor model of the SMOSA.
The latent factor correlations provided information on the relationships that exist between the factors. Table 7.5 reports that the correlations among the latent factors ranged from .01 to .82 (median of $r = .20$) with a majority of the correlations 50 of the 65 (80%) were $< .40$. Given that 80% of the inter-correlations between the 12 factors were below .40, further supports the argument of the distinctiveness of the individual factors of the SMOSA. The eight pursuits identified as being strongly correlated with other pursuits were generally factors associated with the higher-order constructs. For example, task pursuits and effort pursuits ($r = .82$) the lower-order factors of a mastery goal; competition pursuits and leadership pursuits ($r = .65$) the lower-order factors of a performance goal; and praise pursuits and reward pursuits ($r = .77$) the lower-order factors of an extrinsic goal. Interestingly, however, the correlation table also highlighted that the higher-order construct of social goals that is the lower-order factors of affiliation pursuits and social concern pursuits ($r = .31$) only had a moderate correlation, thus suggesting that using the hierarchical structure of social goals rather than the lower-order factors of affiliation and social concern may provide less explanatory power. The self-concept measures had high correlated uniquenesses because the wording of the items was identical except for the subject, for example, “I am good at English” in the English self-concept measure was parallel with “I am good at Maths” for the maths self-concept and “I am good at most school subjects” for the general academic self-concept measure. The uniquenesses of these items were therefore freed in the model, as shown in Figure 7.1.

While the biggest differences emerged when comparing the social goals of affiliation pursuits and social concern pursuits, this was expected, due to their low latent factor correlation of $r = .31$. In addition, variation in the social goals of affiliation pursuits and social concern pursuits was expected given the differing
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costural underpinnings, whereby social concern pursuits emphasise assistance to other students and mentoring them, while affiliation pursuits emphasises liaising with friends. The difference between affiliation pursuits and social concern pursuits was also found in research by McInerney and colleagues (McInerney, Marsh, & Yeung, 2003). This is reinforced given the high inter-correlations between social concern pursuits and the self-perceptions of PAC, English self-concept and general academic self-concept but low correlations between these factors and affiliation pursuits. The implications of evaluating separately the inter-correlations for the lower-order factors rather than relying on the higher-order goals supports the claim that greater identification and understanding of the types of pursuits that work in conjunction with one another in achievement motivation may be achieved. These findings lend support to the argument that clarification may be attained with the use of the lower-order factors when mapping the patterns of change across grades in high school rather than using the higher-order constructs: mastery, performance, social and extrinsic goals. Profile analyses outlined in study 3 will assess this aspect more fully.

Table 7.5 Latent factor correlations among the SMOSA motivational sub-scales.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Task</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Effort</td>
<td>.82</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Compet</td>
<td>.07</td>
<td>.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Leader</td>
<td>.02</td>
<td>.03</td>
<td>.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Affil</td>
<td>-.07</td>
<td>.03</td>
<td>.24</td>
<td>.29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>SocCon</td>
<td>.02</td>
<td>.01</td>
<td>.15</td>
<td>.18</td>
<td>.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Reward</td>
<td>.11</td>
<td>.08</td>
<td>.65</td>
<td>.44</td>
<td>.33</td>
<td>.44</td>
<td></td>
<td></td>
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<tr>
<td>8.</td>
<td>Praise</td>
<td>.07</td>
<td>.05</td>
<td>.62</td>
<td>.43</td>
<td>.32</td>
<td>.44</td>
<td>.77</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>9.</td>
<td>PAC</td>
<td>.03</td>
<td>.03</td>
<td>.34</td>
<td>.13</td>
<td>.09</td>
<td>.45</td>
<td>.42</td>
<td>.34</td>
<td></td>
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<tr>
<td>10.</td>
<td>EngSC</td>
<td>.15</td>
<td>.28</td>
<td>.23</td>
<td>.20</td>
<td>-.01</td>
<td>.30</td>
<td>.30</td>
<td>.18</td>
<td>.63</td>
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<tr>
<td>11.</td>
<td>MathSC</td>
<td>.01</td>
<td>.01</td>
<td>.23</td>
<td>.11</td>
<td>.02</td>
<td>.17</td>
<td>.18</td>
<td>.48</td>
<td>.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>GASC</td>
<td>.03</td>
<td>.05</td>
<td>.27</td>
<td>.16</td>
<td>.04</td>
<td>.38</td>
<td>.34</td>
<td>.26</td>
<td>.78</td>
<td>.69</td>
<td>.45</td>
</tr>
</tbody>
</table>

Note: Affil=affiliation, SocCon=Social concern, PAC=Perceived Academic Capability, EngSC=English self-concept, MathSC=maths self-concept and GASC=general academic self-concept. Correlations above .50 were in bold.
Uniquenesses

Two items emerged with uniquenesses (or error variances) that were high in the a-priori model of the 12-factor SMOSA instrument (see Figure 7.1). One item under a social concern pursuit had a uniqueness of .72 and another item under the PAC subscale had a uniqueness of .70. The social concern pursuit item taken from the GAGOS measure was conceptually oriented to most closely fit with the definitional framework of social concern for other students, worded as “I am most motivated when I am showing concern for others”. Although the modification indices were high for this item also loading on leader pursuits, further exploration of the results indicated that the standardised expected change of Lambda X for this item would only change by .25. Therefore, given the limited degree of change the item would be better placed within social concern pursuits as originally estimated. In addition, treatment of the item by deletion showed little variation in the value of the RMSEA remaining at approximately .03, and the other goodness of fit indicators, the RNI and NNFI indices suggested a poorer model would be produced after deletion of this item. Given the conceptual strength of the item for this factor and lack of improvement in the model when deleted, the item was retained in the 53-item, 12-factor SMOSA structure.
Figure 7.1 The 12 factor structural equation model for the SMOSA.

Each item is labelled under the factors of Ta = task, Ef = effort, Co = competition, Le = leader, Aff = affiliation, Soc = Social concern, Pr = praise, To = Token, SE = PAC, E1-E5 = English self-concept, E6-E10 = maths self-concept and E11-E16 = general academic self-concept.
The other item in the PAC subscale with a high uniqueness was for the item worded as “I can do things as well as most people at school” with an item loading of only .52. This item’s modification indices were high for competition pursuits (19.7) and leader pursuits (13.7), however, the standardised expected change of Lambda X for this item respectively for each were only .10 and .08 and deletion of the item did not show improvement in the model would be obtained. Again, given the findings in the goodness of fit indices of the total a priori model of an RMSEA of .03 and the high levels for the RNI and NNFI; support for the inclusion of this item in the a-priori 53-item, 12-factor model of the SMOSA was accepted. Future research could review the item’s wording for these two items. In addition, further tests of invariance across both grade and sex will be undertaken in the following stage of psychometric testing to further evaluate the goodness of fit for this a-priori model.

**Testing for invariance of the SMOSA factor structure over grade and sex**

Testing for the invariance in the a priori factor structure of the SMOSA across both grades and sex considered four underlying hypotheses (Byrne, 1998, p. 291). The four hypotheses were:

1. The number of underlying factors are equivalent
2. The pattern of factor loadings are equivalent
3. That the structural relations among the four models of the construct are equivalent
4. That the reliability of the paired items from each subscale is equivalent (Byrne, 1998, p. 291).

To this end the factor loadings, factor covariances and the latent mean structure of the SMOSA and the item reliabilities between the groups of this sample of adolescent high school students was undertaken through two separate comparisons. The first investigated the factor invariance across grade, 7, 8 and 9, and the second investigated the factor invariance between males and females. These two
comparisons were the primary focus related in this research, investigation and analyses. Testing of invariance constraints for each group will be undertaken across four stages of invariance.

**Factor invariance across grade**

The factor structure of the 12-factor modelled SMOSA for the total structure of the SMOSA was found. As can be seen in Table 7.6, with 2,131 participants the chi-square statistic was 3101.183, degrees of freedom = 1244, RMSEA = .03; NNFI = .98; RNI = .99, support for hypothesis 2.1 was obtained. To test factor invariance across grade and hypothesis 2.2, the first set of models assessed four levels of Factor Invariance on the SMOSA (see Table 7.6). The first model, the baseline model has no invariance constraints and the hierarchy of testing the instrument for invariance begins with the least restrictive model and implies that no invariance constraints will be placed on the estimated parameters between the groups being compared (Marsh, 1994; Byrne, 1998). Additionally, to test models for comparison, “It is useful to test the same pattern of fixed and free parameters for all groups in the a posteriori baseline model” (Marsh, 1994, p. 12). Therefore, the order of testing the hierarchical constraints that were progressively imposed on the model began with a totally free model with no constraints on the factor loadings; nor the factor correlations and variances; or on the uniquenesses. The second model constrained only the factor loadings (FL) but did not restrict the factor correlations, variances, or the uniquenesses. The third model restricted the factor loadings, factor correlations, factor variances (FL, FC & FV) and held them invariant but did not restrict the uniquenesses. The fourth and final model restricted variance across factor loadings, factor correlations, factor variances and also the uniquenesses (FL, FC FV & Un), this model is also known as the total invariant model (Byrne, 1998).
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The results of the NNFI’s and RNI’s for each of the models were greater than .97 for each level of invariance across grades, thus strongly supporting the model’s equivalence usage across these groups. Review of the RMSEA output showed goodness of fit indicators to be satisfactory and the totally invariant model of 0.03 was a good fit to the data. The individual RMSEAs for the models tested, reported invariance constraints at .03 supporting the model’s goodness of fit testing. Review of SMOSA’s goodness of fit indicators suggests that the overall goodness of fit was satisfactory with acceptable psychometric properties for the purpose of assessing change across grades for this adolescent population. Thus, support was found for hypothesis 2.2.

Table 7.6 No invariance to total invariance tests across grades 7, 8 and 9 of the SMOSA.

<table>
<thead>
<tr>
<th>Model #</th>
<th>n</th>
<th>χ²</th>
<th>df</th>
<th>RMSEA</th>
<th>NNFI</th>
<th>RNI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No invariance Constraints</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>2131</td>
<td>3101.18</td>
<td>1244</td>
<td>0.03</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>Grade 7</td>
<td>725</td>
<td>2247.44</td>
<td>1244</td>
<td>0.03</td>
<td>0.97</td>
<td>0.98</td>
</tr>
<tr>
<td>Grade 8</td>
<td>688</td>
<td>2030.61</td>
<td>1244</td>
<td>0.03</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>Grade 9</td>
<td>718</td>
<td>1994.54</td>
<td>1244</td>
<td>0.03</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td><strong>Models of Systematic Invariance Constraints across 3 groups</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Totally free model</td>
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<tr>
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<td>0.98</td>
<td></td>
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<tr>
<td>FL, FC, FV invariant</td>
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<td>3970</td>
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<td>0.98</td>
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</tr>
</tbody>
</table>

Note FL=Factor Loadings, FC=Factor correlations, FV=Factor variances and Un=Uniquenesses. The totally invariant model had no constraints imposed neither to factor loadings, factor variances and covariances nor at the uniqueness levels.

The first model was used as a basis to compare the more restrictive models with increasing invariance constraints applied. Across the subsequent restrictive models, minimal variation occurred. The RMSEA did not vary across all levels of constraints and the most restrictive model reported an RMSEA .03, NNFI at .98 and RNI at .98.
Therefore, the results for the four models provided good support for the invariance of factor loadings, uniquenesses, factor variances and covariances for grades for the SMOSA.

**Factor invariance for sex**

The second set of models assessed hypothesis 2.3 with the same four levels of factor invariance, to test the validity of the SMOSA for use on males and females (see Table 7.7). The results of the NNFI’s and RNI’s for each of the models were greater than .98 for each level of invariance between males and females, thus strongly supporting the model’s equivalence usage across these groups. Review of the RMSEA output showed the totally invariant model was .03 and therefore psychometrically sound at $p < .05$. The individual RMSEAs for the models tested reported invariance constraints of 0.03 across all models provided further support for the model’s goodness of fit testing. The values of above .98 for NNFI and RNI at each level of constraint with systematic constraints applied showed excellent fit of the data. The factor loadings for both constructs were invariant over gender, thus suggesting that the factors measured had similar responses for boys and girls. Therefore, review of the SMOSA’s goodness of fit indicators found a satisfactory fit to the data. The psychometric soundness through invariance tests between males and females of the SMOSA was found in this adolescent population, providing support for hypothesis 2.3.
Table 7.7 No invariance to total invariance tests for males and females of the SMOSA.

<table>
<thead>
<tr>
<th>Model #</th>
<th>n</th>
<th>$\chi^2$</th>
<th>df</th>
<th>RMSEA</th>
<th>NNFI</th>
<th>RNI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No invariance Constraints</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>2131</td>
<td>3101.18</td>
<td>1244</td>
<td>0.03</td>
<td>0.98</td>
<td>0.99</td>
</tr>
<tr>
<td>Males</td>
<td>1034</td>
<td>2271.53</td>
<td>1244</td>
<td>0.03</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>Females</td>
<td>1097</td>
<td>2233.78</td>
<td>1244</td>
<td>0.03</td>
<td>0.98</td>
<td>0.99</td>
</tr>
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<tr>
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<td>0.98</td>
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</tbody>
</table>

Note FL=Factor Loadings, FC=Factor correlations, FV=Factor variances and Un=Uniquenesses.

The first model was used as a basis to compare the more restrictive models with increasing invariance constraints applied. Across the subsequent restrictive models, minimal variation occurred. The RMSEA across all levels of constraints reported an RMSEA .03, NNFI at .98 and RNI at .98. Therefore, the results for the four models provide good support for the invariance of factor loadings, uniquenesses, factor variances and covariances across sex for the SMOSA.

Summary

In summary, testing the psychometric soundness of the SMOSA supported the reliability and validity of this instrument for use with this adolescent population across grades and sex. The psychometric properties of the SMOSA generally provided equivalence between groups at both grade and sex testing, thus supporting the soundness of the measurement to assess the differences in these groups in subsequent analyses. Clarification of the two items that had high uniquenesses may require review in future research, however, inclusion of these two items in the 12-factor, 53-item SMOSA scale was found to provide goodness of fit indicators deemed
as satisfactory and distinctiveness was supported within the subscales through several testings of confirmatory factor analyses and tests of invariance. Due to the lack of improvement in the final model when deletion of these two items was undertaken and because the goodness of fit in the final model with the inclusion of these two items demonstrated that the 53-item, 12-factor model of the SMOSA provided a good fit to the data further CFA’s were not warranted. Invariance tests across grades and sex also provided equivalence on testing the first time wave of data, providing further support for the use of this model in subsequent analyses. The invariance across grades and sex provides strong support for the model to be used on this sample in subsequent analyses and further testing on the repeated measures across time 2 and 3 with the same sample were therefore not undertaken as given this was on the same sample of students it should be generalisable.
Chapter 8

Study 2 Results: Motivational patterns for males and females across grades for each of the 12 factors.

Introduction

The psychometric soundness of the SMOSA testing the 12-factor model was found to be reliable and valid in chapter 7. This chapter assessed the 12 factors of the SMOSA using polynomial contrasts to map the patterns of change in magnitude and/or direction in achievement motivation across grades 7 to 11. In addition, assessment of whether disparate patterns emerged for males and females was undertaken. Finally, the effects of the interactions (grade X sex) for each of the 12 factor models were analysed. The results addressed several questions.

1. Do males and females report disparate patterns of achievement motivation during high school using this multidimensional framework?

2. Using the 12-factor structure of the SMOSA, do males or females present more facilitative patterns in achievement motivation towards learning? That is, are males or females more salient in the less adaptive forms of learning during high school?

3. If disparate patterns do emerge, at what grade are these differences most salient?

Previous research has not investigated the nature of possible change in linear and/or quadratic effects across grades in high school using a more comprehensive motivational scale specifically designed for adolescents such as the SMOSA. Addressing how achievement motivational pursuits vary, as a factor of grade and/or sex, using polynomial contrasts to include the natural ordering effects across grades 7 to 11, requires clarification through research. To enable a comprehensive account of mapping the patterns of change during adolescence, advanced statistical research is
required, in this case, in the form of multilevel modelling. As suggested by Rasbash, Steele Browne and Prosser “By focusing attention on the levels of hierarchy in the population, multilevel modelling enables the researcher to understand where and how effects are occurring” (2004, p. 2). This level of analysis will be applied to each factor of the SMOSA scale. The use of multilevel modelling (as in MLwiN) will allow for a more delineated approach to be undertaken, thus allowing for greater clarification of the change across grades and where applicable, for sex on each of the multidimensional factors of achievement motivation. One important aspect of multilevel modelling as previously discussed (see chapter 6) allows for separation of the distribution of variance within the nested or hierarchical structure of the data.

In this chapter progressive models were assessed. The parameter estimates of grades and sex, as well as variation in slopes will be applied at the level 2 random effect analyses, that is, at the student within school level. It is hoped that this will provide a clearer understanding of the interpretation for changes in the degree of variation in actual scores across the three time collections of data. Therefore, these advanced forms of analyses allow for enhancement of previous research’s reliance on simple means evaluation and will provide information on the degree of variability at the individual student within school level analysis across grades to compare between the lower-order factors. Previous research has had several associated problems that arise from aggregated bias, which have provided, at best misconceptions in findings or, alternatively as the present thesis suggests, have not allowed for explanation of the individual student variation (Rowe, 2005).

To map the patterns that emerge for males and females across high school using a multidimensional scale for achievement motivation using these advanced statistical techniques allows for a developmental profile to be provided. Using a comprehensive
Achievement motivation scale to gauge student’s individual achievement motivational pursuits and comparing grades and also demonstrating comparisons between males and females will provide an understanding of the contemporary view of adolescent pursuits. This information may be beneficial in several ways. Firstly, having a tool to identify the salient achievement motivational pursuit of an individual student provides a mechanism for engagement and learning not previously available. Secondly, to understand the pattern of achievement motivation at specific grades and whether this varies as a factor of the sex of the student, allows for an understanding of the possible dilemma currently facing educational authorities on the apparent underperformance of males compared to females. Identifying which factors of achievement motivation are different between males and females and which facilitative components females surpass males on using a multidimensional measure will provide a more comprehensive understanding of the nature of achievement motivation. Thirdly, any individual may be assessed using the SMOSA to evaluate whether they have specific factors of engagement that deviate from their grade referent peers, that is, while most grade 11 students may not be motivated by merit certificates or praise, evaluation of an individual student may find one of these forms of achievement motivational pursuits is salient. Perhaps the most embracing quality of the SMOSA is that it is a reasonably parsimonious, yet comprehensive measure (only 53 items, yet 12 factors are assessed) to gauge achievement motivational pursuits during adolescence.

The literature suggests that students’ choices, attitudes and performance in achievement motivational situations are influenced by the particular goals they pursue. Therefore, mapping the patterns of achievement motivational goals and self perceptions for males and females may help clarify aspects of this reported sex disparity (Bouffard, Vezeau & Bordeleau, 1998; Maehr & Braskamp, 1986; Grant &
Dweck, 2003; Urdan & Maehr, 1995; Pintrich, Mann & Boyle, 1993; Wentzel, 1989; Butler, 1999; Eccles & Wigfield, 2002). Mapping the patterns of achievement motivation across grades for females and males using a multidimensional construct to identify where variations occur should assist in understanding the mechanism involved in the reported discrepancies of females outperforming males in high school.

Concerns have been raised within the education system regarding male’s underperformance in comparison to females at the Year 12 level across 90% of school subjects (Nelson, 2004). The reported disparity between males and females in their motivational pursuits and performance is an important contemporary issue. To understand why males are underperforming, clarification of the developmental patterns in achievement motivation during adolescence is required to provide a detailed explanation of their pursuits across high school. This is a contentious issue due to the recent change in funding practice within New South Wales’ education, whereby funds are currently being diverted away from females’ education to apparently equalise males’ opportunities at school. Prior to penalising females for reportedly improved performances by diverting educational resources, an initial enquiry to ascertain which contemporary factors deviate in males’ motivational pursuits and self perceptions during high school compared to females is necessary. Utilizing a comprehensive instrument like the SMOSA may assist in disentangling the possible disparity between males’ and females’ performances through understanding their motivational pursuits and self perceptions across high school.

Therefore, this chapter will investigate each of the 12 factors identified in the SMOSA using MLwiN in the following order. First, due to the cross-cohort sequential design of the study, that is three cohorts of students in three successive grades with data collection at three Times representing a 3 X 3 design; the issue of
possible confounding of cohort, grade and Time will be assessed to determine
whether differences emerge between comparative grades for the differing cohorts.
Second, the data will be normalised to avoid possible errors in results that may be a
factor of aggregation of the latent factors. The use of applying regression weights to
each item prior to creating each latent factor will be undertaken to avoid problems
associated with aggregation bias (see Chapter 7). Third, standardization of all
dependent variables under a common metric will be undertaken using SPSS prior to
bringing the data into MLwiN and allow for comparison between factors to be
evaluated in chapter 9. Fourth, to assess the linear and quadratic effects of grade (their
specific ordering effect), transformation of the independent variable ‘grade’ will be
undertaken, that is, Gدل (the linear effect of grade) and G долго (the quadratic
effect of grade) will be created (fully discussed in Chapter 6). Fifth, inclusion of sex
to the regression equation by dummy coding males = 0 and females = 1 will be
undertaken. Sixth, analyses will be undertaken for each of the factors on the
interaction of grade X sex (linear and quadratic effects) to map the pattern of change
that may emerge. Finally analysis of the fixed effect of Time will be undertaken, to
assess whether differences emerge among the linear or quadratic patterns of the Time
collections of data. This level will include all possible interactions with the previously
assessed parameter estimates with Time to clarify whether possible effects emerge.

**Preliminary analysis**

*Assessment of cohort effects and whether differences emerged*

After normalisation of the data (see Methods Section for a more detailed
account of the normalisation process of this data) assessment was undertaken on
possible differences among cohort effects. As this study was a cross-cohort sequential
design with three cohorts (3 successive grades, 7, 8 and 9) being assessed at three
successive Time collections of data, possible variation among the differing cohorts at the same grade level required assessment, to check the stability of the measure between the same grade at different Time and cohort collections (see Figure 8.1 for graphical representation of the cross-cohort sequential design of the study).

Significance levels and partial effect sizes were evaluated for each of the 12 factors at the three occurrences of cohort and grade level overlap. Independent t-tests were used with the two groups of grade 8 students collected at Time 1 and Time 2 (see Table 8.1) and two groups of grade 10 students at Time 2 and Time 3 (see Table 8.3). ANOVA was used for the three groups of grade 9 students that were represented in Time 1; Time 2 and Time 3 collections of data (see Table 8.2). The implications of variation among the grades through a cohort effect would complicate the results and if this situation were to exist would eliminate the possibility of analysing the data by collapsing across cohorts to assess differences across grades 7 to 11 when and if these differences arise.

<table>
<thead>
<tr>
<th>Cohort 1</th>
<th>Cohort 2</th>
<th>Cohort 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time 1</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Time 2</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Time 3</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

*Figure 8.1 Graphical representation of the research design for grades.*

NB: Lines represent the evaluations of the between cohort effects undertaken in the subsequent tables.

Due to the sample size all analyses throughout this research used the more conservative approach of $\alpha$ set at < .01 level of analysis rather than .05. The Wald statistic of 2.57 is statistically significant for alpha at $p < .01$ level and 3.29 is statistically significant for alpha at the $p < .001$ significance level (Rosenthal & Rosnow, 1985, p. 95). Table 8.1 shows that effort pursuits and reward pursuits were
Achievement motivation

identified as significantly different at the grade 8 level between cohort 1 and cohort 2, although the largest partial effect among the 12 factors explained less than 1% of the variance. As Rosenthal et al. suggest "The effect size tells us something very different from the p level. A result that is statistically significant at conventional levels is not necessarily "practically significant" as judged by the magnitude of the effect" (p. 4). While the sample size impacts on levels of significance, the partial effects are not sensitive to sample size. Given the small reported partial effect size for two factors (largest being .009 for reward) and the large sample size, it is suggested that the significance levels obtained in the grade 8 cohort comparisons were not an indication of any real difference emerging between the two student cohorts.

Table 8.1 Results of independent t-tests for cohorts 1 and 2 at the grade 8 level for each of the 12 factors.

<table>
<thead>
<tr>
<th>Subscale</th>
<th>SS</th>
<th>df</th>
<th>t calc</th>
<th>significance</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>2.159</td>
<td>1</td>
<td>5.700</td>
<td>.017</td>
<td>.004</td>
</tr>
<tr>
<td>Effort</td>
<td>4.055</td>
<td>1</td>
<td>9.872</td>
<td>.002</td>
<td>.007</td>
</tr>
<tr>
<td>Competition</td>
<td>2.831</td>
<td>1</td>
<td>3.317</td>
<td>.069</td>
<td>.002</td>
</tr>
<tr>
<td>Leadership</td>
<td>.449</td>
<td>1</td>
<td>.480</td>
<td>.489</td>
<td>.000</td>
</tr>
<tr>
<td>Affiliation</td>
<td>.000</td>
<td>1</td>
<td>.000</td>
<td>.985</td>
<td>.000</td>
</tr>
<tr>
<td>Social concern</td>
<td>.253</td>
<td>1</td>
<td>.490</td>
<td>.484</td>
<td>.000</td>
</tr>
<tr>
<td>Praise</td>
<td>.053</td>
<td>1</td>
<td>.065</td>
<td>.799</td>
<td>.000</td>
</tr>
<tr>
<td>Reward</td>
<td>11.795</td>
<td>1</td>
<td>12.141</td>
<td>.001</td>
<td>.009</td>
</tr>
<tr>
<td>PAC</td>
<td>.095</td>
<td>1</td>
<td>.208</td>
<td>.648</td>
<td>.000</td>
</tr>
<tr>
<td>English SC</td>
<td>1.577</td>
<td>1</td>
<td>2.478</td>
<td>.116</td>
<td>.002</td>
</tr>
<tr>
<td>Maths SC</td>
<td>.394</td>
<td>1</td>
<td>.436</td>
<td>.509</td>
<td>.000</td>
</tr>
<tr>
<td>Gen Acad SC</td>
<td>.441</td>
<td>1</td>
<td>.895</td>
<td>.344</td>
<td>.001</td>
</tr>
</tbody>
</table>

Significant p values were placed in **bold**. Comparative effect sizes were small.

Table 8.2 shows that effort pursuits, competition pursuits, affiliation pursuits and reward pursuits were identified as significantly different at the grade 9 level among cohort 1, cohort 2 and cohort 3 at p < .01 level of analysis. As can be seen the largest partial effect size among the 12 factors was approximately 1.5% of the
explained variance for effort pursuits. The significance values for these four factors were not practically significant when the effect size for each was taken into account.

Table 8.2 Results of ANOVA for cohorts 1, 2 and 3 compared at the grade 9 level for each of the 12 factors.

<table>
<thead>
<tr>
<th>Subscale</th>
<th>SS</th>
<th>df</th>
<th>F calc</th>
<th>significance</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>2.516</td>
<td>2</td>
<td>3.479</td>
<td>.031</td>
<td>.004</td>
</tr>
<tr>
<td>Effort</td>
<td>11.361</td>
<td>2</td>
<td>14.568</td>
<td>.000</td>
<td>.015</td>
</tr>
<tr>
<td>Competition</td>
<td>10.392</td>
<td>2</td>
<td>5.798</td>
<td>.003</td>
<td>.006</td>
</tr>
<tr>
<td>Leadership</td>
<td>1.004</td>
<td>2</td>
<td>.614</td>
<td>.541</td>
<td>.001</td>
</tr>
<tr>
<td>Affiliation</td>
<td>13.256</td>
<td>2</td>
<td>7.875</td>
<td>.000</td>
<td>.008</td>
</tr>
<tr>
<td>Social concern</td>
<td>1.088</td>
<td>2</td>
<td>1.036</td>
<td>.355</td>
<td>.001</td>
</tr>
<tr>
<td>Praise</td>
<td>.075</td>
<td>2</td>
<td>.047</td>
<td>.954</td>
<td>.000</td>
</tr>
<tr>
<td>Reward</td>
<td>13.275</td>
<td>2</td>
<td>7.046</td>
<td>.001</td>
<td>.007</td>
</tr>
<tr>
<td>PAC</td>
<td>.272</td>
<td>2</td>
<td>.291</td>
<td>.747</td>
<td>.000</td>
</tr>
<tr>
<td>English SC</td>
<td>3.145</td>
<td>2</td>
<td>2.263</td>
<td>.104</td>
<td>.002</td>
</tr>
<tr>
<td>Maths SC</td>
<td>3.048</td>
<td>2</td>
<td>1.647</td>
<td>.193</td>
<td>.002</td>
</tr>
<tr>
<td>Gen Acad SC</td>
<td>.507</td>
<td>2</td>
<td>.471</td>
<td>.624</td>
<td>.001</td>
</tr>
</tbody>
</table>

Significant p values were placed in **bold**. Comparative effect sizes were small.

Table 8.3 Results of independent t-tests for cohorts 2 and 3 compared at the grade 10 level for each of the 12 factors.

<table>
<thead>
<tr>
<th>Subscale</th>
<th>SS</th>
<th>df</th>
<th>t calc</th>
<th>significance</th>
<th>Partial $\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>.586</td>
<td>1</td>
<td>1.516</td>
<td>.218</td>
<td>.001</td>
</tr>
<tr>
<td>Effort</td>
<td>.673</td>
<td>1</td>
<td>1.704</td>
<td>.192</td>
<td>.001</td>
</tr>
<tr>
<td>Competition</td>
<td>4.729</td>
<td>1</td>
<td>5.328</td>
<td>.021</td>
<td>.004</td>
</tr>
<tr>
<td><strong>Leadership</strong></td>
<td><strong>11.170</strong></td>
<td>1</td>
<td><strong>13.958</strong></td>
<td><strong>.000</strong></td>
<td>.011</td>
</tr>
<tr>
<td>Affiliation</td>
<td>2.188</td>
<td>1</td>
<td>2.669</td>
<td>.103</td>
<td>.002</td>
</tr>
<tr>
<td>Social concern</td>
<td>1.555</td>
<td>1</td>
<td>2.837</td>
<td>.092</td>
<td>.002</td>
</tr>
<tr>
<td>Praise</td>
<td>4.208</td>
<td>1</td>
<td>5.093</td>
<td>.024</td>
<td>.004</td>
</tr>
<tr>
<td>Reward</td>
<td>1.925</td>
<td>1</td>
<td>2.158</td>
<td>.142</td>
<td>.002</td>
</tr>
<tr>
<td>PAC</td>
<td>.224</td>
<td>1</td>
<td>.476</td>
<td>.490</td>
<td>.000</td>
</tr>
<tr>
<td>English SC</td>
<td>.423</td>
<td>1</td>
<td>.554</td>
<td>.457</td>
<td>.000</td>
</tr>
<tr>
<td>Maths SC</td>
<td>2.555</td>
<td>1</td>
<td>2.963</td>
<td>.085</td>
<td>.002</td>
</tr>
<tr>
<td>Gen Acad SC</td>
<td>.004</td>
<td>1</td>
<td>.007</td>
<td>.933</td>
<td>.000</td>
</tr>
</tbody>
</table>

Significant p values identified are in **bold**. Comparative effect sizes were small.

Table 8.3 shows that only leader pursuits was identified as having significant p values at the grade 10 level between cohort 2 and cohort 3. As can be seen the largest effect for this group of 12 factors was 1.1% of the explained variance (Hills, 2003).
Each of these Tables, 8.1, 8.2 and 8.3 identified factors emerging as significantly different between the cohorts, however these differences when evaluated through partial effect size were very small. This indicates that no real significance was obtained. In addition where factors emerged as being significantly different; due to the small partial effects identified this was probably more a factor of the sample size than any true significance being obtained. Among the 36 factors (3 grade level comparisons for 12 factors each) the largest effect size was .015, for the factor of effort pursuits at grade 9 (Table 8.2) which roughly equates to 1.5% of the explained variance. In addition, no individual factor emerged across all three analyses as being consistently significant. The research’s cross-cohort sequential design included the effects of grade, time and cohort. Any two of these three factors incorporated the effect of the third within the analysis, and given the small effects outlined in the previous analyses. Therefore, cohort effects were not included in any further analyses.

**Descriptive data for grades, total sample and sex computed through MLwiN**

The standardised means and number of students per cell for each of the SMOSA’s subscales using MLwiN analyses have been placed in each sub-factor’s section. Represented are individual grades, that is; at grades 7, 8, 9, 10 and 11 for males and females, plus the total standardised means for grades and sex.

**Task pursuits within motivation**

**Introduction**

A task pursuit is a positive component of facilitative learning. It is one of the two pursuits that represent a mastery goal; task pursuits and effort pursuits. Increases in a task pursuit would equate to a more adaptive pattern of engagement at school. A task pursuit is defined as a student’s perception of achievement when personal improvement is obtained. Hypothesis 3.1, 3.2 and 3.3 all relate to the factor of task
pursuits. Hypothesis 3.1 suggests that there should be gradual declines in task pursuits from grade 7 and then a plateauing should occur between grade 9 and 10 with gradual recovery in grade 11. Hypothesis 3.2 suggests that males should have lower task pursuits than females. Hypothesis 3.3 suggests that differences should emerge between males and females. Males should have a less facilitative or adaptive pattern of learning than females; recording lower levels of task pursuits uniformly across grades 7 to 11.

Seven models were progressively assessed with the addition of individual variables used to identify the pattern of development in task pursuits for adolescents in high school. The first level was the baseline variance components model used as a baseline for future comparison with subsequent models; the second equation included Gdelin to assess the linear increase or decline in the level of task pursuits across the ordered effect of grades (Model 2). The third model included Gdequad to assess the quadratic effect of grade on task pursuits across adolescence that is, the possible recovery or lessening in the magnitude of decline evidenced across the ordered effects of grade as predicted in hypothesis 3.1 (Model 3). The fourth model assessed the inclusion of the effect of sex for the variable of task pursuits (Model 4). Model 5 included the components of sex, grade and added the interaction of sex and grade through a linear effect. Model 6 included the components of sex, grade and the interaction of sex X linear grade (quadratic effect) for sex and grade. Model 7 builds on the previous models and includes the effect of Time as fixed, linear and quadratic effects to the equation. All parameter estimates and standard errors of estimates found in each of the progressive models have been presented in Table 8.5 to allow easy comparison of the progressive nature of the inquiry into task pursuits across grades and between the sexes.
Model 1, is the baseline variance components model. This model allows for
the residual variance to be represented separately for each level within the nesting
hierarchy (Rasbash, Steele, Browne, & Prosser, 2004). In the present research three
levels were deemed necessary and the total variance was partitioned into the different
variance components at each level, that is the variance associated with school (level
k), student (level j) and time (level i) levels within the hierarchy (Rasbash, Steele,
Browne, & Prosser, 2004). To assist in understanding the symbolic representation
used within each equation a brief explanation follows; subscript \( ijk \) means that
variables vary from test occasion to test occasion (time level), from individual to
individual (student level), and from school to school (school level) and these
notations within the equation represent the random part of the model where nesting of
the variance is applied (Rasbash, Steele, Browne, & Prosser, 2004). Therefore, the
residuals, \( v_{0k} \), represent the random school effect, \( u_{0jk} \), the random student effect
within each school and \( e_{0ijk} \), the random time effect for each student within each
school. The mean intercept, \( \beta_0 \), constitutes the fixed part of the model for task
pursuits (Figure 8.2). The fixed intercept in Model 1 shows after standardization of
the twelve factors, task pursuits had an intercept of .686 with a standard error = .025.
This suggests that while variation exists, this population’s mean estimate for task
pursuits was deemed as positive with a value of .686 on the 12-factor standardised
scale because it was above the standardised mean of zero.

The randomised part of the baseline model for task pursuits indicated that for
each of the three random levels, the existence of significant variation at the three
different levels exists. A simple baseline model such as Figure 8.2 suggests at the
school level (level 3) variation exists in the individual parallel slopes among the
schools. The level 3 residuals reported among the 11 schools demonstrated variance
existed of \( v_{0k} = .016 (0.006) \) significant at the \( p<.01 \) level. At the intercept for the level 2 residuals, \( u_{0j} \), representing the student level, had a variance of \( .148 (0.008) \), which also suggests that this parameter estimate was large at this level and significant, \( p<.001 \). The greatest variance, however, within the baseline model was at the level 1 Time residuals, \( e_{0ijk} = .252(0.007) \) which was highly significant, \( p<.001 \) in this baseline model. The significant Time effect suggests that variance in task pursuits varied as a function of the differences associated with the Time collection of data for a given student within each school. The large variation associated with Time is consistent with the modest test-retest correlations found, and may reflect some systematic effects associated with Time, for example the normal maturation effect associated in repeated measures when assessing progressive grades. The apparent decline in grades was expected and as student’s variation in their rates of declines across grades at the student within school level occurred, this variation among individuals was anticipated.

**Model 1: Baseline variance components model for task pursuits**

\[
\begin{align*}
\text{zn}_{\text{task}_{ijk}} &\sim \mathcal{N}(XB, \Omega_x) \\
\text{zn}_{\text{task}_{ijk}} &= \beta_{0ijk} + \varepsilon_{0ijk} \\
\beta_{0ijk} &= 0.686(0.025) + v_{0k} + u_{0jk} + \varepsilon_{0ijk} \\
\begin{bmatrix} v_{0k} \\ u_{0jk} \\ \varepsilon_{0ijk} \end{bmatrix} &\sim \mathcal{N}(0, \Omega_{uv}) : \Omega_{uv} = \begin{bmatrix} 0.016(0.006) \\ 0.148(0.008) \\ 0.252(0.007) \end{bmatrix} \\
\end{align*}
\]

\(-2^{*}\text{loglikelihood(MLLS Deviance)} = 10371.460(5621 \text{ of } 5833 \text{ cases in use})\)

In this model task is the outcome measure for the individual student \( j \) of school \( k \) at time \( i \). \( N = \text{number of levels}, X_{B} = \text{fixed part of the model}; \Omega = \text{covariance matrix.} \beta_{0ijk} \text{ refers to the intercept.} \)
The amount of variability evidenced at Time collections is understood to measure the nested model of Time within Student within School, which is an overall value of the variance explained as the random structure of this research design. However, within the current research, Time is not completely independent; there is an overlap with grade and cohort factors. In addition, individual students had 3 time collections each that may have represented students with time collections for grades 7 to 8 to 9 (cohort 1); grades 8 to 9 to 10 (cohort 2) or grades 9 to 10 to 11 (cohort 3). The purpose of this research was to map the pattern of change/s expected to occur across grades, which naturally overlapped with the Time variable. The first cohort was hypothesised to have declines, the second cohort generally a plateauing of effects and the third cohort to evidence recovery in task pursuits.

While the findings may initially suggest volatility within the measure, at the time within student within school level analysis, several explanations are proffered for this anomaly. The previous analyses of low partial effects found in assessment of cohort differences at parallel grades raises doubt on the assertion of the instability of the measure. In addition, measuring abstract phenomenon such as attitudes, motivation, etc, has been suggested to be less reliable than a constant such as age (Cohen & Cohen, 1983). Finally, variability at Time may not necessarily have led to instability in the measure, but more that variation between Time occasions may be a factor of the phenomenon rather than an indication of the lacking in the reliability of the measure. Claims by Kline (1973) regarding the focus that psychological tests should have high test-retest correlations reinforces that this rigid practice ignores the process involved in measurement and interpretation. In reference to reliable psychological measurement, Kline suggests, “The most obvious feature of persons is that they change, and grievous though this may be to the champions of reliable
psychological measurement, it must be recognised that we must seek to understand change and to measure our degree of understanding by the degree to which we can predict it. We do not need to regard change in test scores as indicating ‘error variance’’ (Kline, 1973, p. 162). Finally, as Cohen and Cohen suggest, “the extreme cases at Time 1 will be less extreme at Time 2” (p. 48). They go on to explain this is an artefact of regression towards the mean (where low scores improve and high scores deteriorate when standard deviations and means are constant). There were 69,996 (12 factors X 5833 [3 time collections varied –Time 1 = 2131, Time 2 = 2026 & Time 3 = 1676]) data points used in this analysis. Therefore the variation that emerged in the rank ordering of individual student responses between time collections of data was expected. That individual variability may occur suggests the more powerful approach of multi-level modelling should be used to more accurately evaluate the degree of variation (range) in response to each factor. This is particularly important when mapping the patterns of change across adolescence and the aspect of change during adolescence is the basis of this enquiry. In an attempt to better understand this phenomenon, evaluating the data to assess whether students varied differentially across grades was an important point in this enquiry. The use of MLwiN may help reiterate the difficulties when assessing motivation through simple mean level evaluation. Valuable information may be assumed rather than analysed appropriately when the individual variability is not separated through random level analyses.

Prior to moving away from the explanation of the baseline variance components model (Figure 8.2) the intra-class correlation was also computed. The intra-class correlation was calculated by dividing the value of each level by the total value of the sum of the three levels, which estimates the proportion of variance at each level, also
known as the “variance partition coefficient” (VPC) (Goldstein, 2003, pp. 16-17). The intra-class correlation is the proportion of group level variance compared to the estimated total variance of the model, in this case, three levels of analysis (Goldstein). The total variance in task pursuits is the sum of the level 3, level 2 and level 1 variances (.016 + .148 + .252) = .416 (Snijders & Bosker, 1999). That is the total variance for this baseline model is 41.6%. The between-school variance was calculated using the total percentage and dividing the value of each level by the total value of the sum of the three levels, and this partitioning of variance explained is known as the intra-class correlation. Therefore, at level 3, School = .016/.416 accounts for 4% of the total variance or intra-school variance within this model. The intra-student or variance at level 2 was similarly calculated using the parameter estimate for that level and dividing it by the total variance. The calculations suggest that the intra-student level = .148/.416 accounted for 36% of the total variance and the first level, the intra-time level = .252/.416 accounted for 60% of the total variance of this model.

Model 2 was a simple level variation model, which allowed for the same 3 levels previously used in Model 1 to be assessed with the addition of the fixed linear ordered effect of grades across grades 7 to 11 (see Figure 8.3). The simple level model at a given level assumes that variation at the intercept level may occur within each level of analysis but that the intercepts will have parallel slopes. For example, at the student within school level, the simple level analysis model would allow each student within school $u_{ijk}$, to have an individual intercept but all those intercepts at that level would be parallel (Rasbash, Steele, Browne, & Prosser, 2004). Model 3 added the fixed quadratic effect of grades across grades 7-11. Model 4 added the fixed effect of sex in a simple model and tested whether males and females differed in
their task pursuits. Subsequent models tested the interactions of sex and grade through linear (Model 5) and quadratic effects across grades 7 to 11 (Model 6). Finally, assessment of whether the effect of Time (the occasion of the collection of the data) through linear, and/or their relative interactions varied across their task pursuits was analysed in Model 7. The applied weights for the polynomial contrasts testing the ordering effects across grades 7 to 11 (linear and quadratic) have been fully explained in the Methods section (see chapter 6).

Model 2 (Figure 8.3) shows a significant linear effect across grades, $\beta_1 (-0.061/0.008 = -7.63, p < .001)$ suggesting a pattern of declines occurred across the sequential grades of 7 through to 11 in task pursuits. Given the data was transformed through standardisation across the 12 factors; task pursuits reported an overall positive intercept of .687. The addition of the linear effect of grade for task pursuits provided a significant reduction between Model 1 and Model 2 in the loglikelihood statistics, $(10371.46 – 10292.31)$, with a single parameter added, $\chi^2 = 179.15, p < .001$. 

**Model 2: Including the linear effect of grade.**

$z_{\text{task}\_yk} \sim N(XB, \Omega)$

$z_{\text{task}\_yk} = \beta_{0\_yk} \text{cons} + 0.061(0.008)g_{\text{delin}\_yk}$

$\beta_{0\_yk} = 0.686(0.025) + \nu_{0\_yk} + \mu_{0\_yk} + \varepsilon_{0\_yk}$

$\nu_{0\_yk} \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.015(0.005) \end{bmatrix}$

$\mu_{0\_yk} \sim N(0, \Omega_\mu) : \Omega_\mu = \begin{bmatrix} 0.151(0.008) \end{bmatrix}$

$\varepsilon_{0\_yk} \sim N(0, \Omega_\varepsilon) : \Omega_\varepsilon = \begin{bmatrix} 0.246(0.007) \end{bmatrix}$

$-2 \times \text{log likelihood (IGLS Deviance)} = 10292.310 (5613 \text{ of 5833 cases in use})$

Figure 8.3 The linear contrast from grades 7 to 8 to 9 to 10 and 11.
**Model 3: Adding the quadratic effect of grade**

\[
\begin{align*}
    z_{\text{task}_{jk}} &\sim \mathcal{N}(\text{X}_{jk}, \Omega) \\
    z_{\text{task}_{jk}} &= \beta_{0jk} \text{cons} + 0.057(0.008) g_{\text{de lin}_{jk}} + 0.020(0.005) g_{\text{de quad}_{jk}} \\
    \beta_{0jk} &= 0.701(0.025) + v_{0k} + u_{0jk} + e_{0jk}
\end{align*}
\]

\[
\begin{align*}
    \begin{bmatrix} v_{0k} \end{bmatrix} &\sim \mathcal{N}(0, \Omega_r) : \Omega_r = \begin{bmatrix} 0.015(0.005) \end{bmatrix} \\
    \begin{bmatrix} u_{0jk} \end{bmatrix} &\sim \mathcal{N}(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.151(0.008) \end{bmatrix} \\
    \begin{bmatrix} e_{0jk} \end{bmatrix} &\sim \mathcal{N}(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.245(0.006) \end{bmatrix}
\end{align*}
\]

\[-2 \times \text{loglikelihood (IGLS Deviance)} = 10277.070\text{ (5613 of 5833 cases in use)}
\]

**Figure 8.4 The quadratic effect of grade was significant.**

The equation presented in Model 3 (Figure 8.4) included the quadratic ordering effect of grades 7 to 11. The inclusion of this contrast variable reported significant gdequad coefficients, \( \beta_2 (0.020/0.005 = 4.0, p<.001) \). The subsequent quadratic analysis showed that across the natural ordering of grades 7 to 11, there was a trend towards recovery around grade 11 as predicted in hypothesis 3.1 (see Table of means, 8.4). As can be seen in Figure 8.5, the slope of the gradient for grade shows gradual decline until grade 10 with a plateauing effect by grade 11. Evaluation of the loglikelihood statistics showed a reduction between Model 2 and Model 3 with the inclusion of the quadratic effect of grade (10292.31 - 10277.07) and given a single parameter was added to the regression equation, \( \chi^2 = (1) 15.24, p < .001 \), a significant difference emerged.
Model 4: Adding sex to the previous model

\[
\text{ztask}_{jk} \sim \mathcal{N}(X \beta, \Omega)
\]

\[
\text{ztask}_{jk} = \beta_{0jk} \text{cons} + \gamma_{0j} + 0.642(0.025) \text{sex}_{jk} + 0.140(0.023) \text{sex}_{jk}
\]

\[
\beta_{0jk} = 0.642(0.025) + \gamma_{0j} + u_{0jk} + \epsilon_{0jk}
\]

\[
\begin{bmatrix}
\gamma_{0j} \\
u_{0jk} \\
\epsilon_{0jk}
\end{bmatrix} \sim \mathcal{N}(0, \Omega_{\gamma, \nu, \epsilon}) : \Omega_{\gamma} = \begin{bmatrix} 0.012(0.005) \end{bmatrix}, \Omega_{\nu} = \begin{bmatrix} 0.148(0.008) \end{bmatrix}, \Omega_{\epsilon} = \begin{bmatrix} 0.245(0.007) \end{bmatrix}
\]

\[\text{-2*loglikelihood(IQLS Deviance)} = 10233.960(5611 \text{ of } 5833 \text{ cases in use})\]

Figure 8.6 The analysis of the addition of sex to the equation.

Model 4 (Figure 8.6) included sex in the regression equation to assess whether differences emerged (after dummy coding the variable) between males (0) and females (1) in Task pursuits. Significant sex coefficients, \(\beta_3\), (.140/0.023 = 6.09, \(p < .001\)) were found. During high school males had significantly lower levels of Task pursuits than females. That is females on average did .140 of a standard deviation unit better than males, supporting the prediction of hypothesis 3.2. A significant reduction
in the loglikelihood statistics was found with the addition of sex (10277.07 – 10233.96) between models 3 and 4 with a single parameter added, $\chi^2 = (1) 43.11, p < .001$. That is, given the way the scale was defined, girls reported higher Task pursuits than boys and because this is a facilitative component of achievement motivational pursuits, girls therefore reported a more facilitative pattern of development across grades than boys.

**Model 5: Inclusion of the interaction of sex X the linear effect of grade for Task pursuits**

$$\text{zn}_{\text{task}}_{gh} \sim \mathcal{N}(\mathcal{I}, \Omega)$$

$$\text{zn}_{\text{task}}_{gh} = \beta_{0_{gh}} + 0.082_{(0.011)}\text{gdeqad}_{gh} + 0.019_{(0.005)}\text{gdequad}_{gh} + 0.145_{(0.023)}\text{sex}_{gh} + 0.044_{(0.015)}\text{gdeqgex}_{gh} + \epsilon_{0_{gh}} + \nu_{0_{gh}}$$

$$\begin{bmatrix} \nu_{0_{gh}} \\ \epsilon_{0_{gh}} \end{bmatrix} \sim \mathcal{N}(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.012_{(0.005)} \\ 0.148_{(0.008)} \end{bmatrix}$$

$$\begin{bmatrix} \nu_{1_{gh}} \\ \epsilon_{1_{gh}} \end{bmatrix} \sim \mathcal{N}(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.244_{(0.006)} \end{bmatrix}$$

$-2^{\chi^2 \text{loglikelihood}(IOLS Deviance)} = 10225.170(5611 \text{ of } 5933 \text{ cases in use})$

*Figure 8.7 The interaction of sex X the linear effect of grade was significant.*

Model 5 assessed the interaction of the linear effect of grade X sex. Significant sex X linear grade interaction coefficients, $\beta_{4}, (0.044/0.015 = 2.93, p < .01)$ were reported (see Figure 8.7). This significant interaction effect suggests that during high school, a disparate pattern of development emerged between males and females in their task pursuits; supporting hypothesis 3.3. Males had lower levels of task pursuits compared to females across all grades (see Table 8.4). The significant linear difference suggests that a different pattern of development emerged between males and females across the grades. Systematic declines were evidenced in a linear fashion for males across grades, however, the rate of decline lessened for females with a trend towards recovery evidenced in female’s task pursuits around grade 11 (see Table 8.4).
Achievement motivation for means and Figure 8.9 for degree of individual variation). The interaction of the linear effect of grade X sex was statistically significant (Figure 8.7). A reduction in the loglikelihood statistics with the inclusion of the interactions of sex X the linear effect of grade was evidenced between Model 4 and Model 5 (10233.96 – 10225.17) and with a single parameter added, $\chi^2 = (1) 8.79, p < .01$. A significant improvement in the explanatory power of the revised model occurred.

Model 6 assessed the interaction of the quadratic effect of grade X sex. The sex X quadratic grade interaction coefficients, $\beta_5$, (-0.004/0.010) was not significant (see Figure 8.8). A reduction in the loglikelihood statistics with the inclusion of the interactions of sex X the linear effect of grade was evidenced between Model 5 and Model 6 (10225.17 – 10225.02), but this was not significant. MLwiN’s capabilities allowed for a comprehensive account of individual student variation by mapping each student’s standardised scores in task pursuits across their 3 time collections of data.

**Model 6: The interaction of sex X the quadratic effect of sex**

\[
\begin{align*}
ztask_{y,t} & \sim N(0, \Omega) \\
ztask_{y,t} & = \beta_{0y} + \beta_{1y} \text{grade} + \beta_{2y} \text{sex} + \beta_{3y} \text{grade} \times \text{sex} + \beta_{4y} \text{grade}^2 + \beta_{5y} \text{sex} \times \text{grade}^2 + \epsilon_{y,t} \\
\beta_{0y} & = 0.640(0.026) + \nu_{0y} + \nu_{0y} + \epsilon_{0y} \\
\nu_{0y} & \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.012 & (0.005) \end{bmatrix} \\
\nu_{0y} & \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.148 & (0.008) \end{bmatrix} \\
\epsilon_{0y} & \sim N(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = \begin{bmatrix} 0.244 & (0.006) \end{bmatrix}
\end{align*}
\]

$-2 \times \text{loglikelihood(IGLS Deviance)} = 10225.020 (5611 of 5833 cases in use)$

*Figure 8.8 the interaction of sex and the quadratic effect of grade was not significantly different for task pursuits.*
Table 8.4 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for task pursuits.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.89(363)</td>
<td>.80(689)</td>
<td>.75(964)</td>
<td>.73(649)</td>
<td>.74(270)</td>
<td>.77(2935)</td>
</tr>
<tr>
<td>Male</td>
<td>.85(333)</td>
<td>.70(643)</td>
<td>.60(922)</td>
<td>.54(584)</td>
<td>.52(184)</td>
<td>.64(2676)</td>
</tr>
<tr>
<td>Total</td>
<td>.87(696)</td>
<td>.75(1332)</td>
<td>.68(1886)</td>
<td>.64(1243)</td>
<td>.65(454)</td>
<td>.71(5644)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.

Figure 8.9 MLwiN’s graphical capabilities highlight the different contrast effects between males and females. Females are the higher line, showing a clear quadratic effect at the grade 11 level compared to males who continued to decline.

MLwiN can map the patterns of responses from the three time collections of data for males in task pursuits to compare graphically female’s pattern of response at the time within student within school level of analysis (Figure 8.10). The mean overall responses for males and females across grades are captured in Figure 8.10, which shows a larger percentage of males reporting lower values across grades compared to responses by females. This capability compliments the values obtained through the fixed effects models and provides a visual representation of the pattern of responses across the time within student within school level analysis (random levels) rather than solely relying on mean evaluations to describe this phenomenon. Greater variability was identified in the pattern of responses particularly at the grade 10 level for males compared to females through the random effects model. A fanning out in
their responses (wider spread for males increasing across grades) was found. Also noticeable is that the top performing students regardless of whether they were male or female had similar levels of task pursuits. However, it is the spread of the majority of boys that is a concern in this analysis. The mean overall responses for males and females across grades are captured in Figure 8.10, which shows a larger percentage of males reporting lower values across grades compared to responses for females.

Figure 8.10 Comparison graphs for females and males in task pursuits across grades predicting students within school lines for random slope student within school level analysis for the linear & quadratic effect of grade and sex variables.
Model 7: Adding the interactions of timelin & timequad & relevant interactions 

\[
\begin{align*}
\eta_{y, y} &\sim N(\mu, \Omega) \\
\xi_{y, y} &\sim N(0, \Omega) \\
\tau_{y, y} &\sim N(0, \Omega)
\end{align*}
\]

\[
\begin{align*}
\beta_{y} &= 0.614(0.069) + \tau_{x} + \tau_{y} + \sigma_{y}
\end{align*}
\]

-3*Loglikelihood(GFIES Deviance) = 10209.290 (5611 of 5833 cases in use)

Finally, the effects of the linear and quadratic effects of Time and the relevant interactions were added in Model 7 (see Figure 8.11). Only the linear effect of grade was significant at the .01 level after all coefficients were entered into the final model. A reduction in the loglikelihood statistics with the inclusion of the linear and quadratic effects of Time and the relevant interactions between Model 6 and Model 7 (10225.02 – 10209.29), \( \chi^2 = (12) 15.73 \) was not significant. Therefore this final model with the addition of time and its relevant interactions did not significantly improve the explanatory power of the modelled equations for task pursuits.

Summary

To review the findings on task pursuits; hypothesis 3.1 was supported with the fixed effect in the ordering of grades in both linear and quadratic contrasts. The fixed effect of grades showed a reduction in the rate of decline around grade 9 with a plateauing effect emerging. A significant change in the rate of decline also occurred by grade 11 and noted with the significant quadratic grade effect emerged.

Hypothesis 3.2 was supported with a fixed effect of sex reported, where males had
lower levels of task pursuits compared to females. Hypothesis 3.3 was also supported. The full equation incorporated the ordering effects of sex, grade and (grade X sex) interactions that used orthogonal contrasts to assess both the linear and quadratic effects of grades. Model 6 found significant differences in the linear effects (only) across grades between males and females. Females consistently reported higher task pursuits than males and a different pattern of development was evidenced in the grade X sex (linear) interaction (see Figure 8.10). Females showed evidence of recovery compared to males (see Table 8.4). Males’ rate of decline in task pursuits across grades (see Figure 8.8) did not show the same reported recovery evidenced by females. An initial decline is noted in Figure 8.8 for females with recovery between grades 10 and 11. Mean presentation may help qualify this point – see previous point (see Table 8.4).

Table 8.5 outlines the seven progressive models presented for task pursuits. Minimal change occurred in the value of the coefficients in the fixed effects parameter estimates (except on the Models that included the fixed effect of Time) across the progressive models. The final model (Model 7), representing the linear and quadratic effects of Time and relevant interactions, did not identify a significant improvement through deviance of the loglikelihood statistics. Model 5 was the final model showing improvements through significant loglikelihood statistics. Overall, a different pattern emerged between males and females in achievement motivation represented through task pursuits. Females had higher levels across all grades and also evidenced recovery in this facilitative component of mastery pursuits by grade 11, which is in contrast to males continued declines. The random effect of task pursuits also charted the degree of variation in the mapped standardised scores across grades. A greater degree of variation around the mean for males compared to females.
was found whereby females showed less variation particularly across the grades than males in the individually mapped responses to task pursuits.

Given that the fully modelled equation for task pursuits including time and its relevant interactions (Model 7) did not identify a significant loglikelihood statistic and that only one significant parameter estimate for the linear effect of grade was found. Preliminary analysis was undertaken to assess whether the inclusion of this model across the remaining factors was warranted. Only 8 significant parameter estimates across the possible 204 coefficients analysed (17 X 12 factors representing less than 3.9%) were identified. Among these, three were identified for the linear effect of grade in reward, affiliation and competition (excluding these effects only 2.4% emerged as significant at the .01 level). In addition, as previously stated variation was expected in the rank-ordering of the responses when 69,996 data points were assessed. Therefore, due to the possible confound of grade within models for time level analysis and because the previously undertaken cohort effect analyses which found that no significant differences when comparing each factor at grade level, and given the degree of analysis required is lengthy, to facilitate our enquiry the remaining analyses of the inclusion of time will not be undertaken for subsequent factors.
Table 8.5 Progressive multilevel models for task pursuits on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
<th>M7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.686</td>
<td>.686</td>
<td>.701</td>
<td>.642</td>
<td>.638</td>
<td>.640</td>
<td>.614</td>
</tr>
<tr>
<td><strong>Fixed effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.061(.008)</td>
<td>-.057(.008)</td>
<td>-.058(.008)</td>
<td>-.082(.011)</td>
<td>-.082(.011)</td>
<td>-.094(.040)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.020(.005)</td>
<td>.019(.005)</td>
<td>.019(.005)</td>
<td>.021(.008)</td>
<td>.021(.008)</td>
<td>.001(.031)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fixed effects Interactions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdelin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.044(.015)</td>
<td>.043(.015)</td>
<td>.049(.055)</td>
</tr>
<tr>
<td>SexXgdequad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.004(.010)</td>
<td>.023(.043)</td>
<td></td>
</tr>
<tr>
<td>Timelin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.032(.068)</td>
<td></td>
</tr>
<tr>
<td>Timequad</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>.024(.029)</td>
<td></td>
</tr>
<tr>
<td>Timelin X gdelin</td>
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<td></td>
<td></td>
<td></td>
<td>.016(.071)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timelin X gdequad</td>
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<td></td>
<td></td>
<td></td>
<td>.035(.028)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timelin X sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.010(.093)</td>
<td></td>
</tr>
<tr>
<td>Timelin X gdelin X sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.046(.098)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timelin X gdequad X sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.011(.038)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timequad X gdelin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.022(.020)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timequad X gdequad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.009(.015)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timequad X sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.008(.039)</td>
<td></td>
</tr>
<tr>
<td>Timequad X gdelin X sex</td>
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<td></td>
<td></td>
<td></td>
<td>.002(.027)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timequad X gdequad X sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.003(.021)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loglikelihood statistic</td>
<td>10371.46</td>
<td><strong>10292.31</strong></td>
<td><strong>10277.07</strong></td>
<td><strong>10233.96</strong></td>
<td><strong>10225.17</strong></td>
<td>10225.02</td>
<td>10209.29</td>
</tr>
<tr>
<td><strong>Random effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>.016(.006)</td>
<td>.015(.005)</td>
<td>.015(.005)</td>
<td>.012(.005)</td>
<td>.012(.005)</td>
<td>.012(.005)</td>
<td>.012(.004)</td>
</tr>
<tr>
<td>Student $\sigma^2_u$ (intercept var)</td>
<td>.148(.008)</td>
<td>.151(.008)</td>
<td>.151(.008)</td>
<td>.148(.008)</td>
<td>.148(.008)</td>
<td>.148(.008)</td>
<td>.148(.008)</td>
</tr>
<tr>
<td>Time</td>
<td>.252(.007)</td>
<td>.246(.007)</td>
<td>.245(.006)</td>
<td>.245(.007)</td>
<td>.244(.006)</td>
<td>.244(.006)</td>
<td>.243(.006)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**. Significance was set at the $\alpha$ level of .01 or stronger.
Effort pursuits within motivation

Introduction

The pursuit and application of effort is a positive component of facilitative learning. It is one of two pursuits recognized as a mastery goal (McInerney, Marsh, & Yeung, 2003) that of task pursuits and effort pursuits. Increased effort pursuits whereby students apply more effort equates to a more adaptive pattern of engagement during high school. An effort pursuit is the student’s perception regarding the need to persevere and overcome challenges. Hypothesis 4.1, 4.2 and 4.3 all relate to the factor of effort pursuits. Hypothesis 4.1 suggested there should be gradual declines evidenced in effort pursuits from grade 7 and then a plateauing with gradual recovery between grade 10 and grade 11 (represented in Models 2 & 3). Hypothesis 4.2, suggested that males should have lower effort pursuits compared to females (represented in Model 4). Hypothesis 4.3 suggested that differences in the pattern of development should emerge across high school in effort pursuits between males and females. Lower levels of effort pursuits will be found for males compared to females uniformly across grades 7 to 11 (see Models 5 & 6 for interaction analyses).

Mapping the patterns of possible change in effort pursuits during adolescence will be evaluated across only six progressive models because the factor of time as previously explained has been eliminated. To respond to the research hypotheses and to reduce the number of models being presented only four modeled equations will be presented in text for this factor and subsequent factors. However, all relevant parameter estimates, standard errors for the fixed and random effects for each of the six models, will be presented progressively in Table 8.6. Modeled equations will be presented in text for Model 1 (the baseline variance components
model), Model 3 for the linear and quadratic effects of grade to evaluate hypothesis 4.1, Model 4 the fixed effect of sex to evaluate hypothesis 4.2 and Model 6 for the full model including grade X sex interactions to evaluate hypothesis 4.3. To reduce the reiteration of the progressive models being presented in future factor analyses, only four models will be presented in text for each subsequent factor. However, all parameter estimates for the six models will be produced in a table at the end of the text for that factor for each subsequent factor.

The standardised mean intercept, $\beta_{ijk}$, which constitutes the fixed part of the model for effort pursuits (see Figure 8.12) had a value of .555 with a standard error of .034. This suggests that on average effort pursuits were evaluated as a positive component of the motivational structure of the SMOSA due to the way the scale was standardised across all 12-factors. The random part of the baseline model for effort pursuits indicated that for each of the three random levels, significant variation existed. The level 3 residuals demonstrated a variance of $\nu_{0k} = 0.35 \pm 0.010$, representing significance in intercept lines among the eleven schools for effort pursuits.

**Model 1: Baseline variance components model for effort pursuits**

$$ z_{effort_{ijk}} \sim N(\mu, \Omega) $$

$$ z_{effort_{ijk}} = \beta_{0ijk} + \nu_{0k} + \mu_{ijk} + e_{0ijk} $$

$$ \nu_{0k} \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.035(0.010) \end{bmatrix} $$

$$ \mu_{0k} \sim N(0, \Omega_{\mu}) : \Omega_{\mu} = \begin{bmatrix} 0.161(0.009) \end{bmatrix} $$

$$ e_{0ijk} \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.272(0.007) \end{bmatrix} $$

$$ -2\text{loglikelihood(TOLLS Deviance)} = 10790.340(5596 \text{ of 5833 cases in use}) $$

Figure 8.12 Baseline variance components model for effort pursuits.
At the intercept of level 2 residuals, $u_{0jk}$, representing the student level, a variance of .161 and standard error of .009 was found ($161/0.009 = 17.89$), significant difference among the students, $p < .001$. While, the amount of variation in effort pursuits represented in this model, explained by differences at the individual student level was large, the greatest variance within the baseline model was at the level 1 residuals, $e_{0ijk} = .272 (.007)$ that is, the time within student within school level analysis where residuals ($272/0.007$) were significant $p < .001$. The three random levels presented by $v_{0k} = 35/468 = 7\%$ for level 3 the school, $u_{0jk} = 161/468 = 34\%$ for level 2 the student and $e_{0ijk} = 272/468 = 58\%$ at level 1 Time.

Model 2 and Model 3 (Figure 8.13) added the linear and quadratic effects of grades respectively to the baseline variance components model for evaluation of the pattern of development in effort pursuits to test Hypothesis 4.1. In Model 3 with the inclusion of the linear and quadratic contrasts found significant linear grade coefficients ($\beta_1 = -0.131/0.008 = 16.38, p < .001$) and significant quadratic coefficients ($\beta_2 = -0.018/0.005 = 3.6, p < .001$). The significant linear effect suggests that a pattern of decline occurred across grades 7 to 11, however the reported quadratic effect showed that across grades with a lessening in the rate of that decline occurred as predicted in hypothesis 4.1 (see Figure 8.14). Across grades 7 to 11, effort pursuits were positively reported above the standardised mean of zero for the SMOSA.
Model 3: The inclusion of the linear & quadratic effect of effort pursuits

\[
\mathbf{z_{neffort}_{jk}} \sim N(\mathbf{x}_{0}B, \mathbf{\Omega}) \\
\mathbf{z_{neffort}_{jk}} = \mathbf{\beta}_{0jk} + -0.131(0.008)g_{\text{delin}_{jk}} + 0.018(0.005)g_{\text{dequad}_{jk}}
\]

\[\mathbf{\beta}_{0jk} = 0.567(0.031) + \mathbf{\nu}_{0jk} + \mathbf{\mu}_{0jk} + \mathbf{\epsilon}_{0jk}\]

\[\mathbf{\nu}_{0jk} \sim N(0, \mathbf{\Omega}_{\nu}) : \mathbf{\Omega}_{\nu} = \begin{bmatrix} 0.027(0.008) \end{bmatrix}\]

\[\mathbf{\mu}_{0jk} \sim N(0, \mathbf{\Omega}_{\mu}) : \mathbf{\Omega}_{\mu} = \begin{bmatrix} 0.178(0.009) \end{bmatrix}\]

\[\mathbf{\epsilon}_{0jk} \sim N(0, \mathbf{\Omega}_{\epsilon}) : \mathbf{\Omega}_{\epsilon} = \begin{bmatrix} 0.244(0.007) \end{bmatrix}\]

\[-2^\text{loglikelihood}(IOLs Deviance) = 10482.370(5588 of 5833 cases in use)\]

Figure 8.13 The analysis of the quadratic effect of grade added to the equation.

Figure 8.14 Effort pursuits graph across grades 7 to 11 showing the linear effects.

The inclusion of the linear and quadratic effects of grade found a significant reduction occurred, progressively in the loglikelihood statistics (10790.34 – 10482.37) with a deviance of 307.97. Given that two parameters were added to the equation, for the linear and quadratic fixed effects, \(\chi^2 = (4) 307.97, p < .001\), the reduction was highly significant indicating improvement was achieved with the addition of grades to the regression equation. As can be seen in Table 8.7 there was progressive improvement across both models. Therefore, both the linear and quadratic effects of grade added real significance to the explanatory power of the models.
Model 4: Inclusion of the effects of sex in effort pursuits

\[ z_{\text{effort}_{y_k}} \sim N(X\beta, \Omega) \]

\[ z_{\text{effort}_{y_k}} = \beta_{3} \text{cons} + -0.132(0.008)gdelev_{y_k} + 0.018(0.003)gdequad_{y_k} + 0.097(0.024)\text{sex}_{y_k} \]

\[ \beta_{0y_k} = 0.529(0.033) + \nu_{0y_k} + \mu_{0y_k} + e_{0y_k} \]

\[ \begin{bmatrix} \nu_{0y_k} \\ \mu_{0y_k} \end{bmatrix} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.027(0.009) \end{bmatrix} \]

\[ \begin{bmatrix} \mu_{0y_k} \end{bmatrix} \sim N(0, \Omega_{\mu}) : \Omega_{\mu} = \begin{bmatrix} 0.175(0.009) \end{bmatrix} \]

\[ \begin{bmatrix} e_{0y_k} \end{bmatrix} \sim N(0, \Omega_{e}) : \Omega_{e} = \begin{bmatrix} 0.244(0.007) \end{bmatrix} \]

\[ -2\text{loglikelihood(TGLS Distance)} = 10450.300(5586 of 5833 cases in use) \]

Figure 8.15 Significant differences are shown in the addition of sex with males having lower levels of effort pursuits compared to females.

Model 4 (Figure 8.15) included the additional parameter estimates for sex, the parameter estimate for \( \beta_{3} \), the coefficient of sex (.097/0.024 = 4.04), \( p < .001 \) was significant. Due to sex having a reference categorisation (dummy coding males = 0 and females = 1), the positive coefficient suggests that females were .097 of a standard deviation unit higher on average, than males in effort pursuits. Thus, supporting hypothesis 4.2 that suggests females have higher levels than males.

Model 4 showed significant variation occurred with the addition of sex to the equation (see Figure 8.15) in the random effects, with estimated intercepts of .528 (SE = .033) at the time within student within school level analysis. The addition of sex to the progressive models significantly reduced the loglikelihood statistic (10482.37 – 10450.30) between Models 3 to 4, \( \chi^2 = (1) 32.07, p < .001 \), and therefore significant improvement was found in the explanatory power of the modelled equations for effort pursuits in the revised model.
Table 8.6 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for effort pursuits.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.94(365)</td>
<td>.73(681)</td>
<td>.58(957)</td>
<td>.48(645)</td>
<td>.42(267)</td>
<td>.63(2915)</td>
</tr>
<tr>
<td>Male</td>
<td>.81(331)</td>
<td>.65(637)</td>
<td>.50(926)</td>
<td>.38(590)</td>
<td>.27(187)</td>
<td>.53(2671)</td>
</tr>
<tr>
<td>Total</td>
<td>.88(696)</td>
<td>.69(1318)</td>
<td>.54(1883)</td>
<td>.43(1235)</td>
<td>.36(454)</td>
<td>.58(5586)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.

Model 6 (Figure 8.16) added the interactions of sex X linear and sex X quadratic effects of grade respectively as contrast variables but found no significant sex X linear effect of grade interaction coefficients, $\beta_4$, (.007/.015) and no sex X quadratic effect of grade interaction coefficients, $\beta_5$, (0.015/0.010) were found. As previously mentioned, the parameter estimates for Model 5 are presented in Table 8.7. Also in this model the previously identified significant fixed quadratic effect of grades was no longer significant with the addition of the grade X sex (quadratic) interaction to the equation. Males had lower levels of effort pursuits compared to females at each grade level but the patterns for males and females followed a similar trajectory. Support for hypothesis 4.3 was not found because the disparate motivational patterns suggested for males and females during high school appear to be occurring by degree rather than through disparate patterns emerging. Females had higher effort pursuits than males across all grades (see means in Table 8.6). These cumulative analyses and the graphical presentation shown in Figure 8.18, suggest that the reported difference between males and females was systematically evidenced across grades, that is males were lower across all grades but the patterns of development were similar. Including the interactions of grade (linear) X sex and grade (quadratic) X sex to the model and comparing the change in the loglikelihood statistic between Models 4 and 6 (10450.30 – 10448.12) did not provide significant improvement in the explanatory power of the revised equation $\chi^2 = (2) 2.18$. 
Greater variability was identified in the pattern of responses particularly at grade 7 for males compared to females in the random effects model (see Figure 8.17). A fanning out in their responses (wider spread for males increasing across grades) was found. Also noted is that the top performing students regardless of sex had similar levels of effort pursuits. However, it was the systematic decline that was of concern in this analysis. The responses for both males and females across grades are captured in Figure 8.18. This shows systematic declines for males across all grades but after an initial decline, females had slight recovery between grades 10 and 11, although this was not significant.

**Model 6: Inclusion of grade X sex interactions for effort pursuits**

$$z_{\text{effort}_{jk}} \sim N(\mu, \Omega)$$

$$z_{\text{effort}_{jk}} = \beta_{0jk}\text{cons} + 0.136(0.011)g_{\text{edlin}_{jk}} + 0.010(0.009)g_{\text{eduquad}_{jk}} + 0.109(0.025)\text{sex}_{jk} + 0.007(0.015)g_{\text{edlin} \cdot \text{sex}_{jk}} + 0.015(0.010)g_{\text{eduquad} \cdot \text{sex}_{jk}}$$

$$\beta_{0jk} = 0.521(0.033) + \psi_{0k} + u_{0jk} + \epsilon_{0jk}$$

$$\begin{bmatrix} \psi_{0k} \\ \mu_{0jk} \\ \sigma_{0jk} \end{bmatrix} \sim N(0, \Omega_{y}) : \Omega_{y} = \begin{bmatrix} 0.027(0.009) \\ 0.175(0.009) \\ 0.244(0.007) \end{bmatrix}$$

$$-2\times\log(\text{likelihood/ICLS Deviance}) = 10448.120(5586 \text{ of } 5833 \text{ cases in use})$$

*Figure 8.16 The full equation with sex, grade (linear & quadratic) and their interactions.*
Figure 8.17 Variation graphed for females and males in effort pursuits across grades for each time collection of data for each student to highlight the variation that exists.

Figure 8.18 The graphical capabilities of MLwiN highlights the pattern of decline for males and females. Females are the higher line.
Summary

Support was found for hypothesis 4.1, with progressive declines and a significant quadratic effect being evidenced across grades. Support was also found for hypothesis 4.2, where sex differences emerged; females had higher levels of effort pursuits than males. Support was not found for hypothesis 4.3. Significant linear effects occurred with declines across grades for both females and males. Although the pattern of change was similar across grades for females and males, females consistently reported higher levels than males in effort pursuits across grades 7 to 11 (see Table 8.6). While the subsequent interactions of sex X linear effect of grade were not significant, Figure 8.18 shows that females had a slight trend toward recovery between grade 10 and grade 11, whereas males continued to decline.

Significantly greater variability at the student within school level analysis for the random effects was also identified between males and females. There was a greater spread in responses for males compared to females across grades but more particularly around early adolescence (see Figure 8.17). Comparing Figure 8.18 and Figure 8.17 highlights the strengths of utilising MLwiN because it displays, not only mean evaluations at grade levels for males and females but also allows for a mapping individually of the time within student within school level data. This allows for a visual representation of the amount of variation in each individual response. This allows for the within and between variance to be identified and for visual comparison in responses between males and females (Figure 8.17). Table 8.7 presents the parameter estimates for the six progressive equations modelled for effort pursuits. Minimal variation occurred across the random effect parameter estimates in the six modelled equations, after progressively adding each contrast.
variable with minimal variation occurring for the addition of the linear effect of grade.

Model 4 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 4 for effort pursuits. Improvement in the explanatory power was not found with the addition of the fixed interactions in models 5 or 6.

Table 8.7 Progressive multilevel models for effort pursuits on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.555</td>
<td>.553</td>
<td>.567</td>
<td>.535</td>
<td>.528</td>
<td>.521</td>
</tr>
</tbody>
</table>

Fixed effects

Gdelin         | -.134(.008) | -.131(.008) | -.132(.008) | -.134(.011) | -.136(.011) |
Gdequad        | .018(.005)  | .018(.005)  | .018(.005)  | .010(.008)  |
Sex            | .097(.024)  | .098(.024)  | .109 (.025) |

Fixed effects Interactions

SexXgdelin     | .004(.015)  | .007(.015)  |
SexXgdequad    | .015(.010)  |

Loglikelihood statistic

<table>
<thead>
<tr>
<th></th>
<th>10790.34</th>
<th>10494.60</th>
<th>10482.37</th>
<th>10450.30</th>
<th>10450.22</th>
<th>10448.12</th>
</tr>
</thead>
</table>

Random effects

School          | .035(.010) | .027(.008) | .027(.008) | .027(.009) | .028(.009) | .027(.009) |
Student         | .161(.009) | .178(.009) | .178(.009) | .175(.009) | .175(.009) | .175(.009) |
Time            | .272(.007) | .245(.007) | .244(.007) | .244(.007) | .244(.007) | .244(.007) |

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.
**Achievement motivation**

**Competition pursuits within motivation**

**Introduction**

A competition pursuit is one of the two pursuits that represent a performance goal, the other being leader pursuits. A competition pursuit is the perceived importance for students to see that beating others or coming first in their schoolwork is important for their learning. Performance goals have been generally regarded as less facilitative in the course of learning than for example, a mastery goal. Hypothesis 5.1, 5.2 and 5.3 all relate to the factor of competition pursuits. Hypothesis 5.1 suggested there should be gradual declines in competition pursuits occurring during adolescence until grade 11. Hypothesis 5.2, suggested that males should report higher levels of competition pursuits than females. Hypothesis 5.3, suggested that differences by degree and direction should emerge in competition pursuits across grades between males and females. Males will have higher levels of competition pursuits across grades 7 to 11 than females (interaction effect).

Four abbreviated models will be evaluated to show the pattern of competition pursuits for adolescents to assess the stepwise inclusion of additional levels on subsequent equations. To view the parameter estimates, standard deviations and random variance estimates from the full six models for competition pursuits see Table 8.9. Model 1, the baseline variance components model (see Figure 8.19), reported the standardised mean intercept, $\beta_{0ijk}$, for competition pursuits as -.358 (.051). This suggests that competition pursuits were below the mean at the intercept on the standardised test scores of the 12 factors of the SMOSA. In effect the value of the intercept for competition pursuits indicates that this form of motivation was not viewed as a positive component of motivation within this student population. The
three random levels presented by $v_{0k} = 82/1037 = 8\%$ for level 3 the school, $u_{0jk} = 431/1037 = 41\%$ for level 2 the student and $e_{0ijk} = 524/1037 = 51\%$ at level 1 Time.

**Model 1: Baseline variance components model for competition pursuits**

$$z_{ncomp_{0k}} \sim \text{N}(X\beta, \Omega)$$

$$z_{ncomp_{0k}} = \beta_{0jk} + \epsilon_{0jk}$$

$$\begin{bmatrix} v_{0k} \\ u_{0jk} \\ e_{0ijk} \end{bmatrix} \sim \text{N}(0, \Sigma) : \begin{bmatrix} \Omega_v \\ \Omega_u \\ \Omega_e \end{bmatrix} = \begin{bmatrix} 0.082(0.024) \\ 0.431(0.020) \\ 0.524(0.014) \end{bmatrix}$$

$-2^{*}\text{log likelihood(IGLS Deviance)} = 15170.070(5669 \text{ of } 5833 \text{ cases in use})$

*Figure 8.19 The baseline variance components model for competition pursuits.*

The random part of the baseline model for competition pursuits indicated that for each of the three random levels, significant variation existed. The level 3 residuals, that of school level, demonstrated a variance of $v_{0k} = .082 (.024), 3.42, p < .001$ representing significant differences in intercept lines among the eleven schools.

At the intercept of level 2 residuals, $u_{0jk}$, the student within school level variance of $.431 (SE = .020), 21.55, p < .001$. The baseline model was at the level 1 residuals, $e_{0ijk}$, $=.524 (.014)$ that is, the time within student within school level analysis was also $(.524/.014 = 37.43)$ significant, $p < .001$.

**Model 3: Inclusion of linear and quadratic effects for grade in competition pursuits**

$$z_{ncomp_{0k}} \sim \text{N}(X\beta, \Omega)$$

$$z_{ncomp_{0k}} = \beta_{0jk} + \text{cons} - 0.103(0.011) gde\text{lin}_{0jk} + 0.019(0.007) gde\text{quad}_{0jk}$$

$$\beta_{0jk} = -0.342(0.052) + v_{0k} + u_{0jk} + e_{0jk}$$

$$\begin{bmatrix} v_{0k} \\ u_{0jk} \\ e_{0ijk} \end{bmatrix} \sim \text{N}(0, \Sigma) : \begin{bmatrix} \Omega_v \\ \Omega_u \\ \Omega_e \end{bmatrix} = \begin{bmatrix} 0.083(0.024) \\ 0.437(0.020) \\ 0.508(0.014) \end{bmatrix}$$

$-2^{*}\text{log likelihood(IGLS Deviance)} = 15058.580(5661 \text{ of } 5833 \text{ cases in use})$

*Figure 8.20 shows the analysis with linear and quadratic effects of grade added.*
To test Hypothesis 5.1, Model 3 (Figure 8.20) added the linear and quadratic effects of grades to the baseline variance components model to evaluate the pattern of development in competition pursuits across grades. The inclusion of the linear and quadratic contrasts reported significant linear $\beta_1$, coefficient of grades (-.103/.011 = -9.37, $p < .001$) and significant quadratic coefficients $\beta_2$, (0.019/.007 = 2.71, $p < .01$). The significant linear effect suggests that a pattern of decline across grades 7 to 11 occurred in competition pursuits. However, the reported quadratic effect found that across grades shows that a slowing in the rate of decline also occurred. Support for hypothesis 5.1 was found, however the quadratic effect found was not predicted (see Figure 8.21).

Comparing the baseline variance components model with the addition of the linear and quadratic effects of grade, found a significant reduction occurred in the loglikelihood statistics (15170.70 – 15058.58) being a deviance of 112.12. This suggests that the addition of grades provided significantly greater explanatory power to the regression equation. As can be seen in Table 8.9 progressive improvement occurred in assessment of the deviance in loglikelihood statistics with the addition of the linear and quadratic effect of grades. The systematic declines in competition pursuits are graphically represented in Figure 8.21.

*Figure 8.21* Graph shows the pattern of change across grades 7-11 for competition.
Model 4 (Figure 8.22) included sex as a contrast variable reporting significant sex coefficients, $\beta_3 (-.325/0.036 = -9.03, p < .001)$. These results show that males on average reported .325 standard deviation units higher for competition pursuits than females; supporting hypothesis 5.2. This provides further support to previous findings that females are less performance-based in their motivational pursuits than males. The addition of sex to the model reported a significant deviance in the loglikelihood statistic ($15058.58 – 14973.06$) between Model 4 and Model 3, $\chi^2 = (1) 85.52, p < .001$, the addition of sex significantly improved the explanatory power in model 4.

**Model 4: Inclusion of the effects of sex in competition pursuits**

\[
\begin{align*}
\text{zncomp}_{jk} &\sim \mathcal{N}(\bar{\beta}, \Omega) \\
\beta_{0jk} &= \beta_{0jk \text{cons}} + -0.100(0.011)gdeleyn_{jk} + 0.021(0.007)gdequad_{jk} + -0.325(0.036)\text{sex}_{jk} \\
\beta_{1jk} &= -0.214(0.051) + \nu_{1jk} + \kappa_{1jk} + \delta_{1jk} \\
\nu_{1jk} &\sim \mathcal{N}(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.070(0.021) \end{bmatrix} \\
\kappa_{1jk} &\sim \mathcal{N}(0, \Omega_{\kappa}) : \Omega_{\kappa} = \begin{bmatrix} 0.417(0.020) \end{bmatrix} \\
\delta_{1jk} &\sim \mathcal{N}(0, \Omega_{\delta}) : \Omega_{\delta} = \begin{bmatrix} 0.509(0.014) \end{bmatrix}
\end{align*}
\]

$-2 \cdot \text{loglikelihood}(JLCS Deviance) = 14973.060(5659 \text{ of } 5833 \text{ cases in use})$

**Figure 8.22** Significant differences are shown in the addition of sex with males having higher levels of competition pursuits compared to females.

**Model 6: Inclusion of grade X sex interactions for competition pursuits**

\[
\begin{align*}
\text{zncomp}_{jk} &\sim \mathcal{N}(\bar{\beta}, \Omega) \\
\beta_{0jk} &= \beta_{0jk \text{cons}} + -0.095(0.017)gdeleyn_{jk} + 0.012(0.011)gdequad_{jk} + -0.313(0.038)\text{sex}_{jk} + -0.011(0.022)gdeleyn_{jk} + \\
&\quad + 0.018(0.015)gdequad_{jk} + \text{sex}_{k} \\
\beta_{1jk} &= -0.221(0.051) + \nu_{1jk} + \kappa_{1jk} + \delta_{1jk} \\
\nu_{1jk} &\sim \mathcal{N}(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.070(0.021) \end{bmatrix} \\
\kappa_{1jk} &\sim \mathcal{N}(0, \Omega_{\kappa}) : \Omega_{\kappa} = \begin{bmatrix} 0.418(0.020) \end{bmatrix} \\
\delta_{1jk} &\sim \mathcal{N}(0, \Omega_{\delta}) : \Omega_{\delta} = \begin{bmatrix} 0.508(0.014) \end{bmatrix}
\end{align*}
\]

$-2 \cdot \text{loglikelihood}(JLCS Deviance) = 14971.220(5659 \text{ of } 5833 \text{ cases in use})$

**Figure 8.23** The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions
Figure 8.24 The graphical capabilities of MLwiN highlights the pattern of decline for males and females. Females are the lower line that shows little difference emerging by degree between males and females across grades 7 to 11.

Table 8.8 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for competition pursuits.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>-.01(339)</td>
<td>-.14(644)</td>
<td>-.24(943)</td>
<td>-.33(595)</td>
<td>-.39(187)</td>
<td>-.22(2708)</td>
</tr>
<tr>
<td>Male</td>
<td>-.27(368)</td>
<td>-.46(689)</td>
<td>-.59(965)</td>
<td>-.67(659)</td>
<td>-.69(270)</td>
<td>-.55(2951)</td>
</tr>
<tr>
<td>Total</td>
<td>-.14(707)</td>
<td>-.30(1333)</td>
<td>-.42(1908)</td>
<td>-.51(1254)</td>
<td>-.56(451)</td>
<td>-.39(5659)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.

The equation presented in Model 6 (Figure 8.23) added the interaction of sex with both the linear and quadratic effects of grade respectively. No significant sex X linear grade interaction coefficients, \( \beta_4, (0.011/0.022) \) or sex X quadratic grade interaction coefficients, \( \beta_5, (0.018/0.015) \) were found. Model 6 found that males had higher levels of competition pursuits compared to females across all grades and the linear effect of grade reported significant declines across the sequential ordering of grades. However, the sex X linear effect of grade interaction did not report disparate patterns emerging in competition pursuits between males and females across grade levels.

Including the interactions of the linear effect of grade X sex and quadratic effect of grade X sex to the model did not significantly reduce the loglikelihood statistic (14973.06 – 14971.22) with a deviation by 1.84 between Model 6 and Model 4.
Given that two parameters were added to the regression equation, the loglikelihood statistic showed no significant improvement in the explanatory power between model 6 and model 4.

The cumulative analyses and graphical presentation in Figure 8.24 shows that while females generally declined in competition pursuits across grades, males had less variation in the gradient at the student within student level analysis and evidenced recovery in competition pursuits compared to females (see mean evaluation in Table 8.8 and variation in the individual patterns of development in Figure 8.25). While males were consistently higher in competition pursuits across grades, similar patterns of development was found between males and females. Therefore, hypothesis 5.3 was not supported. Figure 8.25 shows the comparison between males and females in competition pursuits mapping each individual student’s 3 waves of data. Less variability occurred for males across all grades than females in the random slopes model. Competition pursuits were highest around grade 7 and a similar pattern of variability across grades emerged for females and males of declines (see Figure 8.24).
Support was found for hypotheses 5.1 and 5.2 but not for hypothesis 5.3. Clear declines were evidenced across grades (see Figure 8.21) supporting hypothesis 5.1. In response to hypothesis 5.2, females generally had lower levels of competition pursuits than males. Hypothesis 5.3 was not supported because a similar pattern of decline in competition pursuits emerged in the interaction between males and females across grades. Although females’ were lower than males in their responses the emergence of disparate patterns of development in competition pursuits hypothesised was not found (see Figure 8.24). Males had higher competition pursuits uniformly across grades and males and females moved in a similar trajectory across grades. Table 8.9 presents the

**Figure 8.25 Variation graphed for females and males in competition pursuits across grades for each time collection for each student.**

**Summary**

Support was found for hypotheses 5.1 and 5.2 but not for hypothesis 5.3. Clear declines were evidenced across grades (see Figure 8.21) supporting hypothesis 5.1. In response to hypothesis 5.2, females generally had lower levels of competition pursuits than males. Hypothesis 5.3 was not supported because a similar pattern of decline in competition pursuits emerged in the interaction between males and females across grades. Although females’ were lower than males in their responses the emergence of disparate patterns of development in competition pursuits hypothesised was not found (see Figure 8.24). Males had higher competition pursuits uniformly across grades and males and females moved in a similar trajectory across grades. Table 8.9 presents the
parameter estimates for the six progressive equations for competition pursuits.

Minimal variation occurred across the random effects after progressively adding each contrast variable to the subsequent equations. Model 4 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up to and including model 4 for competition pursuits. Improvement in the explanatory power was not found with the addition of the fixed interactions for models 5 or 6 (see Table 8.9).

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.358</td>
<td>-.357</td>
<td>-.342</td>
<td>-.214</td>
<td>-.214</td>
<td>-.221</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.106(.011)</td>
<td>-.103(.011)</td>
<td>-.100(.011)</td>
<td>-.092(.017)</td>
<td>-.095(.017)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.019(.007)</td>
<td>.021(.007)</td>
<td>.021(.007)</td>
<td>.012(.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-.325(.036)</td>
<td>-.326(.036)</td>
<td>-.313(.038)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdelin</td>
<td>-.015(.022)</td>
<td>-.011(.022)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdequad</td>
<td>.018(.015)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Loglikelihood statistic: 15170.70 15065.10 15058.58 14973.06 14972.61 14971.22

Random effects:
| School         | .082(.024) | .083(.024) | .083(.024) | .070(.021) | .070(.021) | .070(.021) |
| Student        | .431(.020) | .437(.020) | .437(.020) | .417(.020) | .418(.020) | .418(.020) |
| Time           | .524(.014) | .509(.014) | .508(.014) | .509(.014) | .509(.014) | .508(.014) |

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.
Leader pursuits within motivation

Introduction

A leader pursuit is one of the two pursuits, that of competition and leader, which represent a performance goal. Performance goals have been generally regarded in the literature as less facilitative in the course of learning than mastery goals according to Goal Achievement Theory. A leader pursuit is the perceived importance for students to see group leadership as an important component of their learning.

Hypothesis 6.1, 6.2 and 6.3 all relate to the factor of leader pursuits. Hypothesis 6.1 suggested there should be gradual declines in leader pursuits during adolescence across grades. Hypothesis 6.2, suggested males should report higher levels of leader pursuits compared to females. Hypothesis 6.3 suggested that differences by degree and direction across high school should emerge in leader pursuits between males and females. Males will have higher levels of leader pursuits across grades.

As set out in the previously modelled equation for competition pursuits, the same four models will investigate the pattern of development in leader pursuits for adolescents to answer the abovementioned hypotheses. To view the parameter estimates, standard deviations and random variance estimates for the complete six models of leader pursuits see Table 8.11. Model 1 the baseline variance components model reported a mean intercept, $\beta_0$, for leader pursuits (Figure 8.26) of $-991 (.032)$. The three random levels presented by $\nu_{0k} = 19/996= 2\%$ for level 3 the school, $\nu_{0jk} = 418/996= 42\%$ for level 2 the student and $\nu_{0ijk} = 559/996= 56\%$ at level 1 Time.
Model 1: Baseline variance components model for leader pursuits

\[ \text{znleader}_{ijk} \sim N(\mu, \sigma) \]

\[ \beta_{0ijk} = -0.991(0.323) + \psi_{0k} + \nu_{ijk} + \epsilon_{0jk} \]

\[ \psi_{0k} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.019(0.009) \end{bmatrix} \]

\[ \nu_{ijk} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.418(0.021) \end{bmatrix} \]

\[ \epsilon_{0jk} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.559(0.015) \end{bmatrix} \]

-2*\text{loglikelihood}(ICLS Deviance) = 15337.120 (5666 of 5833 cases in use)

Figure 8.26 The baseline variance components model for leader pursuits.

Model 3: Inclusion of linear and quadratic effects for grade in leader pursuits

\[ \text{znleader}_{ijk} \sim N(\mu, \sigma) \]

\[ \beta_{0ijk} = \beta_{0ijk} \text{cons} + -0.118(0.012)g \text{delin}_{ijk} + 0.037(0.008)g \text{dequad}_{ijk} \]

\[ \beta_{0jk} = -0.952(0.037) + \psi_{0k} + \nu_{ijk} + \epsilon_{0jk} \]

\[ \psi_{0k} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.030(0.011) \end{bmatrix} \]

\[ \nu_{ijk} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.421(0.020) \end{bmatrix} \]

\[ \epsilon_{0jk} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.538(0.014) \end{bmatrix} \]

-2*\text{loglikelihood}(ICLS Deviance) = 15180.210 (5658 of 5833 cases in use)

Figure 8.27 shows the analysis with linear and quadratic effects of grade added.

Model 3 (Figure 8.27) added the linear and quadratic effects of grades to the baseline variance components model to evaluate the pattern of development in leader pursuits to test Hypothesis 6.1. The inclusion of the linear and quadratic contrasts reported significant linear grade coefficients (\(\beta_1 = -0.118/0.012 = 9.83, p < .001\)) and significant quadratic coefficients (\(\beta_2 = 0.037/0.008 = 4.63, p < .001\)). The significant linear effect suggests that a pattern of decline occurred across grades 7 to 11. The reported quadratic effect showed that across grades a lessening in the rate of decline occurred, as predicted in hypothesis 6.1 (see Figure 8.28 for graphical presentation of the pattern of change across grade). Including the variables of the linear and quadratic effects of grade to the model reduced the loglikelihood statistic (15337.12 – 15180.21) in Model 3 from the baseline model (Model 1). \(\chi^2 = (2) = 156.91, p < .001\). The
addition of the linear and quadratic effects of grade significantly improved the explanatory power of the model. As predicted in hypothesis 6.1., a change in the rate of decline occurred. Figure 8.28 shows the declines gradually lessened at grade 10 and plateaued by grade 11.

![Graphical representation of the pattern of change in leader pursuits across grades 7-11.](image)

**Figure 8.28** The graphical representation of the pattern of change in leader pursuits across grades 7-11.

**Model 4: Inclusion of the effects of sex in leader pursuits**

\[
\begin{align*}
\text{znleader}_{gk} &\sim N(\gamma, \Omega) \\
\beta_{g0} & = \beta_{0g0} \text{cons} + -0.115(0.011) g\text{delin}_{g0} + 0.038(0.008) g\text{dequad}_{g0} + -0.218(0.035) \text{sex}_{g0}
\end{align*}
\]

\[
\begin{align*}
\beta_{0g0} & = -0.866(0.036) + v_{0g0} + \mu_{0g0} + e_{0g0}
\end{align*}
\]

\[
\begin{align*}
[v_{0g0}] &\sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.021(0.009) \end{bmatrix} \\
[\mu_{0g0}] &\sim N(0, \Omega_{\mu}) : \Omega_{\mu} = \begin{bmatrix} 0.414(0.020) \end{bmatrix} \\
[\rho_{g0}] &\sim N(0, \Omega_\rho) : \Omega_\rho = \begin{bmatrix} 0.538(0.014) \end{bmatrix}
\end{align*}
\]

\[-2\text{loglikelihood(IGLS Deviance)} = 15139.810(5656 \text{ of } 5833 \text{ cases in use})\]

**Figure 8.29** Significant differences are shown in the addition of sex with males having higher levels of leader pursuits compared to females.

The equation represented in Model 4 (Figure 8.29) included sex in the equation reporting significant \( \beta_3 \), sex coefficients (-.218/0.035 = -6.26, \( p < .001 \)). These results found males on average reported .218 standard deviation units higher for leader pursuits than females supporting hypothesis 6.2. These findings add further support to the literature suggesting females have lower levels of performance-based motivational pursuits than males. The addition of sex to the model reduced the loglikelihood.
statistic (15180.21 – 15139.81) between Model 3 to Model 4. $\chi^2 = (1) 40.40, p < .001$ and significantly improved the explanatory power in the revised model. Figure 8.30 shows the comparison between males and females in leader pursuits mapping each individual student’s three waves of data. A similar pattern of variability occurred for males and females across all grades in the random slopes model although females were lower than males. While there is considerable variation among all students within this sample, males had a greater degree of variation across grades than females.

![Graph showing standardised Leader values for males across grades](image1)

**Figure 8.30 Variation graphed for females and males in leader pursuits across grades for each time collection of data for each student to highlight the variation that exists.**

![Graph showing standardised Leader values for females across grades](image2)

**Table 8.10 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for leader pursuits.**

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>-.71(366)</td>
<td>-1.0(693)</td>
<td>-1.18(969)</td>
<td>-1.26(660)</td>
<td>-1.23(272)</td>
<td>-1.10(2960)</td>
</tr>
<tr>
<td>Male</td>
<td>-.63(336)</td>
<td>-.80(646)</td>
<td>-.92(936)</td>
<td>-1.00(590)</td>
<td>-1.0(188)</td>
<td>-.88 (2696)</td>
</tr>
<tr>
<td>Total</td>
<td>-.67(702)</td>
<td>-.67(1339)</td>
<td>-.90(1905)</td>
<td>-1.05(1250)</td>
<td>-1.14(460)</td>
<td>-1.0(5656)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.
Achievement motivation

Model 6: Inclusion of grade X sex interactions for leader pursuits

\[
\text{znleader}_{yk} \sim N(\mu, \Omega)
\]

\[
\text{znleader}_{yk} = \beta_{yk, \text{cons}} + 0.101(0.017)\text{gdelelin}_{yk} + 0.021(0.011)\text{gdequad}_{yk} + 0.198(0.037)\text{sex}_{yk} + 0.028(0.022)\text{gdelelin}_{yk} + 0.032(0.015)\text{gdequad}_{yk} \nonumber \\
\beta_{yk} = -0.876(0.037) + u_{yk} + e_{yk}
\]

\[
\begin{bmatrix}
\nu_{yk} \\
\sigma_{yk} \\
e_{yk}
\end{bmatrix} \sim N(0, \Omega) : \Omega = \begin{bmatrix}
0.020(0.008) \\
0.415(0.020) \\
0.537(0.014)
\end{bmatrix}
\]

\[-2 \log(\text{likelihood}) = 15133.020\text{ (5656 of 5833 cases in use)}
\]

Figure 8.31 The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.

The equation presented in Model 6 (Figure 8.31) systematically added the interaction of sex and the linear and quadratic effects of grade respectively as variables and reported no significant sex X linear effect of grade interaction coefficients, \(\beta_{k} (\text{-} .028/\text{.022})\) and no significant sex X quadratic effect of grade interaction coefficients, \(\beta_{5} (\text{.032}/\text{.015})\) at the .01 level. These non-significant findings on the interaction effects and a review of the graph suggest that across grades a similar pattern of change occurred at the same grades for males and females. While males had higher levels of leader pursuits compared to females at each grade level, the degree and direction of change did not show significant variation between males and females across the grades. These cumulative analyses and Figure 8.32 show that males and females both had declines in leader pursuits across grades but significant interaction effects did not emerge in the analysis, not supporting hypothesis 6.3. Males and females varied in leader pursuits by degree but generally a similar pattern emerged of systematic declines. Including the interactions of the linear effect of grade X sex and quadratic effect of grade X sex interactions to the model reduced the loglikelihood statistic (15139.81 – 15133.02) between Model 6 and Model 4, \(\chi^{2} = (2) 6.79\).
Figure 8.32 The graphical capabilities in MLwiN show the disparate pattern of across grades. Females are the lower line in leader pursuits compared to males.

Summary

Support was found for hypothesis 6.1 with gradual declines across grades. Support was also found for hypothesis 6.2. Males reported significantly higher levels of leader pursuits than females. However, hypothesis 6.3 was not supported. While differences emerged in the patterns of change between males and females, these patterns were not significantly different at grade level although there was a trend towards significance in the grade (quadratic) X sex effect with a coefficient of .032/.015 (see Table 8.10 for mean evaluations and Figure 8.30). The full equation using orthogonal contrasts incorporating the ordering effects of sex, grade and (grade X sex) their interactions to assess both the linear and/or quadratic effects was presented in Model 6. Significant linear declines across grades were found. Significant differences in sex with females consistently reporting lower levels in leader pursuits than males (see Figure 8.32 & Table 8.10). Table 8.11 presents the parameter estimates for the six progressive equations for leader pursuits. Model 4 presented the most statistically significant model gauged through
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the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 4 for leader pursuits. Improvement in the explanatory power was not found with the addition of the fixed interactions in models 5 or 6.

Table 8.11 Progressive multilevel models for leader pursuits on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.991</td>
<td>-.981</td>
<td>-.952</td>
<td>-.866</td>
<td>-.863</td>
<td>-.878</td>
</tr>
</tbody>
</table>

**Fixed effects**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gdelin</td>
<td>-.125 (.011)</td>
<td>-.118 (.012)</td>
<td>-.115 (.011)</td>
<td>-.096 (.017)</td>
<td>-.101 (.017)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.037 (.008)</td>
<td>.038 (.008)</td>
<td>.039 (.008)</td>
<td>.021 (.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-.218 (.035)</td>
<td>-.221 (.035)</td>
<td>-.198 (.037)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fixed effects Interactions**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SexXgdelin</td>
<td>-.035 (.022)</td>
<td>-.028 (.022)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdequad</td>
<td>.032 (.015)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Loglikelihood statistic 15337.12  **15203.82**  15180.21  **15139.81**  15137.40  15133.02

**Random effects**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>.019 (.008)</td>
<td>.029 (.011)</td>
<td>.030 (.011)</td>
<td>.021 (.009)</td>
<td>.020 (.008)</td>
<td>.020 (.008)</td>
</tr>
<tr>
<td>Student</td>
<td>.418 (.021)</td>
<td>.419 (.020)</td>
<td>.421 (.020)</td>
<td>.414 (.020)</td>
<td>.415 (.020)</td>
<td>.415 (.020)</td>
</tr>
<tr>
<td>Time</td>
<td>.559 (.015)</td>
<td>.542 (.014)</td>
<td>.538 (.016)</td>
<td>.538 (.014)</td>
<td>.537 (.014)</td>
<td>.537 (.014)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.
**Affiliation pursuits within motivation**

*Introduction*

An affiliation pursuit is one of the two pursuits that represent social goals, the other being social concern. An affiliation pursuit is the perceived importance for students to see socialising or being in groups at school with friends as an important component in their learning. Social goals have been regarded in the literature as less facilitative in the course of learning than a mastery goal because of student’s movement away from independent learning. Affiliation pursuits should decline as student’s progress across grades because autonomy and independence have been linked to self-regulation and relative to facilitative learning where the need for external influences should show gradual decline across grades. As discussed in the literature, adolescence is a time when social emphasis and peer relationships are most pronounced and therefore clarification of this factor is a necessary inclusion when attempting to understand the patterns that emerge across adolescence in motivational pursuits. The literature suggests that the developmental pattern of affiliation pursuits should evidence declines for both males and females if students are working towards facilitative learning. Females should show a steeper rate in their pattern of development than males across grades.

Hypothesis 7.1, 7.2 and 7.3 all relate to the factor of affiliation pursuits. Hypothesis 7.1., suggests there should be gradual declines in affiliation pursuits progressively across grades 7 to 11. Hypothesis 7.2., suggested that females will have higher levels of affiliation pursuits compared to males. Hypothesis 7.3., suggests that the interactions of sex and grade should show a disparate pattern in affiliation pursuits. Differences should emerge across the grades between males and females in affiliation pursuits.
As set out in subsequent analyses the same six models will evaluate the patterns of change in affiliation pursuits for adolescents to answer the three-abovementioned hypotheses. However, only four modelled equations will be presented in text. To view the parameter estimates, standard deviations and random variance estimates for the complete six models, see Table 8.13. Model 1, the baseline variance components model reported a standardised mean intercept, $\beta_0$, for affiliation pursuits (Figure 8.33) of .018 with a $se = .016$. The value of the intercept at .018 in the baseline model suggests that students generally are close (only marginally above) to the standardised mean for their perception of affiliation during adolescence. The three random levels presented by $v_{0k} = 0/934 = 0\%$ for level 3 the school level is negligible, $u_{0jk} = 390/934 = 42\%$ for level 2 the student, and $e_{0ijk} = 544/934 = 58\%$ at level 1 Time.

**Model 1: Baseline variance components model for affiliation pursuits**

$$z_{naffil} \sim N(X\beta, \Omega)$$

$$z_{naffil} = \beta_{0jk} + \epsilon_{0ijk}$$

$$\beta_{0jk} = 0.018(0.016) + v_{0k} + u_{0jk} + e_{0ijk}$$

$$\begin{bmatrix} v_{0k} \\ u_{0jk} \\ e_{0ijk} \end{bmatrix} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.000(0.000) \\ 0.390(0.020) \\ 0.544(0.014) \end{bmatrix}$$

$$-2*loglikelihood(IGLS Deviance) = 14990.630(5632 of 5833 cases in use)$$

*Figure 8.33 The baseline variance components model for affiliation pursuits.*
Model 3: Inclusion of linear and quadratic effects for grade in affiliation pursuits

\[ y_{jk} \sim N(\chi_E, \Omega) \]

\[ y_{jk} = \beta_{0jk} \text{cons} + -0.117(0.011)g \text{deline}_{jk} + 0.005(0.007)g \text{dquad}_{jk} \]

\[ \beta_{0jk} = 0.012(0.017) + \nu_{0jk} + \zeta_{0jk} + \epsilon_{0jk} \]

\[ \begin{bmatrix} \nu_{0jk} \\ \zeta_{0jk} \end{bmatrix} \sim N(0, \Omega_\alpha) : \Omega_\alpha = \begin{bmatrix} 0.000(0.002) \\ 0.398(0.020) \end{bmatrix} \]

\[ \epsilon_{0jk} \sim N(0, \Omega_\epsilon) : \Omega_\epsilon = \begin{bmatrix} 0.524(0.014) \end{bmatrix} \]

\[-2*\text{loglikelihood(ML fit)} = 14849.680 \text{ cases in use} \]

Figure 8.34 shows the analysis with linear and quadratic effects of grade added.

Model 3 (Figure 8.34) added the linear and quadratic effects of grades to the baseline variance components model to evaluate the pattern of development across grades in affiliation pursuits to test Hypothesis 7.1. The inclusion of the linear and quadratic contrasts reported significant linear grade coefficients \( \beta_1 \) (-10.64, \( p < .001 \)) but not significant quadratic coefficients \( \beta_2 \) (.005/.007).

![Figure 8.35 The graphical representation of the pattern of change in systematic declines across grades 7-11 for affiliation pursuits.](standardised_grades_for_Affiliation_values.png)

The significant linear effect suggests that a pattern of decline occurred across grades 7 to 11 as predicted in hypothesis 7.1. The lack of significant variation in the quadratic effect across grades also suggests that these declines were systematic with insignificant change in direction (see Figure 8.35). Including the variables of the linear and quadratic effects of grade to the model reduced the loglikelihood statistic...
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(14990.63 – 14849.68) in Model 3 compared to the baseline model (Model 1). \( \chi^2 = (2) = 140.95, p < .001, \) which significantly improved the explanatory power of the revised model.

The equation represented in Model 4 (see Figure 8.36) included sex into the model and reported no significant difference in \( \beta_3, \) sex coefficients \((-0.007/0.032)\) being found. These results show that males and females did not differ in affiliation pursuits during high school and overall males were .007 standard deviation units higher than females. Thus, the hypothesised prediction of 7.2 that females will have significantly higher levels of affiliation pursuits than males was not supported. By adding sex to the model, the loglikelihood statistic \((14849.68 – 14845.88), \chi^2 = (1) 3.8, \) found no significant reduction when Model 3 and Model 4 were compared.

**Model 4: Inclusion of the effects of sex in affiliation pursuits**

\[
\text{znaffil}_{jk} \sim \mathcal{N}(\beta_{jk}\text{cons} + 0.118(0.011)\text{gdelin}_{jk} + 0.006(0.007)\text{gdequad}_{jk} + -0.007(0.032)\text{sex}_{jk}, \beta_{0jk} = 0.016(0.024) + \nu_{jk} + \nu_{0jk} + \varepsilon_{0jk})
\]

\[
\begin{bmatrix}
\nu_{jk} \\
\nu_{0jk}
\end{bmatrix} \sim \mathcal{N}(0, \Omega_v) : \Omega_v = \begin{bmatrix}
0.000(0.002)
\end{bmatrix}
\]

\[
\begin{bmatrix}
\nu_{0jk}
\end{bmatrix} \sim \mathcal{N}(0, \Omega_v) : \Omega_v = \begin{bmatrix}
0.396(0.020)
\end{bmatrix}
\]

\[
\begin{bmatrix}
\varepsilon_{0jk}
\end{bmatrix} \sim \mathcal{N}(0, \Omega_v) : \Omega_v = \begin{bmatrix}
0.524(0.014)
\end{bmatrix}
\]

\(-2 \times \text{loglikelihood(FGLS Deviance)} = 14845.880(5622 \text{ of } 5833 \text{ cases in use})\)

*Figure 8.36 Significant differences are shown in the addition of sex with males having higher levels of affiliation pursuits compared to females.*
Model 6: Inclusion of grade X sex interactions for leader pursuits

\[ znaffi_{ij} \sim N(\xi, \Omega) \]

\[ znaffi_{ij} \sim \beta_{ycons} + \beta_{ygrade} X grade_{ji} + \beta_{ysex} X sex_{j} + \beta_{ygrade X sex} X grade_{ji} \times sex_{j} + \epsilon_{ij} \]

\[ \beta_{ygrade} = 0.022(0.025) + \gamma_{g} + u_{g} + \epsilon_{g} \]

\[ \beta_{ysex} = 0.009(0.015) + \gamma_{s} + u_{s} + \epsilon_{s} \]

\[ \left[ \begin{array}{c}
\gamma_{g} \\
\gamma_{s}
\end{array} \right] \sim N(0, \Omega_{g}) : \Omega_{g} = \left[ \begin{array}{cc}
0.009(0.002) \\
0.398(0.020)
\end{array} \right] \]

\[ \left[ \begin{array}{c}
u_{g} \\
u_{s}
\end{array} \right] \sim N(0, \Omega_{u}) : \Omega_{u} = \left[ \begin{array}{cc}
0.524(0.014)
\end{array} \right] \]

\[ \text{-2*loglikelihood(OLS Deniance) = 14844.45 (5622 of 5833 cases in use)} \]

Figure 8.37 The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.

Model 6 (Figure 8.37) added the interaction of sex to the linear and quadratic effects of grade respectively no significant sex X the linear effect of grade interaction coefficients, \( \beta_{4} \), (-.024/.022) and no significant sex X quadratic effect of grade interaction coefficients, \( \beta_{5} \), (-.009/0.015) were found. Including the interactions of the linear effect of grade X sex and the quadratic effect of grade X sex to the model marginally reduced the loglikelihood statistic (14845.88 – 14844.45). When Model 6 was compared to Model 4, \( \chi^{2} = (2) 1.43 \), no significant improvement was found.

Table 8.12 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for affiliation pursuits.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.27(367)</td>
<td>.13(693)</td>
<td>.00(960)</td>
<td>-.12(652)</td>
<td>-.25(271)</td>
<td>.01(2943)</td>
</tr>
<tr>
<td>Male</td>
<td>.25(331)</td>
<td>.12(639)</td>
<td>.00(930)</td>
<td>-.09(593)</td>
<td>-.16(186)</td>
<td>.03(2679)</td>
</tr>
<tr>
<td>Total</td>
<td>.26(698)</td>
<td>.12(1332)</td>
<td>.00(1890)</td>
<td>-.11(1245)</td>
<td>-.21(457)</td>
<td>.02(5622)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.

Therefore, males and females did not vary in affiliation pursuits in the fixed effect of sex nor in the interactions of grade through either the linear or quadratic effects X sex. Disparate patterns of affiliation pursuits between males and females
were not found across grades (see Table 8.12 for evaluation of means that shows little variation). Hypothesis 7.3 was not supported.

Summary

Support was found for hypothesis 7.1 with systematic declines across the fixed effect of grades in adolescent’s affiliation pursuits. However, support was not found for hypothesis 7.2, as no significant differences emerged between males and females in their reported affiliation pursuits. Hypothesis 7.3 incorporated the ordering effects of sex, grade and grade X sex interactions using orthogonal contrasts. Assessment of the interaction effects of the linear and quadratic effects X sex found no significant differences emerged. There were no significant differences identified by degree or direction in the rate of declines across grades between males and females. Table 8.13 presents the parameter estimates for the six progressive equations modelled for affiliation pursuits and minimal variation occurred across the random parameter estimates.

Model 2 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 2 for affiliation pursuits. Improvement in the explanatory power was not found with the addition of the fixed quadratic effect of grade model 3 onwards.
Table 8.13 Progressive multilevel models for affiliation pursuits on grade, sex and their respective interactions (linear and quadratic).

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.018</td>
<td>.009</td>
<td>.012</td>
<td>.016</td>
<td>.018</td>
<td>.022</td>
</tr>
<tr>
<td><strong>Fixed effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.119(.011)</td>
<td>-.117(.011)</td>
<td>-.118(.011)</td>
<td>-.105(.016)</td>
<td>-.104(.016)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.005(.007)</td>
<td>.006(.007)</td>
<td>.006(.007)</td>
<td>.011(.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-.007(.032)</td>
<td>-.009(.032)</td>
<td>-.016(.034)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fixed effects Interactions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdelin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.022(.022)</td>
<td>-.024(.022)</td>
</tr>
<tr>
<td>SexXgdequad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-.009(.015)</td>
<td></td>
</tr>
<tr>
<td><strong>Loglikelihood Statistic</strong></td>
<td>14990.63</td>
<td>14850.22</td>
<td>14849.68</td>
<td>14845.88</td>
<td>14844.84</td>
<td>14844.45</td>
</tr>
<tr>
<td><strong>Random effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>.000(.000)</td>
<td>.000(.002)</td>
<td>.000(.002)</td>
<td>.000(.002)</td>
<td>.000(.002)</td>
<td>.000(.002)</td>
</tr>
<tr>
<td>Student</td>
<td>.390(.020)</td>
<td>.398(.020)</td>
<td>.398(.020)</td>
<td>.397(.020)</td>
<td>.397(.020)</td>
<td>.398(.020)</td>
</tr>
<tr>
<td>Time</td>
<td>.544(.014)</td>
<td>.524(.014)</td>
<td>.524(.014)</td>
<td>.524(.014)</td>
<td>.524(.014)</td>
<td>.524(.014)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.
A social concern pursuit is one of the two pursuits, that of affiliation and social concern, which represent social goals. Social concern pursuits are student’s perception that being concerned for other students’ schoolwork and having a willingness to help them may also assist their own learning. While social goals have been generally regarded in the literature as less facilitative in the course of learning, a social concern pursuit should be more adaptive than the other social goal of affiliation. For optimal engagement and performance, social goals in general should decline as students’ progress across the grades. Autonomy and independence have been linked to self-regulation and facilitative learning due to the decreased need for external influences. Defining autonomy as involving the initiation and regulation of one’s own actions (Ryan & Deci, 2000) suggests that a social concern pursuit may have a different pattern of learning than other social goals, such as affiliation. A social concern pursuit is related to lending support and helping others with their work, and may involve initiating and regulating one’s own actions to initially understand the material. Social concern pursuits are related to mentoring other students and therefore may be facilitative. Students high in social concern pursuits are not dependent upon having other’s assistance or guidance but instead they provide the assistance through mentoring. In addition, where initial assistance may be necessary to master a task, the ability of other students to assist their peers also may have a reciprocal effect that is facilitative towards learning. Through providing assistance to their peers, the student high on social concern may be gaining a better understanding of the material themselves. While gradual declines are generally indicated for social goals, this aspect of motivation has had limited research.
Achievement motivation compared to other goals. Therefore, the patterns of development across grades are less clearly defined. However, as discussed previously social concern pursuits should show evidence of gradual declines for males and females after the transition to high school in Year 7. Males should report lower levels of social concern and have a steeper rate of decline than females across grades.

Hypothesis 8.1, 8.2 and 8.3 all relate to the factor of social concern pursuits. Hypothesis 8.1., suggests there should be gradual declines evidenced in social concern pursuits in early adolescence across the grades. Hypothesis 8.2., suggests that females will have higher levels of social concern pursuits compared to males. Hypothesis 8.3., suggests that the interactions of grade X sex should show emerging trends of disparate patterns of development for social concern pursuits between males and females. Differences by degree and direction across the course of high school should emerge in social concern pursuits between males and females, with males having lower levels of social concern pursuits than females.

Model 1: Baseline variance components model for social concern pursuits

\[ z_{soccon,jk} \sim N(X\beta, \Omega) \]

\[ z_{soccon,jk} = \beta_{soccon} + \epsilon_{soccon,jk} \]

\[ \mu_{soccon} = 0.055(0.035) + \nu_{soccon} + \eta_{soccon} + \epsilon_{soccon,jk} \]

\[ \nu_{soccon} \sim N(0, \Omega_\nu) : \Omega_\nu = [0.036(0.011)] \]

\[ \eta_{soccon} \sim N(0, \Omega_\eta) : \Omega_\eta = [0.225(0.011)] \]

\[ \epsilon_{soccon,jk} \sim N(0, \Omega_\epsilon) : \Omega_\epsilon = [0.311(0.008)] \]

\[-2 \loglikelihood(1)LS Deviance) = 11878.280(5612 of 5833 cases in use)\]

Figure 8.38 The baseline variance components model for social concern pursuits.

As set out in affiliation pursuits the same four abbreviated models will be presented to demonstrate the pattern of social concern pursuits for adolescents to answer the abovementioned hypotheses. To view the output for the complete six models for social concern pursuits see Table 8.15 where individual parameter
estimates and standard errors for the fixed variables and random components of the models will be presented. Model 1 the baseline variance components model reported a standardised mean intercept, $\beta_0$, for social concern pursuits (Figure 8.38) of .055 (SE = .035). This level in the overall standardised scores for the intercept suggests that generally students had more positive perceptions of social concern pursuits compared to other factors of the SMOSA. The three random levels reported $\nu_{0k} = .036/572 = 6\%$ for level 3 the school, $u_{0jk} = .225/572 = 40\%$ for level 2 the student, and $e_{0ijk} = .311/572 = 54\%$ at level 1 Time.

**Model 3:** Inclusion of linear and quadratic effects for grade in social concern pursuits

$z_{soccon_{ijk}} \sim N(X\beta, \Omega)$

$z_{soccon_{ijk}} = \beta_{0jk} + \beta_{1jk} x_{ijk} + \beta_{2jk} x_{ijk}^2 + \nu_{0jk} + \mu_{0jk} + e_{0ijk}$

$\begin{bmatrix} \nu_{0k} \\ \mu_{0jk} \\ e_{0ijk} \end{bmatrix} \sim N(0, \Omega_e)$ : $\Omega_e = \begin{bmatrix} 0.034 & 0.011 \\ 0.011 & 0.031 \end{bmatrix}$

$-2\times$loglikelihood(MLGLS Deviance) = 11737.640 (5604 of 5833 cases in use)

Figure 8.39 shows the analysis with linear and quadratic effects of grade added.

Model 3 (Figure 8.39) added the linear and quadratic effects of grades to the baseline variance components model to evaluate the pattern of development in social concern pursuits to test Hypothesis 8.1. The inclusion of the linear and quadratic contrasts reported significant linear grade coefficients ($\beta_{1} = -.079/0.009 = 8.78, p < .001$) and quadratic coefficients ($\beta_{2} = 0.032/0.006 = 5.33, p < .001$). The significant variation in the quadratic effect across grades suggests that while systematic declines emerged a significant change in direction across grades was also found.

Figure 8.40 demonstrates graphically that the pattern of change across grade varies between grades 10 and 11 with a plateauing or perhaps possible improvement in social concern pursuits. Including the variables of the linear and quadratic effects of
grade to the model reduced the loglikelihood statistic (11878.28 – 11737.64) in Model 3 compared to the baseline model (Model 1). $\chi^2 = (2) = 140.64, p < .001$, showing significantly improved explanatory power of the models. The negative linear effect suggests systematic declines across grades in social concern pursuits. However, the significant quadratic effect demonstrates recovery or lessening of the rate of decline in the latter part of high school (see Figure 8.40). These findings support the prediction in hypothesis 8.1. The lack of past enquiry on the profiling of social concern pursuits during adolescence makes it difficult to elaborate on the findings of hypothesis 8.1. However, the significant quadratic effect in grades that appeared between grades 10 and 11, suggests that helping or mentoring other students appears to strengthen in the latter stages of high school. Hypothesis 8.1 was partially supported with declines found during early adolescence with a lessening in the rate of declines and plateauing around grades 9 to 11 with possible recovery in social concern pursuits.

![Figure 8.40](image)

*Figure 8.40 is the graphical representation of the pattern of change in magnitude and direction across grades 7-11 for social concern.*
Model 4: Inclusion of the effects of sex in social concern pursuits

$$\text{zmsoccon}_{jk} \sim \mathcal{N}(X\hat{\beta}, \Omega)$$

$$\text{zmsoccon}_{jk} = \beta_{0j} + \beta_{1j} \text{sex}_{jk} + \epsilon_{jk}$$

$$\begin{align*}
\beta_{0j} &= -0.041(0.632) + \gamma_{0j} + \kappa_{0j} + \epsilon_{0j} \\
\gamma_{0j} &\sim \mathcal{N}(0, \Omega_{\gamma}) : \Omega_{\gamma} = \mathbf{0.024(0.008)} \\
\kappa_{0j} &\sim \mathcal{N}(0, \Omega_{\kappa}) : \Omega_{\kappa} = \mathbf{0.211(0.011)} \\
\epsilon_{0j} &\sim \mathcal{N}(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = \mathbf{0.300(0.008)}
\end{align*}$$

$$-2\hat{\chi}^2(\text{loglikelihood(ICEL Deviance)}) = 11599.49(5602 \text{ of 5833 cases in use})$$

Figure 8.41 Significant differences are shown with the addition of sex, where males had higher levels of social concern pursuits compared to females.

Model 4 (Figure 8.41) added the contrast variable of sex to the previous equation and reported significant differences in the estimate for $\beta_3$, sex coefficients ($0.304/.026 = 11.69$, $p < .001$) that is females were .304 standard deviation units higher than males. These results found that females had significantly higher levels of social concern pursuits compared to males, supporting hypothesis 8.2. By adding sex to the model, the loglikelihood statistic $(11737.64 – 11599.49)$, $\chi^2 = (1) 138.15$, $p < .001$, comparing Model 4 to Model 3 was significantly reduced, improving the explanatory power of this revised Model.

Table 8.14 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for social concern pursuits.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.47(358)</td>
<td>.31(686)</td>
<td>.21(958)</td>
<td>.16(555)</td>
<td>.16(269)</td>
<td>.25(2926)</td>
</tr>
<tr>
<td>Male</td>
<td>.20(330)</td>
<td>.01(642)</td>
<td>-.11(930)</td>
<td>-.15(587)</td>
<td>-.13(185)</td>
<td>-.05(2676)</td>
</tr>
<tr>
<td>Total</td>
<td>.34(688)</td>
<td>.17(1328)</td>
<td>.05(1888)</td>
<td>.01(1244)</td>
<td>.04(454)</td>
<td>.10(5602)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.
Figure 8.42 Variation graphed for females and males in social concern pursuits across grades for each time collection for each student to highlight the variation that exists.

To review the degree of variation at the time within student within school random effect, that is the individual residual level variation a graph may assist in providing a better explanation (see Figure 8.42). Individually females have a more even distribution of social concern pursuits with a trend towards recovery across grades, whereas males had a greater degree of variability on the negative side of the standardised measure. Males had lower levels of social concern pursuits than females across all grades (see Table 8.14 for evaluation of means and Figure 8.42 for individual variation of responses across grades).
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Model 6: Inclusion of grade X sex interactions for social concern pursuits

$$z_{soccon_{yk}} \sim N(\mu, \Omega)$$

$$z_{soccon_{yk}} = \beta_{0yk} \text{cons} + -0.082(0.013)gdegrad_{yk} + 0.034(0.008)gdequad_{yk} + 0.299(0.028)sex_{yk} + 0.004(0.017)gdegradsex_{yk} +$$

$$\beta_{0yk} = -0.038(0.033) + \nu_{0yk} + \mu_{0yk} + \epsilon_{0yk}$$

$$\nu_{0yk} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.024(0.008) \end{bmatrix}$$

$$\mu_{0yk} \sim N(0, \Omega_{\mu}) : \Omega_{\mu} = \begin{bmatrix} 0.211(0.011) \end{bmatrix}$$

$$\epsilon_{0yk} \sim N(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = \begin{bmatrix} 0.300(0.008) \end{bmatrix}$$

$$-2 \cdot \text{Loglikelihood} (TOLS Deviances) = 11598.90(5602 of 5833 cases in use)$$

Figure 8.43 The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.

The equation represented in Model 6 (Figure 8.43) added the interaction of sex to the linear and quadratic effects of grade respectively as contrast variables and found non-significant sex X linear effect of grade interaction coefficients, \(\beta_4\), (.004/.017) and non-significant sex X quadratic effect of grade interaction coefficients, \(\beta_5\), (-.008/.011). Females evidenced slight recovery in social concern pursuits in the latter grades compared to males who showed continuous declines, although the difference was not significant. Whereas the fixed effect of sex reported that females had higher levels in social concern pursuits than males and the fixed effect of grade (both linear and quadratic effects of grade) reported significant grade effects with declines found of gradual recovery; the interactions of the linear and quadratic effects of grade X sex were not significant. Including the interactions of the linear effect of grade X sex and the quadratic effect of grade X sex to the model did not significantly improve the explanatory power of the revised models either.

The loglikelihood statistic (11599.49 – 11598.90) between Model 6 and Model 4, \(\chi^2 = (2), 0.59\), found that females had higher levels of social concern pursuits than
males but the patterns of development across grades were similar for males and females (see Figure 8.44).

![Figure 8.44](image)

**Figure 8.44** The MLwiN graph highlights the different contrast effects between males and females. Females are the higher line. A clear quadratic effect is evident for both males and females in social concern pursuits.

**Summary**

Support was partially found for hypothesis 8.1 with systematic declines across grades in social concern pursuits for adolescents up to grade 9 with a plateauing effect however the recovery or change in the rate of decline was not predicted. Support was found for hypothesis 8.2 where significant differences emerged between males and females. Females had higher levels of social concern pursuits than males. Hypothesis 8.3 was not supported. While different levels of social concern pursuits between males and females were found across grades they were not found in the sex X grade linear interactions or grade X sex quadratic interactions for social concern pursuits. The patterns across grades for males and females followed similar trajectories (see Figure 8.44). Table 8.15 presents the parameter estimates of the six progressive equations modelled for social concern pursuits. Minimal variation occurred across the random parameters, after progressively adding each contrast variable to the subsequent equations. Females were systematically higher in their levels of social concern pursuits but also had less variability compared to
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males. There was significantly greater spread across responses for males compared to females across all grades (see Figure 8.42 & Table 8.14).

Model 4 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 4 for social concern pursuits. Improvement in the explanatory power was not found with the addition of the fixed interactions in models 5 or 6.

Table 8.15 Progressive multilevel models for social concern pursuits on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.055</td>
<td>.055</td>
<td>.080</td>
<td>-.041</td>
<td>-0.041</td>
<td>-.038</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.084(.009)</td>
<td>-.079(.009)</td>
<td>-.081(.009)</td>
<td>-.084(.013)</td>
<td>-.082(.013)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.032(.006)</td>
<td>.030(.006)</td>
<td>.030(.006)</td>
<td>.034(.008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdelin</td>
<td>.006(.017)</td>
<td>.004(.017)</td>
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<td></td>
</tr>
<tr>
<td>SexXgdequad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.008(.011)</td>
<td></td>
</tr>
<tr>
<td>Loglikelihood statistic</td>
<td>11878.28</td>
<td>11767.64</td>
<td>11737.64</td>
<td>11599.49</td>
<td>11599.38</td>
<td>11598.90</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>.036(.011)</td>
<td>.035(.011)</td>
<td>.034(.011)</td>
<td>.024(.008)</td>
<td>.024(.008)</td>
<td>.024(.008)</td>
</tr>
<tr>
<td>Student</td>
<td>.225(.011)</td>
<td>.228(.011)</td>
<td>.229(.011)</td>
<td>.211(.011)</td>
<td>.211(.011)</td>
<td>.211(.011)</td>
</tr>
<tr>
<td>Time</td>
<td>.311(.008)</td>
<td>.302(.008)</td>
<td>.300(.008)</td>
<td>.300(.008)</td>
<td>.300(.008)</td>
<td>.300(.008)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.
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Reward pursuits within motivation

Introduction

A reward pursuit is one of the two pursuits, that of praise and rewards, which represent extrinsic goals in the literature. A reward pursuit is the student’s perception that tangible recognition for application to schoolwork is required as a form of motivation in their learning. Extrinsic goals have been regarded as less facilitative in the course of learning than a mastery goal especially as adolescents’ progress across grades. However, motivational pursuits vary among students and for some students the nature of praise and/or rewards are necessary components to facilitate their process of learning. The use of extrinsic goals is indicative of student’s movement away from the desired autonomous learning style dictated in the literature. Therefore, to better understand the process of extrinsic goals, inclusion of this measure is necessary. Investigating whether differences emerge in these motivational goals between males and females will provide important information. Previous research suggests that the pattern of reward pursuits should show gradual declines for both males and females across grades, where females should show a steeper rate of decline than males (Simpson & McInerney, 2002).

Hypothesis 9.1, 9.2 and 9.3 all relate to the factor of reward pursuits. Hypothesis 9.1., suggests there should be gradual declines in reward pursuits across the grades in high school. Hypothesis 9.2., suggests that males will have higher levels of reward pursuits compared to females. Hypothesis 9.3., suggests that differences will emerge by level and direction across the course of adolescence during high school in reward pursuits. The interactions of sex and grade should show disparate patterns of the development in reward pursuits, with females having lower levels across grades than males.
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The same four models used in the previous factors will demonstrate the pattern of reward pursuits for adolescents to answer the abovementioned hypotheses. To view the parameter estimates, standard deviations and random variance estimates for the six models of reward pursuits see Table 8.17. Model 1 the baseline variance components model reported a mean intercept, \( \beta_0 \), for reward pursuits (Figure 8.45) of -.243 (SE = .044). The three random levels presented by \( v_{ijk} = 51/1084 = 5\% \) for level 3 the school, \( u_{ijk} = 403/1084 = 37\% \) for level 2 the student within school, and \( e_{ijk} = 630/1084 = 58\% \) at level 1 Time within student within school. The negative mean intercept indicates that on average reward pursuits are perceived as less desirable across adolescence after the standardization across the 12 factors of the SMOSA.

**Model 1: Baseline variance components model for reward pursuits**

\[
\begin{align*}
    z_{n\text{reward}_{ijk}} & \sim N(\mu, \Omega) \\
    z_{n\text{reward}_{ijk}} & = \beta_0 + u_{ijk} + v_{ijk} + e_{ijk} \\
    v_{0jk} & \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.051(0.017) \end{bmatrix} \\
    u_{0jk} & \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.403(0.022) \end{bmatrix} \\
    e_{0ijk} & \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.630(0.017) \end{bmatrix}
\end{align*}
\]

\(-2\times\text{log likelihood (JGLS Deviance)} = 15590.830 \text{ of 5595 cases in use}\)

Figure 8.45 The baseline variance components model for reward pursuits.

The equation presented in Model 3 (Figure 8.46) for reward pursuits added the linear and quadratic effects across grades to Model 1 to evaluate hypothesis 9.1. The inclusion of the linear contrasts reported a significant linear \( \beta_1 \), coefficient of grades (-.278/0.012 = -23.17, \( p < .001 \)) and a significant quadratic \( \beta_2 \), coefficient of grades (.041/0.008 = 5.13, \( p < .001 \)). The linear effect suggests that strong progressive declines across grades occurred. The subsequent quadratic analysis showed that across grades there was a lessening in the rate of decline evidenced between grade 10
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and grade 11. Figure 8.47 demonstrated graphically the pattern of change across grades varied around grade 10 and 11 with a plateauing in reward pursuits. Including the variables of the linear and quadratic effects of grade to the model reduced the loglikelihood statistic (15590.83 – 14981.07) in Model 3 from the baseline model (Model 1), $\chi^2 = (2) = 609.76, p < .001$. The addition of the linear and quadratic effects of grade significantly improved the explanatory power of the revised model. Hypothesis 9.1 was partially supported with declines in the slope of reward pursuits. However, while hypothesis 9.1 predicted declines in reward pursuits, the change in the rate of those declines found in the significant quadratic effect was not predicted.

**Model 3: Inclusion of linear and quadratic effects for grade in reward pursuits**

$$z_{\text{reward},jk} \sim \mathcal{N}(\mu, \Omega)$$

$$z_{\text{reward},jk} = \beta_{0jk} \text{cons} + -0.278(0.012)g_{\text{delin},jk} + 0.041(0.008)g_{\text{dequad},jk}$$

$$\beta_{0jk} = -0.204(0.048) + \nu_{0k} + \nu_{0jk} + \epsilon_{0jk}$$

$$[\nu_{0k}] \sim \mathcal{N}(0, \Omega_{\nu}) : \Omega_{\nu} = [0.066(0.020)]$$

$$[\nu_{0jk}] \sim \mathcal{N}(0, \Omega_{\nu}) : \Omega_{\nu} = [0.426(0.021)]$$

$$[\epsilon_{0jk}] \sim \mathcal{N}(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = [0.530(0.014)]$$

$$-2 \times \text{loglikelihood(JGLS Deviance)} = 14981.070 \text{ of 5833 cases in use}$$

Figure 8.46 shows the analysis with linear and quadratic effects of grade added.

**Figure 8.47** Graphically represents the pattern of change in magnitude and direction across grades 7-11 for reward.
Model 4: Inclusion of the effects of sex in reward pursuits

\[ z_{\text{reward}_{ik}} \sim \mathcal{N}(\mu_{ik}, \Omega) \]
\[ z_{\text{reward}_{ik}} = \beta_{\text{cons}} + -0.278(0.012)z_{\text{godelin}_{ik}} + 0.042(0.008)z_{\text{gdequad}_{ik}} + -0.062(0.037)z_{\text{sex}_{ik}} \]
\[ \beta_{\text{sex}} = -0.179(0.050) + \nu_{\text{sex}} + \mu_{\text{sex}} + \varepsilon_{\text{sex}} \]

\[ \begin{bmatrix} \nu_{\text{sex}} \end{bmatrix} \sim \mathcal{N}(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.067(0.021) \end{bmatrix} \]
\[ \begin{bmatrix} \mu_{\text{sex}} \end{bmatrix} \sim \mathcal{N}(0, \Omega_\mu) : \Omega_\mu = \begin{bmatrix} 0.425(0.021) \end{bmatrix} \]
\[ \begin{bmatrix} \varepsilon_{\text{sex}} \end{bmatrix} \sim \mathcal{N}(0, \Omega_\varepsilon) : \Omega_\varepsilon = \begin{bmatrix} 0.531(0.014) \end{bmatrix} \]

-2*\text{loglikelihood}(IKLS Deviance) = 14973.600 (5585 of 5833 cases in use)

Figure 8.48 Significant differences are shown with the addition of sex, where males had higher levels of reward pursuits compared to females.

Model 4 (Figure 8.48) added the contrast variable of sex to the previous equation and reported non significant differences in the estimate for \( \beta_3 \), sex coefficients (-.062/0.037). Males were on average .062 standard deviation units higher than females. These results found that males reported higher levels of reward pursuits compared to females, however, the difference was not significant and therefore hypothesis 9.2 was not supported. By adding sex to the model the loglikelihood statistic (14981.07 – 14973.63) reduced significantly, \( \chi^2 = (1) 7.47, p < .01 \) between Model 3 and Model 4. While the addition of sex significantly improved the explanatory power of the model through the loglikelihood statistic the expected difference between males and females in standardised scores was not found.

Table 8.16 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for reward pursuits.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.39(361)</td>
<td>.00(684)</td>
<td>.57(963)</td>
<td>-.56(647)</td>
<td>-.72(265)</td>
<td>-.25(2920)</td>
</tr>
<tr>
<td>Male</td>
<td>.47(333)</td>
<td>.06(645)</td>
<td>-.27(922)</td>
<td>-.50(579)</td>
<td>-.64(185)</td>
<td>-.17(2665)</td>
</tr>
<tr>
<td>Total</td>
<td>.43(694)</td>
<td>.03(1330)</td>
<td>-.29(1885)</td>
<td>-.53(1226)</td>
<td>-.69(450)</td>
<td>-.21(5585)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.
Model 6: Inclusion of grade X sex interactions for reward pursuits

\[ z_{\text{reward}_{ik}} \sim N(\mu_{i}, \Omega) \]

\[ z_{\text{reward}_{ik}} = \beta_{0} + \beta_{1}(X - \bar{X}) + \beta_{2}(X - \bar{X})^2 + \beta_{3}(X - \bar{X}) \times \text{sex} + \beta_{4}(X - \bar{X}) \times \text{sex}^2 + \beta_{5}(X - \bar{X}) \times \text{sex} + \beta_{6}(X - \bar{X}) \times \text{sex}^2 + \epsilon_{ik} \]

\[ \begin{bmatrix} \mu_{i} \\ \sigma_{\epsilon}^{2} \end{bmatrix} \sim N(0, \Omega_{i}) : \Omega_{i} = \begin{bmatrix} 0.067(0.021) \\ 0.425(0.021) \\ 0.531(0.014) \end{bmatrix} \]

\(-2 \loglikelihood(IGLS Deviance) = 14973.480(5585 of 5833 cases in use)\)

Figure 8.49 The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.

The equation represented in Model 6 (Figure 8.49) added the interaction of sex to the linear and quadratic effects of grade respectively as contrast variables and reported non-significant sex X linear effect of grade interaction coefficients, \( \beta_4 \), (-.003/.023) and non-significant sex X quadratic effect of grade interaction coefficients, \( \beta_5 \), (-.005/.015). The means for reward pursuits across grades for males and females are presented in Table 8.16. Including the interactions of the linear effect of grade X sex and the quadratic effect of grade X sex did not significantly reduce the loglikelihood statistic (14973.60 – 14973.48) when Model 6 compared Model 4, \( \chi^2 = (2) 0.12 \). The cumulative analyses identified declines across grades with significant linear and quadratic effects, where males had higher levels of reward pursuits across all grades. Hypothesis 9.3 was not supported because different levels of reward pursuits were not found between males and females through assessment of the interaction effects of grades X sex. Males and females followed a close, similar trajectory of progressive declines across grades with minimal deviation between males and females across the grades.
Support was found for hypothesis 9.1 with progressive declines across grades in reward pursuits for adolescents with a lessening of those declines around grades 10 and 11. Support was not found for hypothesis 9.2 as the differences identified between males and females were not significant even though males had higher levels of reward pursuits than females. Hypothesis 9.3 was also not supported. The sex X grade linear interactions and grade X sex quadratic effects in reward pursuits were not significant. Females had slightly lower reward pursuits than males but a similar pattern of change emerged across the grades. As seen in hypothesis 9.1 significant declines were found across the fixed effect of grades, although the reported quadratic effect suggested a change in the rate of decline occurred during adolescence. Table 8.17 presents the parameter estimates for the six progressive equations modelled for reward pursuits. Minimal variation occurred across the progressive models in the random effect levels.

Model 4 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 4 for reward pursuits. Improvement in the explanatory power was not found with the addition of the fixed interactions in models 5 or 6.
Table 8.17 Progressive multilevel models for reward pursuits on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.243</td>
<td>-.235</td>
<td>-.204</td>
<td>-.179</td>
<td>-.178</td>
<td>-.176</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.286 (.012)</td>
<td>-.278 (.012)</td>
<td>-.278 (.012)</td>
<td>-.277 (.017)</td>
<td>-.276 (.017)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.041 (.008)</td>
<td>.042 (.008)</td>
<td>.042 (.008)</td>
<td>.044 (.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-.062 (.037)</td>
<td>-.062 (.037)</td>
<td>-.066 (.038)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdelin</td>
<td>.001 (.022)</td>
<td>.003 (.023)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdequad</td>
<td>-.005 (.015)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loglikelihood statistic</td>
<td>15590.83</td>
<td>15009.74</td>
<td>14981.07</td>
<td>14973.60</td>
<td>14973.59</td>
<td>14973.48</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>.051 (.017)</td>
<td>.066 (.020)</td>
<td>.066 (.020)</td>
<td>.067 (.021)</td>
<td>.067 (.021)</td>
<td>.067 (.021)</td>
</tr>
<tr>
<td>Student</td>
<td>.403 (.022)</td>
<td>.423 (.021)</td>
<td>.426 (.021)</td>
<td>.425 (.021)</td>
<td>.425 (.021)</td>
<td>.425 (.021)</td>
</tr>
<tr>
<td>Time</td>
<td>.630 (.017)</td>
<td>.536 (.014)</td>
<td>.530 (.014)</td>
<td>.531 (.014)</td>
<td>.531 (.014)</td>
<td>.531 (.014)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.


Praise pursuits within motivation

Introduction

A praise pursuit is one of the two pursuits, that of praise and rewards
representing extrinsic goals. Extrinsic based goals have been regarded in the literature
as less facilitative in the course of learning than mastery goals because of student’s
movement away from autonomous and internally motivated learning. Research
suggests that extrinsic goals should decline as students’ progress through adolescence.
A praise pursuit is the student’s perception that recognition or acknowledgment for
progress in their schoolwork motivates them towards academic engagement. Hattie’s
meta-analysis on the effects of teacher’s praise and/or rewards during adolescence
found they were not positively related to the student’s self perceptions of ability.
McInerney and McInerney’s (1998) cross-cultural research partially supported
Hattie’s findings with praise pursuits because it was a significant negative predictor of
academic achievement in their research. Previous research suggests that the pattern of
praise pursuits should show gradual declines for males and females across grades,
with females showing a steeper rate of decline than males. Hypothesis 10.1, 10.2 and
10.3 all relate to the factor of praise pursuits. Hypothesis 10.1., suggests there should
be gradual declines evidenced in praise pursuits across grades. Hypothesis 10.2.,
suggests that males should have higher levels of praise pursuits compared to females.
Hypothesis 10.3., suggests that differences by degree and direction across high school
should emerge between males and females in praise pursuits. Males will have higher
praise pursuits than females across grades in high school.

As set out in subsequent factors the same four models will be used to
demonstrate the pattern of praise pursuits for adolescents testing the above-mentioned
hypotheses. To view the parameter estimates, standard deviations and random
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variance estimates for the complete six models for praise pursuits see Table 8.19. Model 1 the baseline variance components model reported a mean intercept, $\beta 0$, for praise pursuits (Figure 8.50) is -.121 (SE = .033). The three random levels presented by $v0k = 23/923 = 2\%$ for level 3 the school, $u0jk = 343/923 = 37\%$ for level 2 the student, and $e0ijk = 567/933 = 61\%$ at level 1 Time. This negative value at the intercept (-.121) for standardised praise pursuits suggests that although a degree of variability exists, praise pursuits are not viewed as high motivationally compared to other factors of the SMOSA.

Model 1: Baseline variance components model for praise pursuits

$$znpraise_{ijk} \sim N(\mu, \Omega)$$
$$znpraise_{ijk} = \beta 0_{jk} + \nu_{0k} + \mu_{0jk} + \epsilon_{0ijk}$$

$$\begin{bmatrix} \nu_{0k} \\ \mu_{0jk} \\ \epsilon_{0ijk} \end{bmatrix} \sim N(0, \Sigma) : \Omega_v = \begin{bmatrix} 0.023(0.009) \\ \mu_{0jk} \end{bmatrix} \sim N(0, \Sigma) : \Omega_u = \begin{bmatrix} 0.343(0.019) \\ \epsilon_{0ijk} \end{bmatrix} \sim N(0, \Sigma) : \Omega_e = \begin{bmatrix} 0.567(0.015) \end{bmatrix}$$

$-2 \times \text{loglikelihood (QLS Deviance)} = 14972.650 (5624 \text{ of } 5833 \text{ cases in use})$

Figure 8.50 The baseline variance components model for praise pursuits.

The equation presented in Model 3 (Figure 8.51) for praise pursuits added the linear and quadratic effects across grades to Model 1 to evaluate hypothesis 10.1. The inclusion of the linear contrasts reported significant linear $\beta 1$, coefficient of grades (-.115/.011 = -10.45, $p < .001$) and significant quadratic $\beta 2$, coefficient of grades (.026/.008 = 3.25, $p < .01$). The linear effect suggests that strong progressive declines across grades developed, and the subsequent quadratic analysis showed that across grades there was a lessening in the rate of decline around grade 10 and a plateauing at grade 11. Figure 8.52 demonstrated graphically the pattern of change across grade which varied around grades 10 and 11 with a plateauing in praise pursuits. Including the linear and quadratic effects of grade to the model reduced the loglikelihood.
statistic (14972.65 – 14831.05) in Model 3 compared to the baseline model (Model 1). \( \chi^2 = (4) = 141.60, p < .001, \) significant improvement in the explanatory power of the models occurred. Hypothesis 10.1 was supported with declines in the slope of praise pursuits. However, while the predicted declines occurred the reduction in the rate of those declines identified was not envisaged.

**Model 3: Inclusion of linear and quadratic effects for grade in praise pursuits**

\[
\begin{align*}
z_{npraise_{yk}} & \sim N(X\beta, \Omega) \\
z_{npraise_{yk}} &= \beta_{0yk} + \beta_{1yk}gdeq{\text{ode}} + \beta_{2yk}gdeq{\text{quad}}_{yk} + \epsilon_{0yk} \\
\beta_{0yk} &= -0.101(0.034) + \nu_{0k} + \nu_{yk} + \epsilon_{0yk} \\
\nu_{0k} & \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.024(0.009) \end{bmatrix} \\
\nu_{yk} & \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.343(0.019) \end{bmatrix} \\
\epsilon_{0yk} & \sim N(0, \Omega_\epsilon) : \Omega_\epsilon = \begin{bmatrix} 0.550(0.015) \end{bmatrix} 
\end{align*}
\]

\[-2^{\text{log likelihood (IGLS Deviance)}} = 14831.050 (5616 of 5833 cases in use)}

**Model 4 (Figure 8.53)** included the variable of sex and reported no significant difference in \( \beta_3, \) sex coefficients (0.036/0.034). These results found that females reported slightly higher levels of praise pursuits compared to males of .036 standard deviation units, however the difference was not significant and hypothesis 10.2 was
not supported. By adding sex to the model, the loglikelihood statistic (14831.05 - 14822.21) between Model 3 and Model 4, $\chi^2 = (1) 8.84, p < .01$ showed significant improvement and explanatory power in the revised model.

**Model 4: Inclusion of the effects of sex in praise pursuits**

$$\text{znpraise}_{yk} \sim N(\mu_{yk}, \Omega)$$

$$\text{znpraise}_{yk} = \beta_{y0k} + \beta_{y1k} \text{sex}_{yk} + \gamma_{yk} \text{grade}_{yk} + \delta_{yk} \text{grade}_{yk}^2 + \epsilon_{yk}$$

$$\beta_{yk} = -0.11(0.037) + \nu_{yk} + \tau_{yk} + \epsilon_{yk}$$

$$\nu_{yk} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.024(0.009) \\ 0.024(0.009) \end{bmatrix}$$

$$\tau_{yk} \sim N(0, \Omega_{\tau}) : \Omega_{\tau} = \begin{bmatrix} 0.343(0.019) \\ 0.343(0.019) \end{bmatrix}$$

$$\epsilon_{yk} \sim N(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = \begin{bmatrix} 0.550(0.015) \\ 0.550(0.015) \end{bmatrix}$$

$-2 \loglikelihood(\text{IOLS Deviance}) = 14822.210(5614 \text{ of } 5833 \text{ cases in use})$

**Figure 8.53** The addition of sex showed females were higher in praise pursuits.

**Model 6: Inclusion of grade X sex interactions for praise pursuits**

$$\text{znpraise}_{yk} \sim N(\mu_{yk}, \Omega)$$

$$\text{znpraise}_{yk} = \beta_{y0k} + \beta_{y1k} \text{sex}_{yk} + \beta_{y2k} \text{grade}_{yk} + \beta_{y3k} \text{grade}_{yk}^2 + \beta_{y4k} \text{grade}_{yk}^3 + \epsilon_{yk}$$

$$\beta_{yk} = -0.11(0.038) + \nu_{yk} + \tau_{yk} + \delta_{yk}$$

$$\nu_{yk} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.024(0.009) \\ 0.024(0.009) \end{bmatrix}$$

$$\tau_{yk} \sim N(0, \Omega_{\tau}) : \Omega_{\tau} = \begin{bmatrix} 0.342(0.019) \\ 0.342(0.019) \end{bmatrix}$$

$$\delta_{yk} \sim N(0, \Omega_{\delta}) : \Omega_{\delta} = \begin{bmatrix} 0.550(0.015) \\ 0.550(0.015) \end{bmatrix}$$

$-2 \loglikelihood(\text{IOLS Deviance}) = 14821.710(5614 \text{ of } 5833 \text{ cases in use})$

**Figure 8.54** The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.

Table 8.18 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for praise pursuits.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.18(361)</td>
<td>.01(683)</td>
<td>-.12(959)</td>
<td>-.21(655)</td>
<td>-.26(269)</td>
<td>-.09(2927)</td>
</tr>
<tr>
<td>Male</td>
<td>.20(337)</td>
<td>-.02(645)</td>
<td>-.18(931)</td>
<td>-.27(589)</td>
<td>-.29(185)</td>
<td>-.12(2687)</td>
</tr>
<tr>
<td>Total</td>
<td>.19(698)</td>
<td>-.01(1328)</td>
<td>-.15(1890)</td>
<td>-.24(1244)</td>
<td>-.27(454)</td>
<td>-.10(5614)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.
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Model 6 (Figure 8.54) added the interactions of sex to the linear and quadratic effects of grade respectively as contrast variables and reported no significant sex X linear effect of grade interaction coefficients, $\beta_4 (0.013/0.022)$ and no significant sex X quadratic effect of grade interaction coefficient, $\beta_5 (-0.012/0.015)$. Including the interactions of the linear effect of grade X sex and the quadratic effect of grade X sex to the model reduced the loglikelihood statistic ($14822.21 – 14821.17$) by 1.04, $\chi^2 = (2) 1.04$. Inclusions of the interaction of grade (linear & quadratic effects) X sex did not significantly improve the model. However, it was the systematic decline that was of concern in this analysis. The responses for both males and females across grades are captured in Figure 8.18. This shows systematic declines for males and females across all grades. While females were higher in their praise pursuits in all grades compared to males, there was no significant difference between the sexes in the developmental patterns analysed.

Summary

Support was found for hypothesis 10.1 with systematic declines across grades in praise pursuits being found for adolescents. However, the significant quadratic effect was not expected, that is the reduction in the rate of decline across grades. No significant differences were identified between males and females. Although females were systematically higher in their levels of praise pursuits they were not significant and failed to support the predictions in hypothesis 10.2. Hypothesis 10.3 was not supported. Non-significant sex X grade linear interactions and non-significant sex X grade quadratic effects in praise pursuits were found. Table 8.19 presents the parameter estimates for the six progressive equations modelled for praise pursuits. Minimal variation occurred across the random parameters, after progressively adding each contrast variable, in the equations.
Model 4 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 4 for praise pursuits. Improvement in the explanatory power was not found with the addition of the fixed interactions in models 5 or 6.

Table 8.19 Progressive multilevel models for praise pursuits on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.121</td>
<td>-.120</td>
<td>-.101</td>
<td>-.116</td>
<td>-.117</td>
<td>-.112</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.120(.034)</td>
<td>-.115(.011)</td>
<td>-.116(.011)</td>
<td>-.124(.017)</td>
<td>-.123(.017)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.026(.008)</td>
<td>.026(.008)</td>
<td>.026(.008)</td>
<td>.032(.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.036(.034)</td>
<td>.037(.034)</td>
<td>.028(.036)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects Interactions</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>SexXgdelin</td>
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<td>SexXgdequad</td>
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<td></td>
<td></td>
<td>-.012(.015)</td>
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</tr>
<tr>
<td>Loglikelihood statistic</td>
<td><strong>14972.65</strong></td>
<td><strong>14842.53</strong></td>
<td><strong>14831.05</strong></td>
<td><strong>14822.21</strong></td>
<td>14821.74</td>
<td>14821.17</td>
</tr>
</tbody>
</table>

Random effects

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
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<tbody>
<tr>
<td>School</td>
<td>.023(.009)</td>
<td>.024(.009)</td>
<td>.024(.009)</td>
<td>.024(.009)</td>
<td>.024(.009)</td>
<td>.024(.009)</td>
</tr>
<tr>
<td>Student</td>
<td>.343(.019)</td>
<td>.343(.019)</td>
<td>.343(.019)</td>
<td>.343(.019)</td>
<td>.343(.019)</td>
<td>.342(.019)</td>
</tr>
<tr>
<td>Time</td>
<td>.567(.015)</td>
<td>.552(.015)</td>
<td>.550(.015)</td>
<td>.550(.015)</td>
<td>.550(.015)</td>
<td>.550(.015)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.
**Self perceptions in adolescence**

Including self-related constructs in a scale to assess and investigate adolescents’ motivational profiles should provide a more comprehensive understanding of the patterns of change associated with adolescents’ development. The early literature on achievement motivation, explained the mechanism driving motivation through a trait-like or needs-based approach. However, more contemporary literature would find these explanations limiting because the recent inclusion of cognitions allows for the incorporation of improvements in learning that has been achieved with psychological interventions related to challenging one’s misconceptions of their individual self-perceptions.

Skaalvik suggests that researchers typically emphasise that self-concept is formed through evaluations from both internal and external influences (1997). Since then a wealth of research has supported the inclusion of self-perceptions in motivation and academic achievement, inextricably linking aspects of student’s motivational pursuits with their perceptions of self-competence (Skaalvik & Bong, 2003). Research has suggested that when working towards facilitative learning, student’s perceptions of their academic competence and/or capability may impact on the degree of effort they apply in the learning environment, which may directly influence their level of motivation and performance in those endeavours. Self-concept researchers typically emphasise that self-concept is formed through reflected appraisals from significant others, social comparisons, and self-attributions (Covington, 2000; Dweck & Leggett, 1988; Schunk, 2000; Wentzel, 1999a). Therefore, during adolescence, a student’s evaluations of how efficacious they are in the learning environment may place significant restrictions on the amount of effort they apply through the types of goals they adopt (Butler, 1999).
Indeed, self-concept has been claimed to be the individual’s fundamental frame of reference and the foundation on which all actions emanate (Marsh & Craven, 1997b). Adolescent’s internalised schemas are formulated through social comparisons of the ability to evaluate and compare with others and some students will be more motivated towards learning. Developmental perspectives suggest that as one’s self-concept of ability becomes better established and more stable, this may increasingly affect adolescent’s performance through motivation and self-perceptions of capability and competence and which, in turn will ultimately impact on student’s learning practices (Skaalvik, 1997). The competitive practices and government policy employed as part of the “Strengthening the Foundations for Lifelong Learning” has reinforced an increased emphasis on performance goals in New South Wales’ (NSW) high schools from grade 7. All students in NSW are required to participate in state-wide tests focussing on English and maths, with students completing the English Language and Literacy Assessment (ELLA) test and the Secondary Numeracy Assessment Program (SNAP) test in grade 7 (Department of Education and Training NSW, 2001). Students partake in retesting of SNAP and ELLA in grade 8, with optional retesting in grade 9 (NSW Department of Education and Training, 2001). These tests are used as state-wide markers of performance in these key areas. Literacy and numeracy achievement are key determinants of schooling in New South Wales. Therefore, adolescent’s self-concept in the specific subject domains of maths and English were deemed essential components of their self-perceptions when evaluating the patterns of development in motivation across high school. Marsh’s Academic Self Descriptive Questionnaire for adolescents (ASDQII) has been strongly validated in the literature and incorporates the components of English, maths and general
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academic self-concept (Byrne, 1996; Byrne, 1998; Marsh & Byrne, 1993; Marsh, Parada, & Ayotte, 2004).

**English self-concept within motivation**

*Introduction*

English self-concept has been regarded in the literature as associated with the development of adolescent’s sense of competence in the domain specific subject area of English (Marsh, 1990b). Hypothesis 11.1, 11.2 and 11.3 all relate to the factor of English self-concept. Hypothesis 11.1, there should be gradual declines evidenced in English self-concept during early adolescence until grade 9, and then a plateauing should occur (between grade 9 and 10) with gradual recovery in grade 11. Hypothesis 11.2., suggested that males will have lower levels of English self-concept compared to females. Hypothesis 11.3., suggests that the interactions of sex and grade should show disparate trends between males and females in English self-concept with females occasioning higher levels across all grades. In addition, females should show evidence of recovery from the initial declines earlier than males. Four models will be presented to demonstrate the pattern of English self-concept for adolescents to answer the abovementioned hypotheses. English self-concept’s complete six models (see Table 8.21) will be presented for the individual parameter estimates and standard errors in the fixed variables and random component for each model.
Model 1: Baseline variance components model for English self-concept

$\text{znengse}_{ijk} \sim N(xE, \Omega)$

$\text{znengse}_{ijk} = \beta_{0ijk} + v_{ijk} + \mu_{ijk} + e_{ijk}$

$[v_{ijk}] \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.054 & 0.017 \\ 0.017 & 0.026 \end{bmatrix}$

$[\mu_{ijk}] \sim N(0, \Omega_\mu) : \Omega_\mu = \begin{bmatrix} 0.361 & 0.016 \\ 0.016 & 0.026 \end{bmatrix}$

$[e_{ijk}] \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.396 & 0.011 \\ 0.011 & 0.026 \end{bmatrix}$

$-2 \times \text{loglikelihood(JGLS Deviance)} = 13661.040 (5628 \text{ of } 5833 \text{ cases in use})$

Figure 8.55 The baseline variance components model for English self-concept.

Model 1 the baseline variance components model reported a mean intercept, $\beta_{0i}$, for English self-concept (Figure 8.55) of -.038 (SE = .043). This standardised intercept value suggests that even at the commencement of high school the line of best fit is negatively represented for English self-concept. Although a degree of variability exists, this dimension is generally a negative factor for students starting high school compared to the other factors of the SMOSA. The three random levels presented by $v_{0k} = 54/811 = 7\%$ for level 3 the school, $w_{0jk} = 361/811 = 45\%$ for level 2 the student, and $e_{0ijk} = 396/811 = 48\%$ at level 1 Time.

The equation presented in Model 3 (Figure 8.56) for English self-concept added the linear and quadratic effects across grades to Model 1 to evaluate hypothesis 11.1. The inclusion of the linear contrasts reported significant linear grade coefficients $\beta_1$, ($-.093/0.010 = -9.30, p < .001$) but no significant quadratic grade coefficients, $\beta_2$ ($0.000/0.007$). The strong negative linear effect and non significant quadratic effect suggests that strong progressive declines across grades 7 to 11 occurred in a systematic nature. Figure 8.57 demonstrated graphically the pattern of change across grade in English self-concept. Including the variables of the linear and quadratic effects of grade to the model reduced the loglikelihood statistic (13661.04 –
Achievement motivation

13556.05) in Model 3 compared to the baseline model (Model 1). $\chi^2 = (2) = 104.99$, $p < .001$. The addition of the linear and quadratic effects of grade found significant improvement in the explanatory power of the revised model however, this was mainly through the linear effect of grades (see Table 8.21). Hypothesis 11.1 was supported with declines being found across grades in English self-concept. The predicted reduction in the rate of those declines in Hypothesis 11.1 around grades 10 to 11 however, was not found.

**Model 3: Inclusion of linear and quadratic effects for grade in English self-concept**

$znengsc_{jk} \sim N(\chi^2, \Omega)$

$znengsc_{jk} = \beta_{0jk} + \beta_{1jk} + \beta_{2jk} + \epsilon_{0jk}$

$\beta_{0jk} = -0.093(0.010) + \beta_{1jk} = 0.000(0.007) + \beta_{2jk}$

$\left[ \begin{array}{c} \gamma_{0jk} \\ \mu_{0jk} \\ \epsilon_{0jk} \end{array} \right] \sim N(0, \Omega_r) : \Omega_r = \left[ \begin{array}{c} 0.042(0.014) \\ 0.362(0.016) \\ 0.388(0.010) \end{array} \right]$

$-2 \log likelihood(IGLS Deviance) = 13556.050(5620 of 5833 cases in use)$

**Figure 8.56** Shows the analysis with linear and quadratic effects of grade added.

**Figure 8.57** The graphical representation of the pattern of systematic declines across grades 7-11 for English self-concept.
Model 4 (Figure 8.58) included the variable of sex and reported significant differences in sex coefficients $\beta_3 (0.095/0.033 = 2.88, p < .01)$. Females reported significantly higher levels of English self-concept by .095 standard deviation units on average above males, thus supporting hypothesis 11.2. By adding sex to the model a significant reduction in the loglikelihood statistic ($13556.05 - 13545.82$), $\chi^2 = 10.23, p < .01$, was found which significantly improved the explanatory power of the revised model.

**Model 4: Inclusion of the effects of sex in English self-concept**

$$
\text{znengsc}_{ijk} \sim N(\chi^2, \Omega)
$$

$$
\text{znengsc}_{ijk} = \beta_{0ijk} + \text{cons} + -0.093(0.010)\text{gdelin}_{ijk} + -0.001(0.007)\text{gdequad}_{ijk} + 0.095(0.033)\text{sex}_{ijk}
$$

$$
\beta_{0ijk} = -0.080(0.043) + \nu_{0k} + \mu_{ijk} + \epsilon_{0ijk}
$$

$$
[\nu_{0k}] \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.045(0.014) \end{bmatrix}
$$

$$
[u_{ijk}] \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.359(0.016) \end{bmatrix}
$$

$$
[e_{0ijk}] \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.388(0.010) \end{bmatrix}
$$

$-2 \times \text{loglikelihood(TGLS Deviance)} = 13545.820 (5619 \text{ of 5833 cases in use})$

**Figure 8.58** Significant differences are shown with the addition of sex, where females had higher levels of English self-concept compared to males.

**Model 6: Inclusion of grade X sex interactions for English self-concept**

$$
\text{znengsc}_{ijk} \sim N(\chi^2, \Omega)
$$

$$
\text{znengsc}_{ijk} = \beta_{0ijk} + \text{cons} + -0.103(0.015)\text{gdelin}_{ijk} + -0.001(0.010)\text{gdequad}_{ijk} + 0.097(0.034)\text{sex}_{ijk} + 0.018(0.020)\text{gdelin}\text{.sex}_{ijk} + 0.001(0.013)\text{gdequad}\text{.sex}_{ijk}
$$

$$
\beta_{0ijk} = -0.082(0.043) + \nu_{0k} + \mu_{ijk} + \epsilon_{0ijk}
$$

$$
[\nu_{0k}] \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.045(0.014) \end{bmatrix}
$$

$$
[u_{ijk}] \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.359(0.016) \end{bmatrix}
$$

$$
[e_{0ijk}] \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.388(0.010) \end{bmatrix}
$$

$-2 \times \text{loglikelihood(TGLS Deviance)} = 13545.020 (5619 \text{ of 5833 cases in use})$

**Figure 8.59** The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.
Table 8.20 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for English self-concept.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.19(352)</td>
<td>.10(681)</td>
<td>.02(973)</td>
<td>-.07(666)</td>
<td>-.16(273)</td>
<td>.02(2945)</td>
</tr>
<tr>
<td>Male</td>
<td>.12(332)</td>
<td>.02(639)</td>
<td>-.08(925)</td>
<td>-.18(591)</td>
<td>-.29(187)</td>
<td>-.07(2674)</td>
</tr>
<tr>
<td>Total</td>
<td>.15(684)</td>
<td>.06(1320)</td>
<td>-.03(1898)</td>
<td>-.12(1257)</td>
<td>-.21(460)</td>
<td>-.02(5619)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.

The equation presented in Model 6 (Figure 8.59) systematically added the interaction of sex to the linear and quadratic effects of grade respectively as contrast variables but reported no significant sex X linear effect of grade interaction coefficients, $\beta_4 (.018/.020)$ and no significant sex X quadratic effect of grade interaction coefficients, $\beta_5 (.001/.013)$. Including the interactions of the linear effect of grade X sex and the quadratic effect of grade X sex to the model did not significantly reduce the loglikelihood statistic (13545.82 – 13545.02) between Model 6 and Model 4, $\chi^2 = (2) .80$. Therefore, while females were higher across all grades in English self-concept than males and significantly different overall in the fixed effect of sex; males and females did not present disparate patterns across grades in the interaction effects of English self-concept. The predicted recovery in English self-concept was not found in the results of the non significant quadratic effects of grade as evidenced in Figure 8.57. Therefore hypothesis 11.1 was partially supported, with linear effects only and hypothesis 11.2 was supported. The main effect of females was significantly higher than males but not individually across grades through interaction effects. Hypothesis 11.3 was not supported with non significant interaction terms for both the linear grade X sex and quadratic grade X sex parameter estimates. Figure 8.60 shows that while females were systematically higher across all grades than males, disparate patterns of development did not emerge between them. Table 8.20 shows the means for males and females across grades 7 – 11. Figure 8.61 shows
the similarity in the declines evidenced for males and females across grades, through
the level 2 random effects of the student within school level analysis but identifies
that a larger spread on the negative side of English self-concept is identified for
males.

Figure 8.60 The graphical representation of the pattern of systematic declines across
grades 7-11 for English self-concept for males and females. Females are the higher
line.
Summary

Support was partially found for hypothesis 11.1 with systematic declines across grades in English self-concept for adolescents. The predicted plateauing between grade 9 and grade 10 and the predicted recovery by grade 11 were not found. Support was found for hypothesis 11.2 where females were higher than males across all grades. Hypothesis 11.3 was not supported with non significant differences identified in the interaction terms between males and females across grades for English self-concept. The difference was by degree rather than direction and the pattern of change followed similar trajectories for males and females. For an overview of the parameter
estimates for the six progressive equations modelled for English self-concept see Table 8.21 and graphical representation may be seen in Figure 8.60.

Model 4 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 4 for English self-concepts. Improvement in the explanatory power was not found with the addition of the fixed effect in models 5 or 6.

Table 8.21 Progressive multilevel models for English self-concept on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.038</td>
<td>-.043</td>
<td>-.043</td>
<td>-.080</td>
<td>-.082</td>
<td>-.082</td>
</tr>
</tbody>
</table>

Fixed effects

- Gdelin: 
  - .093(.010)
  - .093(.010)
  - .093(.010)
  - .103(.015)
  - .103(.015)

- Gdequad: 
  - .000(.007)
  - .001(.007)
  - .001(.007)
  - .001(.007)

- Sex: 
  - .095(.033)
  - .097(.033)
  - .097(.034)

Fixed effects Interactions

- SexXgdelin: 
  - .017(.019)
  - .018(.020)

- SexXgdequad: 
  - .001(.013)

Loglikelihood statistic

<table>
<thead>
<tr>
<th></th>
<th>13661.04</th>
<th>13556.05</th>
<th>13556.05</th>
<th>13545.82</th>
<th>13545.01</th>
<th>13545.02</th>
</tr>
</thead>
</table>

Random effects

- School: 
  - .054(.017) 
  - .042(.014) 
  - .042(.014) 
  - .045(.014) 
  - .045(.014) 
  - .045(.014) 

- Student: 
  - .361(.016) 
  - .362(.016) 
  - .362(.016) 
  - .359(.016) 
  - .359(.016) 
  - .359(.016) 

- Time: 
  - .396(.011) 
  - .396(.011) 
  - .388(.010) 
  - .388(.010) 
  - .388(.010) 
  - .388(.010) 

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in bold.
Maths self-concept within motivation

Introduction

Maths self-concept has been regarded in the literature as associated with the development of an adolescent’s sense of competence within the domain specific academic environment of Mathematics (Marsh, 1990b). Hypothesis 12.1, 12.2 and 12.3 all relate to the factor of maths self-concept. Hypothesis 12.1., suggested there should be gradual declines evidenced in maths self-concept during early adolescence (from grade 7) up to and including grade 9, and then a plateauing should occur (between grade 9 and 10) with gradual recovery in grade 11. Hypothesis 12.2., suggested that males would have higher levels of maths self-concept compared to females. Hypothesis 12.3., suggested the interactions of sex and grade should show disparate trends in maths self-concept with males having higher levels across all grades.

Model 1: Baseline variance components model for maths self-concept

\[ \mathbf{znmathse}_{gk} \sim N(\mathbf{X} \mathbf{B}, \Omega) \]

\[ \mathbf{znmathse}_{gk} = \mathbf{\beta}_{0g} + \mathbf{\nu}_{gk} + \mathbf{\mu}_{gk} + \mathbf{\epsilon}_{g0k} \]

\[ \begin{bmatrix} \mathbf{\nu}_{0k} \\ \mathbf{\mu}_{0k} \\ \mathbf{\epsilon}_{0gk} \end{bmatrix} \sim N(\mathbf{0}, \begin{bmatrix} \Omega_{\nu} & \Omega_{\mu} & \Omega_{\epsilon} \\ \Omega_{\mu} & \Omega_{\mu} & \Omega_{\epsilon} \\ \Omega_{\epsilon} & \Omega_{\epsilon} & \Omega_{\epsilon} \end{bmatrix}) \]

\[ \begin{bmatrix} \Omega_{\nu} = 0.043(0.015) \\ \Omega_{\mu} = 0.519(0.022) \\ \Omega_{\epsilon} = 0.497(0.013) \end{bmatrix} \]

\[-2^{\text{loglikelihood(IGLS Deviance)}} = 15234.760 \text{(5652 of 5833 cases in use)} \]

Figure 8.62 The baseline variance components model for maths self-concept.

Four models will be presented to demonstrate the pattern of maths self-concept for adolescents to answer the abovementioned hypotheses. To view the individual parameter estimates and standard errors for the fixed variables and random
component of maths self-concept’s full six models see Table 8.23. Model 1 the baseline variance components model reported a mean intercept, \( \beta_0 \), for maths self-concept (Figure 8.62) of \(-0.229\) (SE = .042). Therefore, after standardization of the 12-factor SMOSA scale, this negative value at the intercept suggests that maths self-concept was viewed lower than other factors in the scale. The three random levels presented by \( \nu_{0k} = 0.043/1059 = 4\% \) for level 3 the school, \( u_{0jk} = 0.519/1059 = 49\% \) for level 2 the student, and \( e_{0ijk} = 0.497/1059 = 47\% \) at level 1 Time.

**Model 3: Inclusion of linear and quadratic effects for grade in maths self-concept**

\[
\begin{align*}
z_{\text{maths}_{ijk}} & \sim \mathcal{N}(X\beta, \Omega) \\
z_{\text{maths}_{ijk}} &= \beta_{0jk} + \beta_{1jk}g_{\text{lin}_{ijk}} + \beta_{2jk}g_{\text{quad}_{ijk}} + \nu_{0jk} + \mu_{0jk} + \epsilon_{0jk} \\
\beta_{0jk} &= -0.207(0.041) + \nu_{0jk} + \mu_{0jk} + \epsilon_{0jk} \\
\nu_{0jk} &\sim \mathcal{N}(0, \Omega_\nu) : \Omega_\nu = 0.042(0.015) \\
\mu_{0jk} &\sim \mathcal{N}(0, \Omega_\mu) : \Omega_\mu = 0.517(0.022) \\
\epsilon_{0jk} &\sim \mathcal{N}(0, \Omega_\epsilon) : \Omega_\epsilon = 0.486(0.013) \\
\end{align*}
\]

\(-2\times\text{loglikelihood}(IGLS Deviance) = 15122.080(5644 \text{ of } 5833 \text{ cases in use})\)

Figure 8.63 Shows the analysis with linear and quadratic effects of grade added.

Figure 8.64 The graphical representation of the pattern of change in the slope across grades 7-11 for maths self-concept.
Achievement motivation

The equation presented in Model 3 (Figure 8.63) for maths self-concept added the linear and quadratic effects across grades to Model 1 to evaluate hypothesis 12.1. The inclusion of the linear contrasts reported significant linear grade coefficients, $\beta_1 (-.088/.011 = -8.00, p < .001)$ and significant quadratic grade coefficients, $\beta_2 (.027/.007 = 3.86, p < .001)$. The strong negative linear effect and significant quadratic effect suggests that progressive declines occurred across grades but recovery or a plateauing in the nature of declines was evidenced between grade 10 and 11 as predicted in hypothesis 12.1. Figure 8.64 demonstrated graphically the pattern of change across grade in maths self-concept. Including the variables of the linear and quadratic effects of grade to the model reduced the loglikelihood statistic $(15234.76 – 15122.08)$ in Model 3 compared to the baseline model, $\chi^2 = (2) = 112.68, p < .001$, found significant improvement in the explanatory power of the revised model. Hypothesis 12.1 was supported with systematic declines found across grades in maths self-concept and the suspected recovery by grade 11 occurred. The expected change in the gradient of the slope with a lessening in the rate of decline at about grade 9 occurred at grade 10 with evidence of recovery around grade 11 in maths self-concept in this sample.

Model 4: Inclusion of the effects of sex in maths self-concept

$\text{zmaths}_{jk} \sim N(\mu, \Omega)$

$\text{zmaths}_{jk} = \beta_{0jk} \text{cons} + -0.085(0.011) \text{gdelin}_{jk} + 0.029(0.007) \text{gdequad}_{jk} + -0.355(0.037) \text{sex}_{jk}$

$\beta_{0jk} = -0.057(0.041) + \psi_{0jk} + \nu_{0jk} + \epsilon_{0jk}$

$\begin{bmatrix} \psi_{0jk} \end{bmatrix} \sim N(0, \Omega_{\psi}) : \Omega_{\psi} = \begin{bmatrix} 0.033(0.012) \end{bmatrix}$

$\begin{bmatrix} \nu_{0jk} \end{bmatrix} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.493(0.021) \end{bmatrix}$

$\begin{bmatrix} \epsilon_{0jk} \end{bmatrix} \sim N(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = \begin{bmatrix} 0.486(0.013) \end{bmatrix}$

$-2 \Delta \text{loglikelihood} (\text{ICLS Deviance}) = 15027.080 \text{ of 5833 cases in use}$

Figure 8.65 Significant differences are shown with the addition of sex, where males had higher levels of maths self-concept compared to females.
Model 4 (Figure 8.65) included sex and reported significant differences in sex coefficients $\beta_3 (-.355/.037 = -9.95, \ p < .001)$. Males reported significantly higher levels of maths self-concept compared to females supporting hypothesis 12.2. Males had a greater degree of variability (see Figure 8.66) across grades and overall were higher than females at each grade level. Males reported higher maths self-concept across all grades in their perceptions of performance in maths. Adding sex in the revised model reported a significant reduction in the loglikelihood statistic ($15122.08 - 15037.08), \chi^2 = (1) 85.0, \ p < .001$, comparing Model 3 to Model 4.

![Graphs showing variation in maths self-concept for females and males across grades](image)

*Figure 8.66 Variation graphed for females and males in maths self-concept across grades for each time collection for each student to highlight the variation that exists.*
Table 8.22 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for maths self-concept.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>-.20(353)</td>
<td>-.36(682)</td>
<td>-.46(975)</td>
<td>-.52(666)</td>
<td>-.53(272)</td>
<td>-.43(2948)</td>
</tr>
<tr>
<td>Male</td>
<td>.18(334)</td>
<td>.00(638)</td>
<td>-.12(945)</td>
<td>-.17(590)</td>
<td>-.16(187)</td>
<td>-.07(2694)</td>
</tr>
<tr>
<td>Total</td>
<td>-.01(687)</td>
<td>-.18(1320)</td>
<td>-.30(1920)</td>
<td>-.36(1256)</td>
<td>-.38(459)</td>
<td>-.26(5642)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.

**Model 6: Inclusion of grade X sex interactions for maths self-concept**

\[
\begin{align*}
\text{zmathsc}_{jk} & \sim N(0, \Omega) \\
\text{zmathsc}_{jk} & = \beta_{0j} + \gamma_{jk} + \mu_{jk} + \varepsilon_{jk}
\end{align*}
\]

\[
\begin{align*}
\gamma_{jk} & \sim N(0, \Omega_\gamma) : \Omega_\gamma = \begin{bmatrix} 0.033 & 0.012 \end{bmatrix} \\
\mu_{jk} & \sim N(0, \Omega_\mu) : \Omega_\mu = \begin{bmatrix} 0.493 & 0.021 \end{bmatrix} \\
\varepsilon_{jk} & \sim N(0, \Omega_\varepsilon) : \Omega_\varepsilon = \begin{bmatrix} 0.486 & 0.019 \end{bmatrix}
\end{align*}
\]

\[-2\text{Loglikelihood}(\text{OLS Deviance}) = 15026.800 (5642 of 5833 cases in use)\]

*Figure 8.67 The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.*

*Figure 8.68 MLwiN using the full equation from Model 8 as the prediction upon which the points were graphed. Females were lower in maths self-concept than males consistently across grades 7 to 11. There is evidence of recovery around grade 11 for males.*
The equation presented in Model 6 (Figure 8.67) added the interaction of sex to the linear and quadratic effects of grade. No significant sex X linear effect of grade interaction coefficients, $\beta_4 (-.001/.022)$ and no significant sex X quadratic effect of grade interaction coefficient, $\beta_5 (-.008/.015)$ effects across grades were found. Including the interactions of the linear effect of grade X sex and the quadratic effect of grade X sex to the model did not significantly reduce the loglikelihood statistic $(15027.08 – 15026.80)$ comparing Model 6 to Model 4, $\chi^2 = (2) 0.28$. These results do not support hypothesis 12.3 which predicted that a different pattern of motivational pursuits in maths self-concept would occur between males and females. These findings suggest that a similar pattern emerged for them of initial declines across grades as shown in the cumulative analyses and the graphical presentation (see Figure 8.68). Table 8.22 shows the means for males and females across grades 7 to 11. However, while a similar pattern in the nature of change emerged for males and females in maths self-concept across grades, this was as a difference between the levels of the slopes for males and females rather than in different patterns emerging (see Figure 8.68).

**Summary**

Support was found for hypothesis 12.1 with declines across grades in maths self-concept for adolescents with the predicted recovery by grade 11 occurring, evidenced in the significant quadratic effect at the grade level analysis. There was a gradual lessening in the rate of decline in maths self-concept evidenced between grade 10 and grade 11 with possible recovery. Support was also found for hypothesis 12.2 where males were significantly higher than females in maths self-concept. Hypothesis 12.3 was not supported because in maths self-concept, no significant sex X grade linear or quadratic interactions were found. In addition, no
significant deviance in the loglikelihood statistic was found at the interaction level analysis (Model 6). Across the grades females were systematically lower in maths self-concept than males. A difference emerged by degree between males and females rather than in disparate patterns in the development of maths self-concept across the grades (see Figure 8.68). Minimal variation occurred across the random parameters, after progressively adding each contrast variable, in the subsequent equations. Females were systematically lower in their levels of maths self-concept compared to males and there was significantly greater spread across responses for males compared to females.

Model 4 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 4 for maths self-concept. Improvement in the explanatory power was not found with the addition of the fixed interactions in models 5 or 6.

Table 8.23 Progressive multilevel models for maths self-concept on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.229</td>
<td>-.228</td>
<td>-.207</td>
<td>-.057</td>
<td>-.058</td>
<td>-.054</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.092(.011)</td>
<td>-.088(.011)</td>
<td>-.085(.011)</td>
<td>-.087(.017)</td>
<td>-.085(.017)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.027(.007)</td>
<td>.029(.007)</td>
<td>.028(.007)</td>
<td>.033(.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-.355(.037)</td>
<td>-.355(.037)</td>
<td>-.355(.037)</td>
<td>-.360(.039)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdelin</td>
<td>.002(.022)</td>
<td>.001(.022)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdequad</td>
<td>-.008(.015)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loglikelihood statistic</td>
<td>15234.76</td>
<td>15135.04</td>
<td>15122.08</td>
<td>15027.08</td>
<td>15027.07</td>
<td>15026.80</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>.043(.015)</td>
<td>.042(.015)</td>
<td>.042(.015)</td>
<td>.033(.012)</td>
<td>.033(.012)</td>
<td>.033(.012)</td>
</tr>
<tr>
<td>Student</td>
<td>.519(.022)</td>
<td>.517(.022)</td>
<td>.517(.022)</td>
<td>.493(.021)</td>
<td>.493(.021)</td>
<td>.493(.021)</td>
</tr>
<tr>
<td>Time</td>
<td>.497(.013)</td>
<td>.488(.013)</td>
<td>.486(.013)</td>
<td>.486(.013)</td>
<td>.486(.013)</td>
<td>.486(.013)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in bold.
**General academic self-concept**

**Introduction**

General academic self-concept has been regarded in the literature as associated with the development of an adolescent’s sense of competence within the academic environment generally across subjects. Hypothesis 13.1., there should be gradual declines evidenced in general academic self-concept during early adolescence (from grade 7) up to and including grade 9, and then a plateauing should occur (between grade 9 and 10) with gradual recovery in grade 11. Hypothesis 13.2., males should have higher general academic self-concept than females. Hypothesis 13.3., suggests that the interactions of sex and grade should show disparate patterns in general academic self-concept with males having higher levels across grades. Therefore, differences in magnitude and/or direction should emerge in general academic self-concept between males and females across grades.

**Model 1: Baseline variance components model for general academic self-concept**

\[
\begin{align*}
\text{zn} \text{ge} \text{nacsc}_{jk} & \sim \text{N}(X\beta, \Omega) \\
\beta_{0jk} & = \beta_{0jk}\text{cons} \\
\beta_{0jk} & = 0.236(0.042) + \nu_{0jk} + \mu_{0jk} + \epsilon_{0jk} \\
\nu_{0jk} & \sim \text{N}(0, \Omega_\nu) \\
\mu_{0jk} & \sim \text{N}(0, \Omega_\mu) \\
\epsilon_{0jk} & \sim \text{N}(0, \Omega_\epsilon)
\end{align*}
\]

\[
-2\text{loglikelihood(IGLS Deviance)} = 10951.010 \text{ of 5833 cases in use}
\]

Figure 8.69 The baseline variance components model for general academic self-concept.

Four models will be presented to demonstrate the pattern of general academic self-concept for adolescents to answer the abovementioned hypotheses. To view the
output for all general academic self-concept’s models see Table 8.25 where the individual parameter estimates and standard errors for the fixed variables and parameter estimates for the random component of the models will be presented.

Model 1 the baseline variance components model reported a mean intercept, $\beta_0$, for general academic self-concept (Figure 8.69) of .236 (SE = .042). Therefore, after standardization of the 12-factor SMOSA scale, general academic self-concept was viewed comparatively higher than other factors in the overall scale. The three random levels presented by $v_{0k} = .056/617 = 9\%$ for level 3 the school, $u_{0jk} = .278/617 = 49\%$ for level 2 the student, and $e_{0ijk} = .283/617 = 46\%$ at level 1 Time.

\[ Model 3: \text{Inclusion of linear & quadratic effects for grade in general academic self-concept} \]

\[ z_{\text{genacsc}}_{ijk} \sim N(\mathcal{X}_{\beta}, \Omega) \]

\[ z_{\text{genacsc}}_{ijk} = \beta_{\text{cons}} + -0.041(0.009)g_{\text{delin}}_{ijk} + 0.012(0.006)g_{\text{quad}}_{ijk} \]

\[ \beta_{0jk} = 0.244(0.040) + v_{0k} + u_{0jk} + e_{0ijk} \]

\[ [v_{0k}] \sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix} 0.049(0.015) \end{bmatrix} \]

\[ [u_{0jk}] \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.277(0.013) \end{bmatrix} \]

\[ [e_{0ijk}] \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.281(0.008) \end{bmatrix} \]

\[-2\text{loglikelihood (IGLS Deviance)} = 10903.980 (5132 \text{ of 5833 cases in use})\]

Figure 8.70 Shows the analysis with linear and quadratic effects of grade added.
The equation presented in Model 3 (Figure 8.70) added the linear and quadratic effects across grades to the baseline variance components model for general academic self-concept to evaluate whether a change in the gradient of the slope occurred around grade 9 and whether recovery occurred as predicted in Hypothesis 13.1. The inclusion of the linear contrasts reported a significant linear grade coefficient, $\beta_1 (-.041/.009 = -4.20, p < .001)$ and non-significant quadratic grade coefficient, $\beta_2 (.012/.006 = 2.00)$ at .01 level. The linear effect suggests progressive declines across grades occurred (see Figure 8.71). The quadratic analysis across grades found a non-significant effect. Although a change in the rate of decline did occur as predicted in Hypothesis 13.1 it was not significantly different. The quadratic effect of recovery towards the latter grades in high school was less than previously identified in past research. Including the variables of the linear effect and quadratic effects of grade to the model significantly improved the loglikelihood statistic ($10951.01 - 10903.98$) between Model 3 and Model 1, $\chi^2 = (2) 47.03, p < .001$. Thus, the revised modelled equation provided greater explanatory power with the addition of grades to the equation for general academic self-concept (see Table 8.25).

Figure 8.71 The graphical representation of the pattern of the slope across grades 7-11 for general academic self-concept.
Model 4: Inclusion of the effects of sex in general academic self-concept

\[ \text{zgenacsc}_{ijk} \sim N(\mu, \Omega) \]

\[ \text{zgenacsc}_{ijk} = \beta_{0ijk} + \beta_{1ijk} \text{cons} + \beta_{2ijk} \text{gdelin}_{ijk} + \beta_{3ijk} \text{gdequad}_{ijk} + \beta_{4ijk} \text{sex}_{jk} \]

\[ \beta_{0ijk} = 0.274(0.041) + \nu_{0k} + \omega_{0jk} + \epsilon_{0jk} \]

\[ \nu_{0k} \sim N(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.046(0.014) \end{bmatrix} \]

\[ \omega_{0jk} \sim N(0, \Omega_\omega) : \Omega_\omega = \begin{bmatrix} 0.277(0.013) \end{bmatrix} \]

\[ \epsilon_{0jk} \sim N(0, \Omega_\epsilon) : \Omega_\epsilon = \begin{bmatrix} 0.281(0.008) \end{bmatrix} \]

\(-2\times\text{loglikelihood}(ICELS Deviance) = 10896.590(5132 \text{ of } 5833 \text{ cases in use})\)

Figure 8.72 Significant differences are shown with the addition of sex, where males had higher levels of general academic self-concept compared to females.

Model 4 (Figure 8.72) reported significant differences in sex coefficients, \(\beta_3\), (-.080/.029 = -2.76, \(p < .01\)). These results show that males reported significantly higher levels of general academic self-concept compared to females of .08 standard deviation units on average above males, supporting hypothesis 13.2. Females tended to show less variability in their responses (see Figure 8.73) in the student within school random effects graphs. The darker shading around the mean (0.00) is noted for females compared to males in Figure 8.73. By adding sex to the model the loglikelihood statistic significantly reduced (10903.98 – 10896.59) \(\chi^2 = 1\) 7.39, \(p < .01\). Model 4 provided improved explanatory power with the addition of sex to the modelled equation.
Figure 8.73 Variation graphed for females and males in general academic self-concept across grades for each time collection for each student highlighting the existing variation.

Table 8.24 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for general academic self-concept.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.30(259)</td>
<td>.22(614)</td>
<td>.17(884)</td>
<td>.14(662)</td>
<td>.15(268)</td>
<td>.18(2689)</td>
</tr>
<tr>
<td>Male</td>
<td>.38(255)</td>
<td>.31(375)</td>
<td>.25(847)</td>
<td>.22(582)</td>
<td>.20(186)</td>
<td>.27(2445)</td>
</tr>
<tr>
<td>Total</td>
<td>.34(514)</td>
<td>.26(1189)</td>
<td>.21(1731)</td>
<td>.18(1244)</td>
<td>.17(454)</td>
<td>.22(5132)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.

Model 6 (Figure 8.74) added the interaction of sex to the linear and quadratic effects of grade respectively and reported no significant sex X grade (linear)
Achievement motivation

interaction coefficients, $\beta_4$ (-.005/.018), and no significant sex X grade (quadratic) interaction coefficients, $\beta_5$ (.006/0.012). Means for each grade level for males and females are presented in Table 8.24. These results do not support previous literature’s findings that different patterns of general academic self-concept emerge between males and females. The non significant interactions indicate that while a difference emerged in the significant sex coefficient, it is by degree with males reporting higher levels of general academic self-concept compared to females. The pattern of development that is the rate of decline follows a similar trajectory across the grades. Males and females showed progressive declines across grades with little variation in the pattern of those declines as a factor of grade with the non significant quadratic effect. The addition of the interactions of grade linear X sex and grade quadratic X sex in the model did not significantly reduce the loglikelihood statistic ($10896.59 - 10896.36$) comparing Model 6 to Model 4, $\chi^2 = (2) 0.23$. The findings are presented in the cumulative analyses and the graphical presentation in Figure 8.75.

**Model 6: Inclusion of grade X sex interactions for general academic self-concept**

\[
zm_{gen{\text{acs}}}_{jk} \sim N(0, \Omega)
\]

\[
zm_{gen{\text{acs}}}_{jk} = \beta_{0jk} \text{cons} + \text{-0.045(0.014)gdeleak}_{jk} + 0.010(0.009)gdequad_{jk} + \text{-0.076(0.031)sex}_{jk} + 0.006(0.018)sexgdeleak}_{jk} + 0.005(0.012)sexgdequad}_{jk}
\]

\[
\beta_{0jk} = 0.272(0.041) + \nu_{0k} + \mu_{0k} + \epsilon_{0k}
\]

\[
\begin{bmatrix}
\nu_{0k}
\end{bmatrix} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix}
0.046(0.014)
\end{bmatrix}
\]

\[
\begin{bmatrix}
\mu_{0k}
\end{bmatrix} \sim N(0, \Omega_{\mu}) : \Omega_{\mu} = \begin{bmatrix}
0.277(0.013)
\end{bmatrix}
\]

\[
\begin{bmatrix}
\epsilon_{0k}
\end{bmatrix} \sim N(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = \begin{bmatrix}
0.268(0.008)
\end{bmatrix}
\]

-2LogLikelihood(TOIS Deviance) = 10896.360(5132 of 5833 cases in use)

**Figure 8.74** The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.
Partial support was found for hypothesis 13.1 with progressive declines found across grades in general academic self-concept for this adolescent population. The predicted recovery in general academic self-concept did not occur and although there was a trend towards recovery, the identified quadratic effect was not significant.

Support was found for hypothesis 13.2 where males were significantly higher than females. Hypothesis 13.3 was not supported. Across grades, females were systematically lower in general academic self-concept than males. The patterns in the rate of declines for both males and females across grades did not deviate significantly.

The significant sex X grade linear interactions and significant sex X grade quadratic interactions in general academic self-concept hypothesised did not emerge. Minimal variation occurred across the random parameters, after progressively adding each contrast variable, to the subsequent equations. For an overview of the parameter estimates of the six progressive equations modelled for general academic self-concept see Table 8.25. Model 4 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood...
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Statistic up and including model 4 for general academic self-concept. Improvement in the explanatory power was not found with the addition of the fixed interactions in models 5 or 6.

Table 8.25 Progressive multilevel models for general academic self-concept on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.236</td>
<td>.235</td>
<td>.244</td>
<td>.274</td>
<td>.274</td>
<td>.272</td>
</tr>
</tbody>
</table>

**Fixed effects**

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gdelin</td>
<td>-.042(.009)</td>
<td>-.041(.009)</td>
<td>-.041(.009)</td>
<td>-.044(.014)</td>
<td>-.045(.014)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.012(.006)</td>
<td>.012(.006)</td>
<td>.012(.006)</td>
<td>.012(.006)</td>
<td>.010(.009)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>.080(.029)</td>
<td>.080(.029)</td>
<td>.080(.029)</td>
<td>.080(.029)</td>
<td>.076(.031)</td>
<td></td>
</tr>
</tbody>
</table>

**Fixed effects Interactions**

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>SexXgdelin</td>
<td>.006(.018)</td>
<td>.006(.018)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Loglikelihood statistic**

|      | 10951.01 | 10907.77 | 10903.98 | 10896.59 | 10896.49 | 10896.36 |

**Random effects**

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>.056(.016)</td>
<td>.049(.015)</td>
<td>.049(.015)</td>
<td>.046(.014)</td>
<td>.046(.014)</td>
<td>.046(.014)</td>
</tr>
<tr>
<td>Student</td>
<td>.278(.013)</td>
<td>.277(.013)</td>
<td>.277(.013)</td>
<td>.277(.013)</td>
<td>.277(.013)</td>
<td>.277(.013)</td>
</tr>
<tr>
<td>Time</td>
<td>.283(.008)</td>
<td>.282(.008)</td>
<td>.281(.008)</td>
<td>.281(.008)</td>
<td>.281(.008)</td>
<td>.281(.008)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.
Self-efficacy - PAC (Perceived Academic Capability)

Introduction

The Perceived Academic Capability (PAC) is a newly revised measure adapted from McInerney’s Sense of Self Scales (discussed in Chapter 6) that measures student’s perceptions of capability. Hypothesizing the findings on this measure was therefore gauged on applying patterns that were similarly predicted in the preceding self-concept measures of the quadratic effect emerging. Hypothesis 14.1., suggests there should be gradual declines evidenced in PAC during early adolescence (from grade 7) up to and including grade 9, and then a plateauing should occur (between grade 9 and 10) with gradual recovery in grade 11. Hypothesis 14.2., suggested males should report higher levels of PAC than females, given females tendency to underestimate self evaluations and males’ tendency to overestimate reports of self-perceptions in self-report inventories. Hypothesis 14.3., suggests that differences in the patterns of declines should emerge across grades between males and females in PAC. Lower levels of PAC should be evidenced for females compared to males across the ordered grades, given female’s tendency to underestimate self reports of self-perceptions compared to males.

Model 1: Baseline variance components model for PAC

\[ \text{zapas}_{jk} \sim N(XB, \Omega) \]

\[ \text{zapas}_{jk} = \beta_{0jk} + \nu_{0k} + \nu_{0jk} + \epsilon_{0jk} \]

\[
\begin{bmatrix}
\nu_{0k} \\
\nu_{0jk} \\
\epsilon_{0jk}
\end{bmatrix}
\sim N(0, \Omega_v) : \Omega_v = \begin{bmatrix}
0.023 & (0.008) \\
0.219 & (0.011) \\
0.277 & (0.007)
\end{bmatrix}
\]

\[-2*\text{loglikelihood}(ICLS Demance) = 11461.950 (5664 of 5833 cases in use)\]

Figure 8.76 The baseline variance components model for PAC.
Four models will be presented to demonstrate the pattern of Perceived Academic Capability (PAC) for adolescents to answer the abovementioned hypotheses. To view the output for the complete six models for PAC see Table 8.27 where the individual parameter estimates and standard errors for the fixed variables and random effects values will be presented. Model 1 the baseline variance components model reported a mean intercept, $\beta_0$, for PAC (Figure 8.76) as $0.485$ (SE = 0.030). Therefore, after standardization of the 12-factor SMOSA scale, PAC was viewed positively compared to other factors in the scale. The three random levels presented by $\nu_{0k} = 0.23/0.519= 4\%$ for level 3 the school, $u_{0jk} = 0.219/0.519= 42\%$ for level 2 the student, and $e_{0ijk} = 0.277/0.519= 54\%$ at level 1 Time.

**Model 3:** Inclusion of linear and quadratic effects for grade in PAC

$$z_{n_{pacs}_{jk}} \sim N(\mu_{jk}, \Omega)$$

$$z_{n_{pacs}_{jk}} = \beta_{0j} + \text{cons} + 0.032(0.008)g_{dlin_{jk}} + 0.030(0.005)g_{dquad_{jk}}$$

$$\beta_{0j} = 0.506(0.029) + \nu_{0k} + u_{0jk} + e_{0ijk}$$

$$\begin{bmatrix} \nu_{0k} \\ u_{0jk} \\ e_{0ijk} \end{bmatrix} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.020(0.007) \\ 0.220(0.011) \\ 0.273(0.007) \end{bmatrix}$$

$-2^{*}logLikelihood(ICLES Deviance) = 11397.930 (5656 of 5833 cases in use)$

Figure 8.77 shows the analysis with linear and quadratic effects of grade added.

![Graph of the pattern of change in the slope across grades 7-11 for PAC](image)

*Figure 8.78 Graph of the pattern of change in the slope across grades 7-11 for PAC.*
The equation presented in Model 3 (Figure 8.77) added the linear and quadratic effects across grades to the baseline variance components model for PAC to evaluate if a change in the slope occurred around grade 9 and if recovery occurred as predicted in Hypothesis 14.1. The inclusion of the linear contrasts reported significant linear grade coefficients, $\beta_1 (-.032/.008 = -4.00, p < .001)$ and stronger quadratic coefficients, $\beta_2 (.030/.005 = 6.00, p < .001)$. The significant linear effect suggests that progressive declines across grades occurred (see Figure 8.78). The subsequent quadratic analysis showed that across grades a change in direction also emerged with an initial plateauing and then increase between grade 9 and grade 11 supporting hypothesis 14.1. The plateauing in student’s PAC occurred between grades 9 and 10 and between grades 10 and 11 there was evidence of gradual recovery. Including the variables of the linear effect and quadratic effects of grade to the model significantly improved the loglikelihood statistic ($11461.95 – 11397.93$) between Model 3 and Model 1, $\chi^2 = (2) 64.02, p < .001$. Thus, the revised equation provided greater explanatory power by the addition of grades to the equation for PAC.

**Model 4: Inclusion of the effects of sex in PAC**

\[ \begin{align*}
\text{znpac}_{jk} & \sim N(XB, \Omega) \\
\text{znpac}_{jk} & = \beta_0 j + \text{cons} + -0.031(0.008)gdeleg_{jk} + 0.030(0.005)gdequad_{jk} -0.045(0.026)\text{sex}_{jk} \\
\beta_{0jk} & = 0.525(0.031) + \nu_{0jk} + \nu_{0jk} + \epsilon_{0jk} \\
\nu_{0jk} & \sim N(0, \Omega_\nu) \quad : \quad \Omega_\nu = \begin{bmatrix} 0.020(0.007) \end{bmatrix} \\
\nu_{0jk} & \sim N(0, \Omega_\nu) \quad : \quad \Omega_\nu = \begin{bmatrix} 0.220(0.011) \end{bmatrix} \\
\epsilon_{0jk} & \sim N(0, \Omega_\epsilon) \quad : \quad \Omega_\epsilon = \begin{bmatrix} 0.273(0.007) \end{bmatrix}
\end{align*} \]

$-2\times$loglikelihood(UGLS Deviance) = $11391.930(5654$ of 5833 cases in use)

*Figure 8.79 Significant differences are shown with the addition of sex, where males had higher levels of PAC compared to females.*
The equation presented in Model 4 (Figure 8.79) included sex and reported non-significant differences in $\beta_3$, sex coefficients (-.045/0.026). These results show that males reported higher levels of PAC compared to females as predicted however they were not significantly different at the .01 level. Therefore, support for hypothesis 14.2 was not found. By adding sex to the model did not significantly improve the loglikelihood statistic ($11397.93 - 11391.93$), $\chi^2 = (1) 6.00$, at .01 level, between Model 4 and Model 3.

The equation presented in Model 6 (Figure 8.80) added the interactions of sex to the linear and quadratic effects of grade respectively as contrast variables and reported non-significant sex X linear grade interaction coefficients, $\beta_4$ (.018/.016) and non-significant sex X quadratic grade interaction coefficients, $\beta_5$ (.016/0.011). Therefore, across grades there systematic declines occurred until grade 9, which plateaued at grade 9 and evidence of recovery was achieved between grades 9 and 11. The interactions of sex X grades (both linear and quadratic effects) were not significant. Including the interactions of the linear effect of grade X sex and the quadratic effect of grade X sex to the model reduced the loglikelihood statistic ($11391.93 - 11389.01$) between Model 6 and Model 4, $\chi^2 = (2) 2.92$, A significant improvement in the explanatory power of the revised model was not found.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>.61(368)</td>
<td>.47(688)</td>
<td>.41(969)</td>
<td>.42(657)</td>
<td>.51(270)</td>
<td>.46(2952)</td>
</tr>
<tr>
<td>Male</td>
<td>.64(338)</td>
<td>.54(645)</td>
<td>.47(939)</td>
<td>.45(595)</td>
<td>.48(185)</td>
<td>.51(2702)</td>
</tr>
<tr>
<td>Total</td>
<td>.62(706)</td>
<td>.50(1333)</td>
<td>.44(1908)</td>
<td>.44(1252)</td>
<td>.50(455)</td>
<td>.48(5654)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.
Model 6: Inclusion of grade X sex interactions for PAC

\[ zn_{pac,i} \sim N(\mu, \Omega) \]

\[ \begin{align*}
zn_{pac,i} &= \beta_{0i} + \beta_{1i} grade + \beta_{2i} grade \times sex + \beta_{3i} grade^2 + \beta_{4i} sex + \\
&+ \beta_{5i} grade \times sex + \beta_{6i} grade^2 \times sex + \epsilon_{i}
\end{align*} \]

\[ \beta_{0i} = 0.516(0.031) + \nu_{0i} + \epsilon_{0i}\]

\[ \begin{bmatrix} \nu_{0i} \\ \nu_{0i} \end{bmatrix} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.020(0.007) \\ 0.020(0.007) \end{bmatrix} \]

\[ \begin{bmatrix} \nu_{0i} \\ \nu_{0i} \end{bmatrix} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.220(0.011) \\ 0.220(0.011) \end{bmatrix} \]

\[ \begin{bmatrix} \epsilon_{0i} \\ \epsilon_{0i} \end{bmatrix} \sim N(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = \begin{bmatrix} 0.273(0.007) \\ 0.273(0.007) \end{bmatrix} \]

-2*loglikelihood(OLS Deviance) = 11389.010(5654 of 5833 cases in use)

Figure 8.80 The full equation with polynomial inclusion for sex and grade (both linear and quadratic) and their respective interactions.

Summary

Support was found for hypothesis 14.1 with systematic declines across grade in PAC for adolescents until grade 9 and the predicted recovery between grade 10 and grade 11 in PAC occurred. While females were lower than males in PAC until grade 11 the difference was not significant and therefore, hypothesis 14.2 was not supported. Hypothesis 14.3 was also not supported. The interaction of sex X the linear effect of grade and sex X the quadratic effect of grades were not significantly different respectively. For an overview of the parameter estimates for the six progressive equations modelled for PAC see Table 8.27. Minimal variation occurred across the random or fixed effects parameter estimates within the models. Males had higher levels of PAC in all grades until grade 11 when females surpassed them (see Table 8.26).

Model 3 presented the most statistically significant model gauged through the likelihood statistic. Significant deviance was found in the loglikelihood statistic up and including model 3 for PAC. Improvement in the explanatory power was not found with the addition of the fixed effect of sex from model 3.
Table 8.27 Progressive multilevel models for PAC on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>Intercept</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>.485</td>
<td>.483</td>
<td>.506</td>
<td>.525</td>
<td>.524</td>
<td>.516</td>
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</table>

**Fixed effects**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Gdelin</th>
<th>Gdequad</th>
<th>Sex</th>
<th>SexXgdelin</th>
<th>SexXgdequad</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.038(.008)</td>
<td>-.032(.008)</td>
<td>-.031(.008)</td>
<td>-.039(.012)</td>
<td>-.042(.012)</td>
</tr>
<tr>
<td></td>
<td>.030(.005)</td>
<td>.030(.005)</td>
<td>.030(.005)</td>
<td>.022(.008)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-.045(.026)</td>
<td>-.044(.026)</td>
<td>-.032(.027)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fixed effects Interactions**

<table>
<thead>
<tr>
<th>Interaction</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>SexXgdelin</td>
<td>.014(.016)</td>
<td>.018(.016)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXgdequad</td>
<td>.016(.011)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Loglikelihood statistic**

<table>
<thead>
<tr>
<th>Model</th>
<th>Loglikelihood statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>11461.95</td>
</tr>
<tr>
<td>M2</td>
<td>11428.68</td>
</tr>
<tr>
<td>M3</td>
<td>11397.93</td>
</tr>
<tr>
<td>M4</td>
<td>11391.93</td>
</tr>
<tr>
<td>M5</td>
<td>11391.15</td>
</tr>
<tr>
<td>M6</td>
<td>11389.01</td>
</tr>
</tbody>
</table>

**Random effects**

<table>
<thead>
<tr>
<th>Random effect</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>.023(.008)</td>
<td>.020(.007)</td>
<td>.020(.007)</td>
<td>.020(.007)</td>
<td>.020(.007)</td>
<td>.020(.007)</td>
</tr>
<tr>
<td>Student</td>
<td>.219(.011)</td>
<td>.220(.011)</td>
<td>.220(.011)</td>
<td>.220(.011)</td>
<td>.220(.011)</td>
<td>.220(.011)</td>
</tr>
<tr>
<td>Time</td>
<td>.277(.007)</td>
<td>.275(.007)</td>
<td>.273(.007)</td>
<td>.273(.007)</td>
<td>.273(.007)</td>
<td>.273(.007)</td>
</tr>
</tbody>
</table>

All significant parameter estimates and significant deviance in progressive models of the loglikelihood statistic are in **bold**.
Profiles across factors of the SMOSA at each grade level

Introduction

Finally as this chapter has presented each of the 12 factors after standardisation separately across grades with variations of sex noted, it was deemed necessary to conclude by graphically presenting the patterns that emerge at each specific grade for males and females across the 12-factor SMOSA scale. Thereby presenting a profile for each individual grades 7 to 11 of the patterns that emerged across the 12-factors of the SMOSA for males and females. These graphs (Figures 8.81 to 8.85) will represent the pattern indicative of males’ and females’ average level of achievement motivation across the 12 factors. Thus highlighting the most and least salient pursuits at each specific grade and whether males and females present disparate patterns and if so, in which factors these differences are most prevalent.

Profile of the 12-factor SMOSA across grade 7

![Graph showing the estimated marginal means for SMOSA's 12 factors for achievement motivation after standardisation for grade 7 for males and females.]

Figure 8.81 The 12-factors of the SMOSA at grade 7 for males and females.
Figure 8.81 shows that the most salient features are task pursuits and effort pursuits for males and females, however, males are lower than females in both these factors. The least salient pursuit reported was leader pursuits for males and females. The greatest degree of variation between males and females appears to be for social concern pursuits and maths self-concept and to a lesser extent competition pursuits, task pursuits and effort pursuits. Males were stronger in maths self-concept and also, although to a lesser degree in competition pursuits. Females were higher in social concern pursuits, task pursuits and effort pursuits in grade 7, their first year in high school in New South Wales education. This is quite interesting, given much of the literature’s position on the facilitative emphasis of task pursuits and effort pursuits and possible mentoring and further learning associated with social concern pursuits as higher for females than males. Maths self-concept is facilitative in learning for that specific subject domain; and this response follows the emphasis in the literature that females are not as confident in their abilities in maths.

*Profile of the 12-factor SMOSA across grade 8*

![Profile of SMOSA across grade 8 for males and females](image)

*Figure 8.82 The 12-factors of SMOSA at grade 8 for males and females. The most salient pursuit is task pursuits for males and females, the least was leader pursuits.*
Figure 8.82 shows that at grade 8 similarities emerged across certain factors.

Minimal differences emerged between males and females in their levels of affiliation pursuits, praise pursuits, reward pursuits, PAC and general academic self-concept. The most salient pursuit was still task pursuits although effort pursuits and PAC followed closely behind for males and females. Again, the least favoured pursuit reported was for leader pursuits for both males and females, although males reported higher levels for this factor compared to females. The similarity in the pattern emerging across the SMOSA between grades 7 and 8 was noted. However, comparing leader pursuits for males and females between these two graphs, females reported leader pursuits less favourably than males and the gap has comparatively wider compared to grade 7. In fact the performance-based goals were more salient for males than females and the mastery based goals were more salient for females than males.

Social concern pursuits, a factor viewed as conducive to learning and academic engagement was higher for females at grade 8. English self-concept was also a factor where the gap widened between grades, with females reporting higher levels, however, males and females reported English self-concept close to the mean evaluation and therefore, neither males nor females reported this as a favourable pursuit academically at grade 8. Task pursuits and effort pursuits were almost level at grade 7, however at grade 8 the decline in effort pursuits was cause for concern. This phenomenon aligns with Butler’s assertion that the differentiated concept of ability emerges around 11 to 12 years of age and should be noticeable by grade 8.

Competition pursuits were higher for males than females and the difference was more pronounced compared to grade 7. Males reported stronger maths self-concept than females.
Profile of the 12-factor SMOSA across grade 9

Figure 8.83 The 12-factors of the SMOSA at grade 9 for males and females. The most salient pursuit is task pursuits for both males and females, the least was leader pursuits.

Figure 8.83 showed at grade 9 the same salient pursuits emerged with task pursuits, effort pursuits and PAC as the most salient and again leader pursuits the least salient. Similarly praise pursuits were stronger for females in grade 9 than for males, although again this value was close to the mean evaluation and perhaps acknowledgment is necessary for females at this time of development. The stereotypical patterns for maths self-concept and English self-concept were still relevant as was the performance goals and mastery goals. Mastery goals are a focus for both males and females although more so for females and performance-based goals were stronger for males. Although males reported higher performance goals of competition pursuits and leader pursuits compared to females, the reported standardised levels were between 1 to 1.5 standard deviations below the mean. Males viewed these performance goals as less productive forms of motivation than their reported mastery goals of task pursuits or effort pursuits. Given the reported low levels on this standardised scale this should not be generalised into being a facet of
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learning or engagement that males predominately view as motivating. It is stronger when compared to females reported levels. Comparatively, females reported more facilitative components than males both for higher task pursuits and effort pursuits and lower competition pursuits and leader pursuits. Males still evaluated their maths self-concept higher than females but males were lower in English self-concept. Females wanted more praise or acknowledgment than males and also were considerably higher than males in social concern pursuits. Therefore were more acquiescent to mentoring others.

Profile of the 12-factor SMOSA across grade 10

Estimated Marginal Means of SMOSA's 12 factors of Achievement Motivation for grade 10 for males and females

Figure 8.84 The 12-factors of the SMOSA at grade 10 for males and females. The most salient pursuit is task pursuits for both males and females, the least was leader pursuits.

Figure 8.84 represents the 12 factors across the SMOSA for grade 10. Task pursuits and effort pursuits were the highest reported levels of motivation for males and females. Comparing PAC with the other SMOSA dimensions from previous grades suggests that an increase for males and females was found and PAC’s reported level in grade 10 was nearly as strong as reported effort pursuits. Minimal difference
Achievement motivation emerged in grade 10 between the factors of PAC, affiliation pursuits, reward pursuits and general academic self-concept. English self-concept has a small degree of variation between males and females at grade 10 but a large difference is still present for maths self-concept favouring males. According to the literature females present the more facilitative profile (apart from maths self-concept and their higher reported levels of praise pursuits) across the 12-factors of the SMOSA.

Profile of the 12-factor SMOSA across grade 11

Figure 8.85 The 12-factors of the SMOSA at grade 11 for males and females. The most salient pursuit is task pursuits for both males and females, the least was leader pursuits.

Grade 11 evaluation presented in Figure 8.85 found that according to the literature the facilitative components of learning were more pronounced for females than for males. That is, females were higher in task pursuits, effort pursuits, social concern pursuits and English self-concept at grade 11. Males were higher on maths self-concept, which supports much of the literature and current research did not deviate from previous findings. Males were also higher on the other factors generally
seen as less facilitative, such as competition pursuits, leader pursuits, affiliation pursuits and even marginally in praise pursuits.

Figure 8.86 The 12-factors of the SMOSA collapsed across sex. The most salient pursuit is task pursuits and the least was leader pursuits. The greatest degree of decline is for reward pursuits.
Summary of the Profiles for the 12-factor SMOSA across grades

The profiles of the SMOSA presented across each of the five grades highlights the features emphasised throughout this thesis that of disparate patterns of achievement motivation emerged across the differing dimensions lending support that a multidimensional profile would best explain this phenomenon. Profiling the 12-factor SMOSA model for males and females has identified that across grades, females consistently reported higher levels of the facilitative factors set out in the literature, which have been associated with academic engagement and learning. Apart from maths self-concept, which has predominantly been viewed in the literature as having higher levels for males, all other aspects relating to facilitative learning styles were higher for females in these analyses. Males were consistently lower in the mastery goals of task pursuits and effort pursuits. Whether differences emerged between the lower-order factors of the higher-order goals across grades between males and females or in the interactions of grades X sex requires further clarification and to this end a series of Profile Analyses were undertaken in the next chapter.
Chapter 9

Study 3 Results: Profiles of the lower-order factors of motivational pursuits
across grades and sex

Introduction

The individual structure of the more comprehensive 12-factor model of the SMOSA has been supported through reliability and validity testing in Chapter 7. Each of the 12 factors were evaluated on the individual patterns of development across grades, between males and females and on the (grades x sex) interactions. Support was found for the multidimensionality of the SMOSA, with differing patterns emerging across grades in the 12-factors. However, whether significant differences emerged between the lower-order factors, of the commonly used higher-order constructs was not investigated. This chapter evaluated whether disparate patterns emerged between the lower-order factors of the higher-order constructs of mastery goals, performance goals, social goals and extrinsic goals.

The complex nature of achievement motivation required detailed evaluation through profile analyses to assess whether differences emerged in the lower-order factors across grades and/or between males and females. Separation of the higher-order goal constructs into their lower-order factors was anticipated would provide greater explanatory power and additional support for the use of the more comprehensive 12-factor scale to measure achievement motivation during adolescence.

The aim of this chapter was to evaluate whether different trajectories emerged between the two lower-order factors that represented each of the higher-order constructs. For example, do task pursuits and effort pursuits (as lower-order factors) under a mastery goal (higher-order construct) have different patterns of
development across grades, by sex and/or in the interactions? Chapter 9 is one of exploration as investigation involved in mapping the patterns of change during adolescence between the lower-order factors of these higher-order constructs has not been previously undertaken. Mapping the patterns of change across grades and evaluating whether differences emerged between males and females in these trajectories is warranted and would provide additional support for the broader structure of the SMOSA. Failure to evaluate the lower-order factors to ascertain whether disparate patterns emerge between males and females may omit valuable information. Therefore, several general research questions were posed.

a) Whether disparate patterns emerged across grades between the two lower-order factors in each of the four higher-order constructs? (Testing of the Index1 X grade interaction - the flatness hypothesis in each profile analysis).

b) Whether differences emerged between males and females of the lower-order factors? (Testing of the Index1 X sex interaction – levels hypothesis).

c) Whether differences emerged in the interaction between grade X sex between each of the lower-order factors? (Testing of the Index1 X grade X sex interaction – the test of parallelism).

The standardisation of the scale under the common metric in Study 2 (see Chapter 8) meant that profile analyses could be undertaken to assess whether disparate patterns of development emerged between the lower-order factors. The earlier treatment of the data through normalisation and standardisation leant to analyses being undertaken through multi-level modelling; to map adolescent profiles across grades and compare males to females. Investigating this research along the lines of Gorsuch’s claims that greater explanatory power may be achieved using the
lower-order factors formed the basis of this investigation to evaluate achievement motivational profiles during adolescence.

A four-step procedure was used for each of the four higher-order goals of mastery goals, performance goals, social goals and extrinsic goals. These four steps included the following evaluations:

a) Whether significant differences emerged between the lower-order constructs of the higher-order construct.

b) Whether different patterns emerged across grades when comparing the lower-order constructs.

c) Whether males and females varied among these lower-order constructs.

d) Whether the interactions of grades and sex differed between each of the lower-order constructs.

One important aspect of multilevel modelling as previously discussed (see chapter 6) allows for separation of the distribution of variance within the nested or hierarchical structure of the data. Another advantage is the ability to perform simple or complex levels of analysis. As Snijders and Bosker (1999, p. 67) suggest “… in developmental psychology (repeated measurements within individual subjects), it is possible that some subjects progress faster than others” and therefore, simple and complex analyses are required. A simple level approach allows for differences in the intercept at the differing levels of variance to be assessed, however, at a multilevel level analysis, the simple level model assumes that these intercepts will have parallel slopes within each of those levels (Rasbash, Steele, Browne, & Prosser, 2004). This assumption of parallel progression in slopes may not emerge during adolescence. Adolescents may vary in their development not just by degree but as suggested within this thesis, they may also vary in the types of motivation they pursue.
A complex level approach in multilevel analysis allows for the pattern of variation among levels, which simultaneously allows for the intercepts as well as the slopes to vary at the given level of analysis (Rasbash, Steele, Browne, & Prosser, 2004). Using a complex level of analysis at the interaction of Index1 X gdelin and Index X sex would allow for investigation of the amount of variance in slopes among individual responses between the lower-order factors. Past research’s reliance on parallel slopes may not be an adequate assessment when the slopes at the student within school level (level 2 random effect) vary and therefore a complex level analysis would be required. Different patterns of development (that is variance in trajectories of the slope) may occur between task pursuits and effort pursuits and therefore complex level of analysis would be required.

Therefore, this chapter progressively assessed models of increasing complexity. Using the dimension of Mastery as an example, Model 1 assessed the baseline model. Model 2 assessed the parameter estimates of Index 1 (task pursuits and effort pursuits) to ascertain if differences emerged between these lower-order factors. Model 3 assessed grades and the relevant interactions. Model 4 assessed sex and the possible interactions in successive modelled equations. In addition, assessment was undertaken in the variation of slopes at the interaction of Index1 X gdelin (Model 3) and also Index1 X sex (Model 4) at the level 2 analysis; the student within school level for the random-effects analysis. This information should provide clarity and understanding in the interpretation of the degree of variation in responses at the individual student level.

Therefore, these advanced forms of analyses enhanced previous research that has relied on simple mean evaluations to provide information on the degree of variation at the level 2, analysis level. As previously discussed research has had
several associated problems that arise from aggregation bias, which have provided at best possible misconceptions in findings (Rowe, 1991). Multilevel modelling provided the evaluation of individual student responses to be gauged. Mapping the emergent patterns for males and females across high school required the use of a multidimensional scale and advanced statistical techniques, such as multilevel modelling.

**Mastery goals**

The first investigation using profile analysis assessed whether possible differences emerged between the mastery goal’s lower-order factors of task pursuits and effort pursuits and whether disparate patterns emerged across grades and/or between males and females. Preparation of the data included normalisation and standardisation across the 12-factors of the SMOSA. Four progressive models evaluated whether significant differences emerged between task pursuits and effort pursuits (see Table 6.5 for dummy coding of these lower-order factors) across grades, between males and females and among the relevant interactions.

The first model was the baseline variance components model, which provided a basis to gauge possible improvement at each progressive stage through loglikelihood comparisons. The first model represented the higher-order construct of mastery goals. The second model assessed the possible improvement in the model with the inclusion of Index1 which divides mastery goals into task and effort pursuits. The third model analysed the impact of the addition of the fixed effects of grades (either linear or quadratic) and the relevant interactions of Index1 with grades (linear [complex level] and quadratic effects). The fourth model analysed the addition of the fixed effects of sex and the relevant Index1 [complex] interactions as well as the 3-way-interactions (linear and quadratic effects) of grades X Index1 X sex. Assessment of the four
progressive models was undertaken by evaluating the loglikelihood statistics to ascertain whether greater explanatory power was provided with the addition of each subsequent model.

To understand the progressively modelled equations, an overview of the terms used is outlined. The random part of the model shows that each goal was represented as the outcome measure with 3-levels of analysis, that is assessment at each Time collection of data \(i\) for the individual student \(j\) of the school \(k\). The other labels presented were symbolically represented by \(N=\)number of levels, \(XB=\)fixed part of the model; \(\Omega=\)covariance matrix, \(\beta_{0ij}\) refers to the overall intercept of the combined factors of each goal in their referent lower-order pursuits, \(v_{0j}=\)level 3, random school effect, \(u_{0j}=\)level 2, random student within school effect and \(e_{0ij}=\)level 1 the random time within student within school effect of the model.

**Model 1: The baseline variance components model for mastery goals.**

\[
\begin{align*}
\text{mastery}_{ij} & \sim N(\mathbf{XB}_i, \Omega) \\
\text{mastery}_{ij} & = \beta_{0ij}\text{cons} \\
\beta_{0jk} & = 0.619(0.028) + v_{0jk} + u_{0jk} + e_{0jk} \\
\begin{bmatrix} v_{0jk} \\ u_{0jk} \\ e_{0jk} \end{bmatrix} & \sim N(\mathbf{0}, \Omega) : \Omega_v = \begin{bmatrix} 0.023(0.007) \\ \Omega_u = \begin{bmatrix} 0.184(0.007) \\ \Omega_e = \begin{bmatrix} 0.246(0.004) \\ \end{bmatrix} \\ \end{bmatrix} \\ \end{bmatrix}
\end{align*}
\]

\(-2\times\text{loglikelihood}(\text{IGLS Deviance}) = 19949.810(11217 \text{ of } 11666 \text{ cases in use})\)

Figure 9.1 The baseline variance components model for mastery goals.

Model 1 the baseline variance components model had a mean intercept, \(\beta_0\), for mastery goals (Figure 9.1) of .619 with a standard error of estimate = .028. The three random levels presented by \(v_{0k} = .023/.007= 3\%\) for level 3, the school, \(u_{0jk} = .184/.007= 26\%\) for level 2, the student within school, and \(e_{0ijk} = .246/.004= 61\%\) at level 1, time within student within school. This positive value at the intercept
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representing standardised mastery goals suggests that although a degree of variability exists, mastery goals were reported above the mean compared to other factors of the SMOSA.

Model 2 (Figure 9.2) included Index1, to test the difference in mastery goals between the lower-order factors of task pursuits (0) and effort pursuits (1). In Model 2 the intercept for mastery goals was .689 (.028). Task pursuits was the reference category (coded as 0), the negative value at Index1 coefficient, $\beta_1 (-.141/.009 = -15.67, p<.001)$ suggests that effort pursuits were significantly lower than task pursuits (see Figure 9.2). Therefore, testing whether differences emerged between task pursuits and effort pursuits was supported. Assessment of the possible improvement between Model 2 compared to Model 1 (19949.81 - 19720.04) found a significant reduction in the loglikelihood statistic, $\chi^2 = (1) 229.77, p < .001$ supporting the separation of mastery goals lower-order factors.

Model 2: Assessed the difference in the mastery goals of task and effort pursuits.

$$mastery_{ijk} \sim N(\chi \beta, \Omega)$$

$$mastery_{ijk} = \beta_{ijk} + 0.141(0.009)index1_{ijk} + \epsilon_{ijk}$$

$$\beta_{ijk} = 0.689(0.028) + \nu_{0k} + \mu_{0jk} + \epsilon_{ijk}$$

$$\nu_{0k} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.023(0.007) \end{bmatrix}$$

$$\mu_{0jk} \sim N(0, \Omega_{\mu}) : \Omega_{\mu} = \begin{bmatrix} 0.187(0.007) \end{bmatrix}$$

$$\epsilon_{ijk} \sim N(0, \Omega_{\epsilon}) : \Omega_{\epsilon} = \begin{bmatrix} 0.239(0.004) \end{bmatrix}$$

$$-2^{*}\text{loglikelihood(JOGLS Deviance)} = 19720.040(11217 \text{ of 11666 cases in use})$$

Figure 9.2 shows a significant difference between task pursuits and effort pursuits (coded as Index1) occurred with effort pursuits being lower than task pursuits.

Model 3 (Figure 9.3) tested the difference between task pursuits and effort pursuits and included the linear and quadratic effects of grade into the equation. In Model 3, Index1 coefficients, $\beta_1 (-.148/.010 = -14.8, p < .001)$, effort pursuits were
significantly lower than task pursuits. Mastery goals across the linear effect of grade coefficients, $\beta_2 (-.077/0.007 = -11, p < .001)$ found significantly different estimates, that is progressive declines across the grades. Support for previous research of declines across grades during adolescence emerged in overall mastery goals. The quadratic effect of mastery goals across grades, coefficient $\beta_3 (.019/0.005 = 3.8, p < .001)$ was also significantly different. Therefore, across the ordered effects of grades significant changes emerged in the rate of decline for mastery goals. The most significant difference across grades, however was found for the interaction of the linear effect of grades X Index1 coefficients, $\beta_4 (-.055/0.008 = -6.88, p < .001)$. This is testing the flatness hypothesis and the profiles for task pursuits and effort pursuits were significantly different across grades 7 to 11, evidenced by the significant linear grade X Index1 interaction. The interaction for the quadratic grade effects X Index1 coefficients, $\beta_5 (-.001/0.006)$ was not significant (see Figure 9.4). Effort pursuits had systematic declines across grades contrasting to task pursuits’ recovery.

**Model 3: Assessed the difference in the mastery goals across grades.**

$$\text{mastery}_{qk} \sim \mathcal{N}(\beta_1 \text{grade}_{qk} \text{index1}_{qk} + \beta_2 \text{grade}_{qk}^2 + \beta_3 \text{grade}_{qk} \text{index1}_{qk}^2 + \beta_4 \text{grade}_{qk} \text{index1}_{qk} + \beta_5 \text{grade}_{qk}^2 \text{index1}_{qk} + \beta_6 \text{grade}_{qk} \text{index1}_{qk}^2, \Omega),$$

$$\begin{bmatrix}
\beta_2 \\
\beta_3 \\
\beta_4 \\
\beta_5 \\
\beta_6
\end{bmatrix} \sim N(0, \Omega), \quad \Omega = \begin{bmatrix}
0.019(0.006) \\
0.191(0.007) \\
0.000(0.003) & 0.010(0.003) \\
0.221(0.004)
\end{bmatrix}$$

$$-2^{\cdot} \log(\text{likelihoods}) = 19273.620 (11201 \text{ of 11666 cases in use})$$

*Figure 9.3 shows a significant difference between task pursuits and effort pursuits (coded as Index1) across grades linear and quadratic effects and Index1 interactions.*
Figure 9.4 shows a significant difference between task pursuits and effort pursuits (coded as Index1) across grades linear and quadratic effects and Index1 interactions. Effort pursuits represent the lower line.

Model 3 also assessed the variance of the slope residuals $u_{1j}$ and their covariance with the intercept residuals $u_{0j}$ for the interaction of the linear effect of grade X index1. These additional parameters found that firstly, the slope residuals were significantly different at the student within school level (level 2) analysis. The slope residuals identified significant differences emerged among the students with variation around (-.055) of .010 (SE =.003) at the complex level analysis (Model 3). However, no significant covariance of the slope X intercept was found (.000/.003). Overall, significant variability was found among individual students between their task pursuits and effort pursuits which became more pronounced across grades.

Comparing Model 2 and Model 3 found a significant reduction in the loglikelihood statistic, $(19720.04 – 19273.62), \chi^2 (6) = 446.02$, significant at $p < .001$, (four fixed effects and two random effects assessed). This added further support for inclusion of the linear (both simple and complex level at the interaction level) and quadratic effects across grades in the revised model. Therefore, mapping the pattern of development of Index1 showed a significant difference emerged between task pursuits and effort pursuits across the grades. The complex level analysis found significant variation also occurred among the slopes of individual students.
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The coefficient of the linear effect of grade was significant in overall mastery
goals, as was the inclusion of Index1, showing a significant difference between task
pursuits and effort pursuits. More importantly significant differences emerged in the
2-way interaction effect of Index 1 X the linear and quadratic effects of grade effort
pursuits had a steeper decline across the grades than task pursuits (see Figure 9.4).
This suggests that when students are challenged at school they reported less
perseverance in the task as they progressed across grades 7 to 11.

Model 4 (Figure 9.5) included the fixed linear and quadratic effects of grade to
the previous model, and added sex and its relevant interactions (including complex
level analysis at the student within school level) to the equation. This expanded model
tested whether differences emerged between the patterns of task pursuits and effort
pursuits across the grades for males and females (see Figure 9.5). The complete
model of Index1 X grades X sex tested the parallelism of profiles. In this final
modelled equation, Index1 (task and effort pursuits) showed effort pursuits were
significantly lower than task pursuits, $\beta_1 (-.117/.015 = -7.8, p < .001)$, the linear effect
of grades reported significant declines across grades with overall mastery goals’
coefficient, $\beta_2 (-.117/.015 = -7.8, p < .001)$. The sex coefficient $\beta_6 (.154/.024 = 6.42,$
$p < .001)$ for mastery goals was also significant. A significant difference was found in
the patterns of declines between task pursuits and effort pursuits in the linear effect of
grade, Index1 X gdelin coefficient, $\beta_4 (-.036/.012 = -3.0, p < .01)$ but not in the
quadratic level for the grades X Index1 coefficient (.008/.009). There were also
significant differences found in task and effort pursuits between males and females,
the interaction of Index1 X sex coefficient, $\beta_7 (-.057/.021 = -2.71, p < .01)$, that is,
females were significantly higher than males in effort pursuits (see Figure 9.6). The
levels hypothesis was supported with a significant difference being identified between
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males and females for task pursuits and effort pursuits. The 3-way interaction of the linear effect of grades X Index1 X sex, coefficient, $\beta_{10} (-.033/.017)$ was not significant at the .01 level of analysis and neither was the interaction of Index1 X sex X the quadratic effect of grades, coefficient, $\beta_{11} (.015/.013)$. However, it was significant at the .05 level and therefore a strong trend in the 3-way interaction of Index1 X sex X the linear effect of grades was found. The parallelism of profiles was supported at the .05 level, that is differing profiles emerged between males and females for each of the lower-order factors across grades.

Females were significantly higher in task pursuits than males were in effort pursuits. The difference between females’ task pursuits and effort pursuits also became more pronounced across grades, with a greater spread emerging between them in the patterns of development, most emphasised at grade 11. That is, females were also reporting being less motivated to persevere at school (see Figure 9.6).

Table 9.1 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for task pursuits, effort pursuits and mastery goals.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female task</td>
<td>.89(363)</td>
<td>.80(689)</td>
<td>.75(964)</td>
<td>.73(649)</td>
<td>.74(270)</td>
<td>.77(2935)</td>
</tr>
<tr>
<td>Male task</td>
<td>.85(333)</td>
<td>.70(643)</td>
<td>.60(922)</td>
<td>.54(584)</td>
<td>.52(184)</td>
<td>.64(2676)</td>
</tr>
<tr>
<td>Total task</td>
<td>.87(696)</td>
<td>.75(1332)</td>
<td>.68(1886)</td>
<td>.64(1243)</td>
<td>.65(454)</td>
<td>.71(5644)</td>
</tr>
<tr>
<td>Female effort</td>
<td>.94(365)</td>
<td>.73(681)</td>
<td>.58(957)</td>
<td>.48(645)</td>
<td>.42(267)</td>
<td>.63(2915)</td>
</tr>
<tr>
<td>Male effort</td>
<td>.81(331)</td>
<td>.65(637)</td>
<td>.50(926)</td>
<td>.38(590)</td>
<td>.27(187)</td>
<td>.53(2671)</td>
</tr>
<tr>
<td>Total effort</td>
<td>.88(696)</td>
<td>.69(1318)</td>
<td>.54(1883)</td>
<td>.43(1235)</td>
<td>.36(454)</td>
<td>.58(5586)</td>
</tr>
<tr>
<td>Total mastery</td>
<td>.85(1394)</td>
<td>.70(2650)</td>
<td>.63(3771)</td>
<td>.54(2478)</td>
<td>.59(908)</td>
<td>.65(11201)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.
**Model 4: Assessed the difference in the mastery goals across grades, sex and the relevant interactions.**

\[
mastery_{jk} = \beta_{0jk} + \beta_{1jk}\text{index1}_{jk} + \beta_{2jk}\text{quad}_{jk} + \beta_{3jk}\text{sex}_{jk} + \beta_{4jk}\text{sex x index1}_{jk} + \beta_{5jk}\text{sex x quad}_{jk} + \epsilon_{jk}
\]

- \(\epsilon_{jk}\sim N(0, \Omega_{\epsilon})\)
- \(\Omega_{\epsilon} = \begin{bmatrix} 0.018(0.006) \\
                          0.189(0.008) \\
                          -0.001(0.003) \\
                          0.010(0.003) \\
                          -0.004(0.007) \\
                          0.006(0.003) \\
                          0.001(0.009) \end{bmatrix}\)

- \(\Omega_{\beta} = \begin{bmatrix} 0.220(0.004) \end{bmatrix}\)

- \(-2\log\text{likelihood}(\text{OLS Deviance}) = 19196.370(11197 \text{ of 16666 cases in use})\)

*Figure 9.5 Significant differences between task pursuits & effort pursuits (coded as Index1) across grades (linear) & sex. Interactions of sex with Index1 & sex X grade (linear). Differences emerged between males & females in their task & effort across grades.*

No significant estimated variance in the slopes between males and females at the student within school level was found .001 (SE = .009) (see Figure 9.5) at the student within school level around the overall intercept of .189 (.008). Therefore, this was a general trend being reported among each of the sexes. The negative covariance reported between the intercepts and slopes for sex estimated at -.004 (SE = .007) was significantly different. That is males’ effort pursuits showed significantly steeper rates of decline compared to females’ task pursuits. Females’ patterns of engagement for task pursuits lessened in the rate of decline by grade 11 for females (see Figure 9.6). Males and females had significant declines in these facilitative forms of motivation although they both recovered between grades 10 and 11 in task pursuits.

This analysis showed that the difference between males and females became more pronounced for both task pursuits and effort pursuits as they progressed across the grades. Table 9.1 shows the means for mastery goals across grades, for males and females and separation of the lower-order constructs.
Overall significant differences emerged between task and effort pursuits across the grades. Females and males both showed evidence of recovery in task pursuits. Support for the use of the lower-order factors of mastery goals when investigating sex differences or change in the patterns of development across grades was supported in the 2-way interactions. The 3-way interaction of Index1 X sex X linear effect of grade reported significance at the .05 level.

Figure 9.6 presents the differences across grades between males and females in the mastery goals of task pursuits and effort pursuits. The significant interactions of Index1 X sex and Index1 X grades are noted through this overall graph. Males declined until grade 11 in effort pursuits but showed some recovery in task pursuits by grade 11. While these factors were disseminated in Chapter 8, only in the present chapter were task pursuits and effort pursuits compared and evaluated. Females’ patterns of development became more disparate between task pursuits and effort pursuits progressively across the grades. Females were higher for task pursuits and effort pursuits than males and this differentiation also, which became more pronounced across grades.

---

*Figure 9.6 The interactions of sex X index graphed across grades for mastery goals.*
Assessment was undertaken on the possible improvement between Models 3 and 4 using the loglikelihood statistic $(19273.62 - 19196.37)$, with six fixed parameters and three random effects were added to the regression equation. $\chi^2 = (9) 77.25$ was significant, $p < .001$. Therefore suggesting a significantly better model was found for Model 4 than Model 3 to explain mastery goals.

Model 4 added sex and its interactions as well as complex level analysis at the student within school level analysis for sex. The final model found disparate patterns of development emerged in mastery goals across grades. In addition differences emerged between task pursuits and effort pursuits for males and females (see Table 9.1 to evaluate individual standardised means). Males were consistently lower than females across the grades for both effort pursuits and task pursuits. Importantly, the disparity between these lower-order factors was more pronounced when sex was included in the model. Surprisingly, when evaluating the patterns of change between task pursuits and effort pursuits for females across grades the disparity became more pronounced. The greatest discrepancy for females occurred at grade 11 with gradual recovery in task pursuits but continued declines in their effort pursuits (see Figure 9.6). These analyses highlight that the linear effect of grades presents a different pattern of development for task pursuits compared to effort pursuits and that males and females also varied between these lower-order factors. The disparate nature of these findings has not previously been identified in the literature because of the reliance of the higher-order structure to represent mastery goals. The differences are probably best presented in the student within school level analysis (Figure 9.7) and highlight less variation occurred across task pursuits.

Model 4’s inclusion of the complex level analyses for the random effects of grades X sex at the student within school level, identified the range of individual
responses were (gdelin X Index 1 slope coefficient = .10/.003, \( p < .001 \)) significantly different in their trajectories when comparing task pursuits and effort pursuits. These are best visually presented in Figure 9.7.

![Figure 9.7 Greater variation emerged in effort pursuits across grades at the student within school level analysis than task pursuits.](image)

**Summary**

This finding supports the use of the more comprehensive approach of the SMOSA to examine mastery goals during adolescence. Overall, comparing the mastery goals of task pursuits and effort pursuits, initial declines were evidenced for both measures however, a clear differentiation emerged between these two lower-order factors when differences between males and females were added to the modelled equation. The significant 2-way interactions emphasised the necessity to
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use a more comprehensive approach to understand the patterns of achievement motivation during adolescence. In addition, the SMOSA provided clarification in understanding achievement motivation with the use of this more comprehensive manner. The patterns of individual responses across grades between the lower-order factors showed that while effort pursuits have a disparate set of responses across all grades, task pursuits becomes more pronounced for these students as they progressed across the grades. The significant differences in responses at the student within school level analysis for random effects also reinforced the need to use a multilevel modelling approach when investigating achievement motivation found between task pursuits and effort pursuits. The parameter estimates for the progressive models are presented in Table 9.2 for a mastery goal and the lower-order factors (Index1).

Table 9.2 Progressive multilevel models for mastery goals on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.619</td>
<td>.689</td>
<td>.704</td>
<td>.635</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1</td>
<td>-.141(.009)</td>
<td>-.148(.010)</td>
<td>-.117(.015)</td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.077(.007)</td>
<td>-.102(.010)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>.019(.005)</td>
<td>.019(.007)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td>.154(.024)</td>
</tr>
<tr>
<td>Fixed effects with 2-way interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1XGdelin</td>
<td>-.055(.008)</td>
<td>-.036(.012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1XGdequad</td>
<td>-.001(.006)</td>
<td>-.008(.009)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1Xsex</td>
<td>-.057(.021)</td>
<td>.045(.014)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXGdelin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXGdequad</td>
<td>-.002(.010)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects with 3-way interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1 X Gdelin X sex</td>
<td>-.033(.017)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1 X Gdequad X sex</td>
<td>.015(.013)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loglikelihood statistic</td>
<td>19949.81</td>
<td>19720.04</td>
<td>19273.62</td>
<td>19196.37</td>
</tr>
</tbody>
</table>

Random effects

| School         | .023(.007)  | .023(.007)  | .019(.006)  | .018(.006)  |
| Student        | .184(.007)  | .187(.007)  | .191(.007)  | .189(.008)  |
| Student $\sigma^2$ (gdelin X Index1 slope var) | .010(.003)  | .010(.003)  |        |        |
| Student $\sigma^2$ (int/slope cov gdelin X Index1) | .000(.003)  | -.001(.003) |        |        |
| Student $\sigma^2$ (Index1 X sex slope var) |        |        |        | .001(.009)  |
| Student $\sigma^2$ (int/slope cov Index1 X sex) |        |        | -.004(.007) |        |
| Time           | .246(.004)  | .239(.004)  | .221(.004)  | .220(.004)  |

All significant parameter estimates are in bold.
Performance goals

This profile analysis assessed whether possible differences emerged between the performance goals of competition pursuits and leader pursuits. Assessment was also undertaken on whether disparate patterns emerged between the lower-order factors, between males and females and/or across the grades. Four progressive models evaluated whether significant differences emerged between the lower-order factors of performance goals (see Table 6.5 for dummy coding of the lower-order factors). The first model was the baseline variance components model providing a basis to gauge possible improvement at each of the four progressive stages. The first model represented the higher-order construct of performance goals. The second model assessed the possible improvement in the model with the inclusion of Index1 (Index1 dummy coding, competition pursuits = 0, as the reference category and leader pursuits = 1). The third model analysed the impact of the addition of the fixed effects of grades (either linear or quadratic) and the relevant interactions of Index1 with grades (linear [complex] and quadratic effects). The fourth model analysed the addition of the fixed effects of sex and the relevant Index1 X sex [complex] interactions as well as the interactions (linear and quadratic effects) of grades. Assessment of each of these four progressive models was undertaken by evaluating the loglikelihood statistics between each to assess whether greater explanatory power was provided by the addition of each sequential model.

Model 1 the baseline variance components model reported a mean intercept, $\beta_0$, for performance goals (Figure 9.8) was -.661 with a standard error of the estimate of .040. The three random levels presented by $\nu_{0k} = .046/.1138 = 4\%$ for level 3, the school, $u_{0jk} = .338/.1138 = 29\%$ for level 2, the student within school, and $e_{0ijk} = .754/.1138 = 67\%$ at level 1, time within student within school. The reported negative
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value (-.661) at the intercept for standardised performance goals suggests that although a degree of variability exists, performance goals are seen less favourably in the SMOSA’S achievement motivational scale compared to other factors.

Model 1: The baseline variance components model for performance goals.

\[
\begin{align*}
& \text{performance}_{jk} \sim N(\alpha, \sigma) \\
& \beta_{0j} + \nu_{0k} + v_{jk} + \sigma_{0j}.
\end{align*}
\]

\[
\begin{align*}
& \nu_{0k} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.046(0.015) \end{bmatrix} \\
& \nu_{0k} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.338(0.015) \end{bmatrix} \\
& \varepsilon_{0j} \sim N(0, \Omega) : \Omega = \begin{bmatrix} 0.754(0.012) \end{bmatrix}
\end{align*}
\]

\[-2 \times \text{loglikelihood(GLS Deviance)} = 31865.990(11335 \text{ of } 11666 \text{ cases in use})
\]

Model 2 added Index1 (separation of competition pursuits = 0 and leader pursuits = 1) to the equation. The negative coefficient for Index1 suggested that leader pursuits were significantly lower than competition pursuits, coefficient, \( \beta_1 = -0.694/0.015 = -46.27, p < .001 \). This finding supports that differences emerged by degree between the two lower-order factors. Comparing Model 1 (baseline model) to Model 2, found a significant reduction in the loglikelihood statistic (31865.99 - 29839.02), \( \chi^2 = (1) 2026.97, p < .001 \).
Model 2: Assessed the difference in the performance goals of competition and leader pursuits.

\[ \text{performance}_{ijk} \sim N(\mu, \Omega) \]
\[ \text{performance}_{ijk} = \beta_{0ijk} + \beta_{1ijk}\text{cons} + \beta_{2ijk}\text{index1}_{ijk} \]
\[ \beta_{0ijk} = -0.312(0.041) + \nu_{0jk} + \nu_{0jk} + \varepsilon_{0jk} \]
\[ \begin{bmatrix} \nu_{0jk} \\ \nu_{0jk} \\ \varepsilon_{0jk} \end{bmatrix} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = \begin{bmatrix} 0.047(0.015) \\ 0.381(0.015) \\ 0.594(0.009) \end{bmatrix} \]

\[ -2 \times \text{loglikelihood (I.G.L.S Deviance)} = 29839.020 (11335 \text{ of } 11666 \text{ cases in use}) \]

\text{Figure 9.9 Competition pursuits and leader pursuits (coded as Index1) reported leader pursuits significantly lower than competition pursuits.}

Model 3 tested the difference between competition pursuits and leader pursuits across the linear and quadratic effects of grades and their relative interactions (see Figure 9.10). In Model 3, the Index1 coefficients, \( \beta_1 (-0.686/0.017 = -40.35, p < .001) \), leader pursuits were significantly lower than competition pursuits. In Model 3 the linear effect of grade across performance goals, gdelin coefficients, \( \beta_2 (-0.101/0.011 = -9.18, p < .001) \) was significantly different. The quadratic effect of grades across performance goals coefficients, \( \beta_3 (0.24/0.007 = 34.29, p < .001) \) was also significant. The 2-way interaction of Index1 X linear effect of grade \( \beta_4 (-0.028/0.013 = -2.15) \) was not significantly different at .01 and neither was the interaction for the quadratic grade effects X Index1 coefficients, \( \beta_5 (0.012/0.010) \). Therefore, the addition of grades in the model did not find different patterns emerging between the lower-order factors of competition pursuits and leader pursuits across grades. The flatness hypothesis tested similarities in responses to competition pursuits and leader pursuits across grades and the emergent patterns were similar.
Model 3: Assessed the difference in the performance goals across grades.

\[
\text{performance}_{ij} \sim N(\beta_0 + \beta_1 \text{index}1, \Omega)
\]

\[
\text{performance}_{ij} = \beta_0 + \beta_1 \text{index}1 + \beta_2 \text{grade} + \beta_3 \text{grade}^2 + \beta_4 \text{grade} \times \text{index}1 + \epsilon_{ij}
\]

\[
\beta_{0j} \sim N(0, \Omega_0) : \Omega_0 = \begin{bmatrix} 0.052(0.016) \end{bmatrix}
\]

\[
\left[ \begin{array}{c} \mu_{0j} \\ \mu_{1j} \end{array} \right] \sim N(0, \Omega_1) : \Omega_1 = \begin{bmatrix} 0.376(0.015) \\ \begin{bmatrix} -0.023(0.008) \\ 0.044(0.008) \end{bmatrix} \end{bmatrix}
\]

\[
\left[ \begin{array}{c} \mu_{0j} \\ \mu_{1j} \end{array} \right] \sim N(0, \Omega_2) : \Omega_2 = \begin{bmatrix} 0.556(0.010) \end{bmatrix}
\]

\[-2 \times \text{loglikelihood} = 29548.830(11319 \text{ of } 11666 \text{ cases in use})\]

Figure 9.10 shows a significant difference between competition pursuits and leader pursuits (coded as Index1) across linear and quadratic grades effects and Index1 X linear grade interactions.

Model 3 also involved assessing the variance of the slope residuals \(u_{ij}\) and their covariance with the intercept residuals \(u_{0j}\) for the interaction of the linear effect of grade X index1 in the random effects evaluation. These additional parameters found that firstly, the slope residuals were significantly different at the student within school level (level 2). The slope residuals found among individual student responses reported variation about the mean (-.028) of .044 (SE =.008) at the complex level analysis (Model 3). However, significant covariance of the slope X intercept was also found (.023/008). Overall, significant variability emerged among individual slopes for students across grades between competition pursuits and leader pursuits (see Figure 9.10). Comparing Model 2 to Model 3, found a significant reduction in the loglikelihood statistic (29839.86 - 29548.83), \(\chi^2 = (1) 291.03, p < .001\). Therefore, the addition of grade and its relevant interactions significantly improved the explanatory power in this revised model.

Model 4 (Figure 9.11) added the coefficient of sex and its relative interactions. Inclusion of the fixed effects of Index1, sex and grade (both linear and quadratic
respectively) and the interactions of sex X grade (both linear and quadratic) as well as
the complex level analysis of grade X Index1 were tested. Overall leader pursuits
were significantly lower than competition pursuits, coefficient, $\beta_1 (\cdot747/\cdot025 = -$
29.88, $p<.001$). Across grades significant declines of a linear nature were found, in
the higher-order construct of performance goals, the gdelin coefficient, $\beta_2$ $(-.086/\cdot016$
$= -5.38, p<.001)$ but not in the quadratic effect of grades, gdequad coefficient, $\beta_3$
($\cdot021/\cdot011$). There was a non-significant interaction between competition pursuits and
leader pursuits across grades, Index1 X gdelin coefficient, $\beta_4$ ($\cdot030/\cdot020$).

The fixed effect of sex in performance goals was significant showing females
were lower than males for performance goals, coefficient, $\beta_6$ ($\cdot308/\cdot036 = -8.56,$
$p<.001$). The levels hypothesis was supported, because males competition pursuits
were significantly higher than either females’ competition pursuits or leader pursuits,
tested in the Index1 X sex coefficient, $\beta_7$, $ (.115/\cdot035 = 3.29, p<.001)$ (see Figure
9.12). The interaction of sex X gdelin coefficient, $\beta_5$, $ (.026/\cdot021)$ was not significant
and neither was the sex X gdequad coefficient, $\beta_9$ ($\cdot008/\cdot015$). No three-way
interaction was significant. Therefore, the test of parallelism was not supported
because did not emerge significant differences between males and females in the
lower-order factors across grades.

A significant estimated variance in the slopes between the interaction effects of
males and females for competition pursuits and leader pursuits was found of $\cdot143$ (SE
$\cdot026$) at the student within school level around the overall intercept of $\cdot411$ (SE $\cdot017$) (see
Figure 9.13). The negative covariance reported between the intercepts and slopes for
sex, estimated at $\cdot107$ (SE $\cdot018$) was also significantly different. That is different
slopes were identified in the patterns of development between males and females
Achievement motivation

individual responses in the performance goals of competition pursuits and leader pursuits.

The significant findings in this set of analyses identified that the performance goals of competition pursuits and leader pursuits were significantly different and males were significantly higher than females in competition pursuits and leader pursuits (see Figures 9.11 & 9.12). The linear effect of grade X Index1 level, coefficient, $\beta_8 (-.028/.019)$ was not significantly different and neither was the quadratic effect of grade X Index1 level, coefficient, $\beta_9 (.002/.013)$. However, as shown in Figure 9.11 evidence of recovery between grade 10 and grade 11 for leader pursuits occurred for females.

The addition of sex to Model 4 found that the previously identified (Model 3) significant coefficient of Index1 X gdelin was no longer significant in this revised model. The levels hypothesis identified that males and females varied significantly between competition pursuits and leader pursuits. Comparing Model 4 with Model 3 identified a reduction in the loglikelihood statistic $(29548.83 – 29380.11)$, $\chi^2 = (10) 168.72$ that was highly significant, $p < .001$. Therefore adding sex and the relevant interactions to the equation in Model 4 provided a significant improvement to the explanatory power of this revised model. The four progressive multilevel models for performance goals have the parameter estimates for the baseline model, Index1, grade (linear and quadratic), sex and their respective interactions placed in Table 9.4., for easy perusal of the findings.
Model 4: Assessed the difference in the performance goals across grades, sex and the relevant interactions.

\[
\text{performance}_{ik} \sim N(\mu_{ik}, \Omega)
\]

\[
\text{performance}_{ik} = \beta_0 + \beta_{0k} + \beta_{0g} \times \text{index}_{ik} + \beta_{0i} \times \text{index}_{ik}^2 + \beta_{0g} \times \text{index}_{ik} + \beta_{0i} \times \text{index}_{ik}^2 + \gamma_0 + \gamma_{0k} + \gamma_{0g} \times \text{index}_{ik} + \gamma_{0i} \times \text{index}_{ik}^2 + \epsilon_{ik}
\]

\[
\begin{bmatrix}
\gamma_{0k} \\
\gamma_{0g} \\
\gamma_{0i}
\end{bmatrix} \sim N(0, \Omega_\gamma) : \Omega_\gamma = \begin{bmatrix}
0.411(0.017) & -0.034(0.008) & 0.049(0.009) \\
-0.034(0.008) & 0.107(0.018) & 0.034(0.010) \\
0.049(0.009) & 0.034(0.010) & 0.143(0.026)
\end{bmatrix}
\]

\[
\begin{bmatrix}
\epsilon_{ik}
\end{bmatrix} \sim N(0, \Omega_\epsilon) : \Omega_\epsilon = \begin{bmatrix}
0.526(0.010)
\end{bmatrix}
\]

\(-2\times\text{loglikelihood}/(\text{DF and cases in use}) = 29380.110(11315 of 11666 cases in use)\)

Figure 9.11 shows a significant difference between competition pursuits and leader pursuits (coded as Index1) across grades linear & quadratic effects & Index1 interactions.

Figure 9.12 Performance goals for males were represented by competition pursuits as the higher line. This shows that competition pursuits did not vary significantly across grade, however, leader pursuits found evidence of recovery for females.
Table 9.3 MLwiN standardised mean values and number for each cell for the newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for competition pursuits, leader pursuits and performance goals.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female comp</td>
<td>-0.01(339)</td>
<td>-0.14(644)</td>
<td>-0.24(943)</td>
<td>-0.33(595)</td>
<td>-0.39(187)</td>
<td>-0.22(2708)</td>
</tr>
<tr>
<td>Male comp</td>
<td>-0.27(368)</td>
<td>-0.46(689)</td>
<td>-0.59(965)</td>
<td>-0.67(659)</td>
<td>-0.69(270)</td>
<td>-0.55(2951)</td>
</tr>
<tr>
<td>Total comp</td>
<td>-0.14(707)</td>
<td>-0.30(1333)</td>
<td>-0.42(1908)</td>
<td>-0.51(1254)</td>
<td>-0.56(451)</td>
<td>-0.39(5659)</td>
</tr>
<tr>
<td>Female leader</td>
<td>-0.71(366)</td>
<td>-1.0(693)</td>
<td>-1.18(969)</td>
<td>-1.26(660)</td>
<td>-1.23(272)</td>
<td>-1.10(2960)</td>
</tr>
<tr>
<td>Male leader</td>
<td>-0.63(336)</td>
<td>-0.80(646)</td>
<td>-0.92(936)</td>
<td>-1.00(590)</td>
<td>-1.0(188)</td>
<td>-0.88(2696)</td>
</tr>
<tr>
<td>Total leader</td>
<td>-0.67(702)</td>
<td>-0.67(1339)</td>
<td>-0.90(1905)</td>
<td>-1.05(1250)</td>
<td>-1.14(460)</td>
<td>-1.0(5656)</td>
</tr>
<tr>
<td>Total performance</td>
<td>-0.51(1411)</td>
<td>-0.65(2672)</td>
<td>-0.77(3815)</td>
<td>-0.81(2504)</td>
<td>-0.79(917)</td>
<td>-0.72(11319)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets. Comp = Competition pursuits.

![Predicted Competition values for the random slopes model](image1)

![Predicted Leader values for the random slopes model](image2)

Figure 9.13 Great deal of variation emerged in both performance goals of competition pursuits and leader pursuits across grades at the student within school level analysis. Most notably is that at this individual level there was considerable fanning during early and late adolescence.
Performance goals varied as a factor of the subscales of competition pursuits and leader pursuits, across grades. Significant declines for performance goals were found. Sex differences emerged where females were significantly lower from males in competition pursuits and leader pursuits. The interaction of Index1 X sex found a significant two-way interaction between males and females in competition pursuits and leader pursuits (see Figure 9.12). Females were identified as being lower in leader pursuits than males were in competition pursuits or leader pursuits. These findings provide further support to the more comprehensive profiling of achievement motivation through an expanded model incorporating these lower-order factors. Table 9.3 shows the means for performance goals across grades, for males and females and separation of the lower-order constructs.
Table 9.4 Progressive multilevel models for performance goals on grade, sex and their respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.661</td>
<td>.312</td>
<td>-.293</td>
<td>-.166</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>.694(.015)</td>
<td>.686(.017)</td>
<td>-.747(.025)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects with 2-way interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1XGdelin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1XGdequad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1Xsex</td>
<td>.115(.035)</td>
<td>.012(.010)</td>
<td>-.005(.015)</td>
<td></td>
</tr>
<tr>
<td>SexXGdelin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXGdequad</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects with 3-way interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1 X Gdelin X sex</td>
<td></td>
<td></td>
<td></td>
<td>.005(.028)</td>
</tr>
<tr>
<td>Index1 X Gdequad X sex</td>
<td></td>
<td></td>
<td>.031(.020)</td>
<td></td>
</tr>
<tr>
<td>Loglikelihood statistic</td>
<td>31865.99</td>
<td>29839.02</td>
<td>29548.83</td>
<td>29380.11</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>.046(.015)</td>
<td>.047(.015)</td>
<td>.052(.016)</td>
<td>.038(.012)</td>
</tr>
<tr>
<td>Student σ² (gdelin X Index1slope var)</td>
<td></td>
<td></td>
<td>.010(.003)</td>
<td>.049(.009)</td>
</tr>
<tr>
<td>Student σ² (int/slope cov gdelin X Index1)</td>
<td>.000(.003)</td>
<td></td>
<td>-.034(.008)</td>
<td></td>
</tr>
<tr>
<td>Student σ² (Index1 X sex slope var)</td>
<td>.143(.026)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student σ² (int/slope cov Index1 X sex)</td>
<td></td>
<td>.107(.018)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>.754(.012)</td>
<td>.594(.009)</td>
<td>.556(.010)</td>
<td>.526(.010)</td>
</tr>
</tbody>
</table>

All significant parameter estimates are in **bold**.
**Social goals**

This profile analysis assessed whether possible differences in social goals emerged between affiliation pursuits and social concern pursuits and if disparate patterns emerged between males and females and/or across grades. Four progressive models evaluated the social goals of affiliation pursuits and social concern pursuits (see Table 6.5 for dummy coding of these lower-order factors). The first model was the baseline variance components model to provide a basis to gauge possible improvement at each progressive stage. The first model represents the higher-order construct of social goals. The second model assessed the possible improvement in the model with the inclusion of Index1 (Index1 was the representative dummy coding of the independent variable, 0 = affiliation pursuits, 1 = social concern pursuits). The third model analysed the impact of the inclusion of the fixed effects of grades (either linear or quadratic) and the inclusion of complex analyses level analyses for Index1 X gdelin. In addition, the relevant interactions of Index1 X grades (linear and quadratic effects) were assessed. The fourth model analysed the addition of the fixed effects of sex and the relevant Index1 interactions [complex analysis]; the interactions (linear and quadratic effects) of grades X sex plus the relevant interactions of Index1. Assessment of each of these four progressive models was undertaken by evaluating the loglikelihood statistics between each to assess whether greater explanatory power was provided for each sequential model.

Model 1 the baseline variance components model reported a mean intercept, $\beta_0$, for social goals (Figure 9.14) was .046 with a standard error of estimate = .024. The three random levels presented by $\gamma_0k = .012/.758 = 2\%$ for level 3, the school, $u_{0jk} = .184/.758 = 24\%$ for level 2, the student within school, and $e_{0ijk} = 562/.758 = 74\%$ at level 1, Time within student within school. This negative value at the intercept for
standardised social goals suggests that although a degree of variability exists, social goals were seen less favourably at the standardised mean in the SMOSA compared to the other factors.

Model 1: The baseline variance components model for social goals.

\[
\text{social}_{ijk} \sim N(X\beta, \Omega)
\]

\[
\text{social}_{ijk} = \beta_0 + \beta_j + \nu_{ijk} + \epsilon_{ijk}
\]

\[
\begin{align*}
\left[ \nu_{0k} \right] & \sim N(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.012(0.005) \end{bmatrix} \\
\left[ \nu_{jk} \right] & \sim N(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.184(0.009) \end{bmatrix} \\
\left[ \epsilon_{ijk} \right] & \sim N(0, \Omega_\epsilon) : \Omega_\epsilon = \begin{bmatrix} 0.562(0.009) \end{bmatrix}
\end{align*}
\]

\(-2\times\text{loglikelihood (IGLS Deviance)} = 27756.630\) of 11666 cases in use

Figure 9.14 A significant difference occurred between affiliation pursuits and social concern (coded as Index1) where social concern pursuits were higher than affiliation.

Model 2 (Figure 9.15) added Index1 to the baseline variance components model represented by social concern pursuits (1), which were higher than affiliation pursuits (0). A significant difference in the variation of the intercept between affiliation pursuits and social concern, Index1 coefficient, \(\beta_1 (.117/.014 = 8.36, p < .001)\) was found. Adding the lower-order factors of social goals to the baseline model significantly reduced the loglikelihood statistic (27756.63 - 27688.51), \(\chi^2 = (1) 68.12, p < .001\).
Model 2: Assessed the difference in the social goals of social concern and affiliation pursuits.

\[
\text{social}_{jk} \sim N(\mathbf{X} \beta, \Omega)
\]

\[
\text{social}_{jk} = \beta_{0jk} + \text{social}_{jk} \.id{cons} + 0.117(0.014) \text{Index1}_{jk}
\]

\[
\beta_{0jk} = -0.012(0.025) + \nu_{0jk} + \kappa_{0jk} + \varepsilon_{0jk}
\]

\[
\begin{bmatrix}
\nu_{0jk} \\
\kappa_{0jk} \\
\varepsilon_{0jk}
\end{bmatrix} \sim N(0, \Omega_v): \Omega_v = \begin{bmatrix} 0.012(0.005) \end{bmatrix}
\]

\[
\begin{bmatrix}
\nu_{0jk} \\
\kappa_{0jk} \\
\varepsilon_{0jk}
\end{bmatrix} \sim N(0, \Omega_a): \Omega_a = \begin{bmatrix} 0.185(0.009) \end{bmatrix}
\]

\[
\begin{bmatrix}
\varepsilon_{0jk}
\end{bmatrix} \sim N(0, \Omega_s): \Omega_s = \begin{bmatrix} 0.557(0.009) \end{bmatrix}
\]

\(-2^{*}\text{loglikelihood(IGLS Deviance)} = 27688.510(11244 \text{ of 11666 cases in use})\)

Figure 9.15 Social concern pursuits and affiliation pursuits (coded as Index1) reported affiliation pursuits significantly lower than social concern pursuits.

Model 3 (Figure 9.16) found with the inclusion of the fixed effects of grade (both linear and quadratic) (complex level analysis) and also for the interaction of Index1 X grade (both linear and quadratic respectively) significant effects emerged. A significant difference was found for Index1, coefficient, \(\beta_1 (1.44/0.16 = 9.00, p<.001)\), that is affiliation pursuits were on average 1.44 standard deviation units lower than social concern pursuits. Across grades significant declines occurred in a linear nature, \(\text{gdelin} \) coefficient, \(\beta_2 (0.080/0.019 = -4.21, p<.001)\), however, the \(\text{gdequad} \) coefficient, \(\beta_3 (0.003/0.007)\) was not significant. Disparate patterns emerged in the interaction of Index1 X \(\text{gdelin} \), thus testing the flatness hypothesis found significant differences emerged between the lower-order factors. Across grades there were significant continuous declines for affiliation pursuits compared to the apparent recovery in social concern pursuits, \(\text{Index1} X \text{gdelin} \) coefficient, \(\beta_4 (0.041/0.013 = 3.15, p<.01)\) and was also significant the interaction of Index1 X \(\text{gdequad} \) coefficient, \(\beta_5 (0.031/0.010 = 3.10, p<.01)\).
Model 3: Assessed the difference in the social goals across grades.

\[
\text{social}_{jk} \sim N(\mu, \Omega)
\]

\[
\text{social}_{jk} = \beta_{0jk} + \beta_{1jk} \text{Index1}_{jk} + \beta_{2jk} \text{gdequad}_{jk} + \beta_{3jk} \text{Index1.gdequad}_{jk} + \\
\quad + \beta_{4jk} \text{gdequad}_{jk} + \gamma_{jk} + \nu_{jk} + \varepsilon_{jk}
\]

\[
\beta_{0jk} = -0.013(0.026) + \gamma_{jk} + \nu_{jk} + \varepsilon_{jk}
\]

\[
\beta_{1jk} = 0.041(0.013) + \nu_{jk}
\]

\[
\begin{bmatrix}
\nu_{jk} \\
\nu_{yk}
\end{bmatrix} \sim N(0, \Omega_{\nu}) : \Omega_{\nu} = 
\begin{bmatrix}
0.013(0.005) \\
0.000(0.000) 0.000(0.000)
\end{bmatrix}
\]

\[
\begin{bmatrix}
\mu_{jk} \\
\mu_{yk}
\end{bmatrix} \sim N(0, \Omega_{\mu}) : \Omega_{\mu} = 
\begin{bmatrix}
0.186(0.009) \\
0.000(0.000) 0.000(0.000)
\end{bmatrix}
\]

\[
\begin{bmatrix}
\varepsilon_{jk}
\end{bmatrix} \sim N(0, \Omega_{\varepsilon}) : \Omega_{\varepsilon} = 
\begin{bmatrix}
0.345(0.008)
\end{bmatrix}
\]

\[-2 \text{loglikelihood} \text{ (CHIS Deviance)} = 27448.370 \text{ (11228 of 11666 cases in use)}\]

Figure 9.16 The separation of social goals into affiliation pursuits and social concern pursuits showed declines were evidenced across grades. Affiliation pursuits were significantly lower than social concern pursuits across grades.

Comparing Model 2 with Model 3 (27688.51 – 27448.37) found a reduction in the loglikelihood statistic, \( \chi^2 = (6) \) 240.14, \( p < .001 \), therefore providing a significant improvement to the explanatory power of the model. The equation presented in Model 3 (Figure 9.16) involved adding extra parameters to assess the variance of the slope residuals \( u_{ij} \) and their covariance with the intercept residuals \( u_{0j} \). In Model 3, the interaction of Index1 X linear effect of grade was treated at the complex level of analysis, the individual student within school level analyses. This interaction’s slope did not vary significantly between the two lower-order factors of affiliation pursuits and social concern pursuits at the student within school level analysis. The covariance of intercept X slope between competition pursuits and leader pursuits was not significant. This suggested that disparate trajectories emerged between these factors across grades. Affiliation pursuits showed strong systematic declines contrasting to social concerns recovery in the latter grades (see Figure 9.17).
Figure 9.17 Affiliation pursuits are the lower line. A clear linear pattern of declines emerged for affiliation pursuits across grades, however, social concern pursuits showed a quadratic effect or evidence of recovery.

In Model 4, (Figure 9.18) affiliation pursuits were lower than social concern pursuits, Index1 coefficient, β1 (-.052/.022 = -2.36, not significant at .01 level). Given that affiliation pursuits was the reference (dummy coding) category, social concern pursuits on average were .052 standard deviation units higher than affiliation pursuits. The decline in the magnitude of the combined measure for social goals was evidenced across the linear grade coefficient, β2 (gdelin = -.110/.015 = 7.33, p < .001), however the quadratic grade coefficient, β3 (gdequad = -.008/.010) was not significant. The interactions of Index1 X grades, that is differences between the lower-order factors of social concern pursuits and affiliation pursuits in the patterns of the linear effect of grades, coefficient β7 (Index1 X gdelin = -.017/.018) did not emerge. Neither was the interaction of Index1 X the quadratic effect of grades, coefficient, β8 (Index1 X gdequad = .029/.014) significant.

The previously identified significance of the interaction coefficients in Model 3 were subsumed into the model and dispersed when sex and its relevant interactions were added to the model. While the sex coefficient β6 (-.046/.032) was not significant for the higher-order construct of social goals, assessment of the interaction of the
lower-order factors of affiliation pursuits and social concern pursuits and sex identified significant differences emerged at that level. The levels hypothesis tested the Index1 X sex interaction, coefficient $\beta_{11} (-.353 / .032 = -11.03, p < .001)$ that is the interaction effect of affiliation pursuits and social concern pursuits between males and females was highly significant (see Figures 9.18). On average females were significantly higher in their social concern pursuits than their affiliation pursuits. In social concern pursuits they evidenced recovery compared to the continuous declines in their affiliation pursuits. Significant sex differences emerged between males and females. Males were lower than females in social concern pursuits but continuously higher in their affiliation pursuits compared to females. No other significant effects emerged in this model. The addition of sex and its relevant interactions to the model found the previously identified significant linear and quadratic effects across grades as well as the interactions of grade lost their significance in this revised model (see Figure 9.19). No three-way interaction was significant and therefore the test of parallelism was not supported for Social goals.

Model 4: Assessed the difference in the social goals across grades, sex and the relevant interactions.

$$social_{it} = \beta_{0i} + \beta_{1i} \times Index1_{it} + \beta_{2i} \times sex_{it} + \beta_{3i} \times sex_{it} \times Index1_{it} + \beta_{4i} \times grade_{it} + \beta_{5i} \times grade_{it} \times sex_{it} + \beta_{6i} \times grade_{it} \times sex_{it} \times Index1_{it} + \epsilon_{it}$$

$$\beta_{0i} = 0.353(0.032) + u_{0i} + \epsilon_{0i}$$
$$\beta_{1i} = 0.017(0.018) + u_{1i} + \epsilon_{1i}$$
$$\beta_{2i} = 0.030(0.029) + u_{2i} + \epsilon_{2i}$$

$$[\gamma_{0i}] \sim N(0, \Omega_{0i}) : \Omega_{0i} = \begin{bmatrix} 0.009(0.004) \end{bmatrix}$$
$$[\gamma_{1i}] \sim N(0, \Omega_{1i}) : \Omega_{1i} = \begin{bmatrix} 0.308(0.014) & 0.000(0.000) & 0.000(0.000) \\ 0.000(0.000) & 0.000(0.000) & 0.219(0.016) \\ -0.219(0.016) & 0.000(0.000) & 0.201(0.024) \end{bmatrix}$$
$$[\gamma_{2i}] \sim N(0, \Omega_{2i}) : \Omega_{2i} = \begin{bmatrix} 0.485(0.008) \end{bmatrix}$$

$-2$ log likelihood (OLS Deviance) = 26903.350 (11224 of 11665 cases in use)

Figure 9.18 Social goals showed differences emerged between affiliation pursuits and social concern pursuits with declines across grades. Females were lower than males and there was a significant sex by Index1 interaction effect occurring.
In Model 4, sex (complex level) was added to the equation at the student within school level analysis and the slope varied significantly between males and females (.201/.024 = 8.38, \( p < .001 \)). The sex covariance of intercept X slope was also significantly different between affiliation pursuits and social concern pursuits when sex was included in the random effects model (-.219/.016 = -13.69, \( p < .001 \)). This suggests there were significant differences in the random effects at the, student within school level analysis between males and females (see Figure 9.19) on the individual response patterns for social goals. Affiliation pursuits were not significantly different between males and females. Comparing Model 3 and Model 4 using the loglikelihood statistic with the inclusion of sex and the respective interactions found \( \chi^2 = (9) 545.02, p < .001 \), a significant improvement in the explanatory power of the revised model. That is adding sex and its relevant interactions significantly improved the modelled equation. Table 9.5 displays the means for affiliation pursuits, social concern pursuits and social goals across grades and for males and females.

*Table 9.5 The newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for social concern pursuits, affiliation pursuits and social goals.*

<table>
<thead>
<tr>
<th>Scale</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female affil</td>
<td>.27(367)</td>
<td>.13(693)</td>
<td>.00(960)</td>
<td>-.12(652)</td>
<td>-.25(271)</td>
<td>.01(2943)</td>
</tr>
<tr>
<td>Male affil</td>
<td>.25(331)</td>
<td>.12(639)</td>
<td>.00(930)</td>
<td>-.09(593)</td>
<td>-.16(186)</td>
<td>.03(2679)</td>
</tr>
<tr>
<td>Total affil</td>
<td>.26(698)</td>
<td>.12(1332)</td>
<td>.00(1890)</td>
<td>-.11(1245)</td>
<td>-.21(457)</td>
<td>.02(5622)</td>
</tr>
<tr>
<td>Female soc con</td>
<td>.47(358)</td>
<td>.31(686)</td>
<td>.21(958)</td>
<td>.16(555)</td>
<td>.16(269)</td>
<td>.25(2926)</td>
</tr>
<tr>
<td>Male soc con</td>
<td>.20(330)</td>
<td>.01(642)</td>
<td>-.11(930)</td>
<td>-.15(587)</td>
<td>-.13(185)</td>
<td>-.05(2676)</td>
</tr>
<tr>
<td>Total soc con</td>
<td>.34(688)</td>
<td>.17(1328)</td>
<td>.05(1888)</td>
<td>.01(1244)</td>
<td>.04(454)</td>
<td>.10(5602)</td>
</tr>
<tr>
<td>Total social</td>
<td>.28(1388)</td>
<td>.11(2660)</td>
<td>.05(3780)</td>
<td>-.05(2489)</td>
<td>-.03(911)</td>
<td>.06(11228)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets. Affil = Affiliation pursuits and soc con = Social Concern pursuits.
Table 9.6 shows the 4 progressive multilevel models for social goals on grade, sex and their respective interactions (linear and quadratic) and the interactions of Index1. Figure 9.20 shows the graphical representation of the pattern of development in social goals, namely affiliation pursuits and social concern pursuits for males and females across grades in high school. The levels of social goals varied between the factors of affiliation pursuits and social concern pursuits and more importantly these lower-order factors identified significant differences emerged between males and females.
Figure 9.20 Random effects model for social goals showing individual student within school level analysis for social concern and affiliation pursuits.

The random effects model when graphed showed that there was significant variation at the student within school level analysis for social goals. Females showed greater variation on the individually graphed level than males. The higher-order construct of social goals found similar trajectories of continuous declines identified for males and females, however, when the lower-order factors were examined differences in the patterns of development between males and females were apparent (see Figure 9.19 compared to Figure 9.20). Model 4 found significant differences emerging in the fixed effects between the lower-order factors of social concern pursuits and affiliation pursuits between the patterns for males and females as well as the covariance of Index1 X sex. Without separation of the lower-order factors, a
cancelling out of the sex interaction effect would have emerged, and only the
significant difference between the lower-order factors would have been found. The
sex coefficient for overall social goals was not significant. Females were significantly
higher in social concern pursuits than males and significantly higher in social concern
pursuits than in their affiliation pursuits. This expanded model provided further
support for the SMOSA and the more comprehensive approach used to investigate
achievement motivational pursuits.

Table 9.6 Progressive multilevel models for social goals on grade, sex and their
respective interactions (linear and quadratic)

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.046</td>
<td>-.012</td>
<td>-.013</td>
<td>.030</td>
</tr>
<tr>
<td>Fixed effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1</td>
<td></td>
<td>.117 (.014)</td>
<td>.144 (.016)</td>
<td>-.052 (.058)</td>
</tr>
<tr>
<td>Gdelin</td>
<td></td>
<td>-.121 (.010)</td>
<td>-.110 (.015)</td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td></td>
<td>-.003 (.007)</td>
<td>-.008 (.010)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>-.046 (.032)</td>
<td></td>
</tr>
<tr>
<td>Fixed effects with 2-way interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1XGdelin</td>
<td></td>
<td>-.041 (.013)</td>
<td>-.017 (.018)</td>
<td></td>
</tr>
<tr>
<td>Index1XGdequad</td>
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<td>.031 (.010)</td>
<td>.029 (.014)</td>
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<td>Index1Xsex</td>
<td></td>
<td></td>
<td>.353 (.032)</td>
<td></td>
</tr>
<tr>
<td>SexXGdelin</td>
<td></td>
<td></td>
<td>-.022 (.020)</td>
<td></td>
</tr>
<tr>
<td>SexXGdequad</td>
<td></td>
<td></td>
<td>-.007 (.014)</td>
<td></td>
</tr>
<tr>
<td>Fixed effects with 3-way interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1 X Gdelin X sex</td>
<td></td>
<td></td>
<td>.042 (.025)</td>
<td></td>
</tr>
<tr>
<td>Index1 X Gdequad X sex</td>
<td></td>
<td></td>
<td>.006 (.019)</td>
<td></td>
</tr>
<tr>
<td>Loglikelihood statistic</td>
<td>27756.63</td>
<td>27688.51</td>
<td>27448.37</td>
<td>26903.35</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>.012 (.005)</td>
<td>.012 (.005)</td>
<td>.013 (.005)</td>
<td>.009 (.004)</td>
</tr>
<tr>
<td>Student $\sigma^2$ (intercept var)</td>
<td>.184 (.009)</td>
<td>.185 (.009)</td>
<td>.186 (.009)</td>
<td>.308 (.014)</td>
</tr>
<tr>
<td>Student $\sigma^2$ (covariance gdelin X Index1)</td>
<td>.000 (.000)</td>
<td>.000 (.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student $\sigma^2$ (gdelin X Index1 var)</td>
<td>.000 (.000)</td>
<td>.000 (.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student $\sigma^2$ (covariance Index1 X sex)</td>
<td></td>
<td></td>
<td>-.219 (.016)</td>
<td></td>
</tr>
<tr>
<td>Student $\sigma^2$ (Index1 X sex var)</td>
<td></td>
<td></td>
<td>.201 (.024)</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>.562 (.009)</td>
<td>.557 (.009)</td>
<td>.545 (.008)</td>
<td>.485 (.008)</td>
</tr>
</tbody>
</table>

All significant parameter estimates are in **bold**.
Extrinsic goals

This investigation used profile analysis to assess whether differences emerged between the extrinsic goals of reward pursuits and praise pursuits and if disparate patterns emerged between males and females and/or across grades. Four progressive models evaluated whether significant differences emerged between reward pursuits and praise pursuits. The first was the baseline variance components model or null model. The first model represents the higher-order construct of extrinsic goals. The second model assessed the possible improvement in the model with the inclusion of Index1 (the variable created with the two constructs into an independent or grouping variable of reward pursuits = 1 and praise pursuits = 0). The third model analysed the impact of the addition of the fixed effects of grades (either linear or quadratic) and the inclusion of complex level analysis for Index1 X gdelin. In addition, the relevant interactions of Index1 with grades (linear and quadratic effects) were assessed. The fourth model analysed the addition of the fixed effects of Index1 X sex (complex analysis) interactions as well as the interactions (linear and quadratic effects) of grades X sex and its relevant interactions with Index1. Assessment of each of these four progressive models was undertaken by evaluating the loglikelihood statistics between each to assess whether greater explanatory power was provided for each sequential model.

The findings from the baseline variance components model (Model 1) found that the intercept of extrinsic goals was -.175 with a standard error of the estimate = .036. The random part of the model represented in Model 1 (Figure 9.21) reported the three random levels presented by $\nu_{ijk} = .034/.012= 3\%$ for level 3, the school, $u_{ijk} = .418/.016= 26\%$ for level 2, the student within school, and $e_{ijk} = .572/.009= 64\%$ at level 1, Time within student within school. This negative value at the intercept for
Achievement motivation standardised extrinsic goals suggests that although a degree of variability exists, extrinsic goals are viewed less favourably in the motivational scale of the SMOSA compared to other factors.

Model 1: The baseline variance components model for extrinsic goals.

$$extrinsic_{ijk} \sim N(\beta_{ijk} \cdot cons)$$

$$\beta_{ijk} = -0.175(0.036) + \nu_{0j} + \psi_{0jk} + \sigma_{0jk}$$

$$[\nu_{0j}] \sim N(0, \Omega_r) : \Omega_r = \begin{bmatrix} 0.034(0.012) \end{bmatrix}$$

$$[\psi_{0jk}] \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.418(0.016) \end{bmatrix}$$

$$[\epsilon_{0jk}] \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.572(0.009) \end{bmatrix}$$

$$-2 \cdot loglikelihood(\text{TGLS Deviance}) = 29373.250(11219 \text{ cases in use})$$

Figure 9.21 A significant difference occurred between reward pursuits and praise pursuits (coded as Index1) with praise pursuits higher than reward pursuits.

Model 2: Assessed the difference in the extrinsic goals of praise and reward pursuits.

$$extrinsic_{ijk} \sim N(\beta_{ijk} \cdot cons)$$

$$\beta_{ijk} = -0.189(0.014) \cdot \text{Index1}_{ijk}$$

$$\beta_{ijk} = -0.081(0.037) + \nu_{0j} + \psi_{0jk} + \epsilon_{0jk}$$

$$[\nu_{0j}] \sim N(0, \Omega_r) : \Omega_r = \begin{bmatrix} 0.034(0.012) \end{bmatrix}$$

$$[\psi_{0jk}] \sim N(0, \Omega_u) : \Omega_u = \begin{bmatrix} 0.422(0.016) \end{bmatrix}$$

$$[\epsilon_{0jk}] \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.560(0.009) \end{bmatrix}$$

$$-2 \cdot loglikelihood(\text{TGLS Deviance}) = 29197.780(11219 \text{ cases in use})$$

Figure 9.22 Shows significant differences emerged between reward pursuits and praise pursuits occurred.

The findings from Model 2 (Figure 9.22) found that with the inclusion of the fixed effects of Index1 coefficient, $$\beta_1 (-.189/.014 = -13.5, p<.001)$$, praise pursuits were significantly higher than reward pursuits. Adding the lower-order factors of extrinsic goals to the baseline model significantly reduced the loglikelihood statistic (29373.25 -
Achievement motivation

$29197.78, \chi^2 = (1) 175.47, p < .001$ and therefore greater explanatory power was identified with the use of the lower-order structure of extrinsic goals.

*Model 3: Assessed the difference in the extrinsic goals across grades.*

extrinsic$_{jk}$ ~ $N(\Theta, \Omega)$

$\text{extrinsic}_{jk} = \beta_{0jk} + \gamma_{jk} \text{Index}_{1jk} + \gamma_{gdelin} \text{gdelin}_{jk} + \gamma_{gdequad} \text{gdequad}_{jk} + \epsilon_{jk}$

$\beta_{0jk} = -0.054(0.039) + \nu_{0jk} + \xi_{0jk}$

$\beta_{gdelin} = -0.117(0.013) + \nu_{gdelin}$

$\gamma_{gdequad} = 0.027(0.007) + \xi_{gdequad}$

$\epsilon_{jk} \sim N(0, \Omega_e) : \Omega_e = \begin{bmatrix} 0.049(0.013) \\ 0.014(0.007) \\ 0.018(0.007) \end{bmatrix}$

$\begin{bmatrix} \nu_{0jk} \\ \nu_{gdelin} \end{bmatrix} \sim N(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.416(0.015) \\ 0.001(0.007) \\ 0.018(0.007) \end{bmatrix}$

$\begin{bmatrix} \xi_{0jk} \\ \xi_{gdequad} \end{bmatrix} \sim N(0, \Omega_\xi) : \Omega_\xi = \begin{bmatrix} 0.510(0.009) \end{bmatrix}$

$-2^{\text{loglikelihood(GLS Deviance)}} = 28452.840 (11203 of 11666 cases in use)$

*Figure 9.23 The combination of praise pursuits and reward pursuits showed declines were evidenced across grades. Praise pursuits were significantly lower than reward pursuits across grades.*

In Model 3 (Figure 9.23) across grades for extrinsic goals there were significant declines in a linear fashion, gdelin coefficient, $\beta_2 (-.146/.011 = -13.27, p<.001)$ and also a significant quadratic effect, the gdequad coefficient, $\beta_3 (.027/.007 = 3.86, p<.001)$ was found. Significant effects also emerged for the difference between reward pursuits and praise pursuits across the pattern of development of grades. The flatness hypothesis testing the linear effect of grade X Index1, coefficient, $\beta_4 (-.117/.013, -9.00, p > .001)$ found a significant difference but no significant Index1 X gdequad interaction effect occurred coefficient, $\beta_5 (.014/.010)$. The equation presented in Model 3 also involved adding extra parameters to assess the variance of the slope residuals $u_{ij}$ and their covariance with the intercept residuals $u_{0j}$.

Model 3, tested the interaction of Index1 X the linear effect of grade was treated at the complex level analysis, that is the individual student within school random effect level analysis. Index1 X gdelin’s slope varied significantly between the two lower-order factors of praise pursuits and reward pursuits (.018/.007 = 2.57, $p < .01$)
Achievement motivation at the student within school level analysis (see chapter 8). The covariance of intercept X slope between praise pursuits and reward pursuits (.004/.012) however, was not significant. Comparing Model 2 with Model 3 (29197.78 – 28452.84) a reduction in the loglikelihood statistic was found, $\chi^2 = (10) 744.94, p < .001$, providing a significant improvement to the explanatory component of the model with the addition of grade and the complex level analysis of Index1 X gdelin.

**Model 4: Assessed the difference in the extrinsic goals across grades, sex and the relevant interactions.**

$\text{extrinsic}_{jk} \sim N(\mu, \Omega)$

$\text{extrinsic}_{jk} = \beta_{0jk} \text{cons} + -0.155(0.025)\text{Index1}_{jk} + -0.148(0.016)\text{gdelin}_{jk} + 0.035(0.011)\text{gdequad}_{jk} + \beta_{4jk}\text{Index1}\cdot\text{gdelin}_{jk} + 0.006(0.014)\text{Index1}\cdot\text{gdequad}_{jk} + 0.019(0.026)\text{sex}_{jk} + \beta_{6jk}\text{Index1}\cdot\text{sex}_{jk} + 0.004(0.021)\text{sex}\cdot\text{gdelin}_{jk} + -0.014(0.014)\text{sex}\cdot\text{gdequad}_{jk} + 0.008(0.025)\text{sex}\cdot\text{Index1}\cdot\text{gdelin}_{jk} + 0.015(0.019)\text{Index1}\cdot\text{sex}\cdot\text{gdequad}_{jk}$

$\beta_{0jk} = -0.665(0.042) + \nu_{0k} + \nu_{0jk}$

$\beta_{4jk} = -0.112(0.019) + \nu_{4k} + \nu_{4jk}$

$\beta_{6jk} = -0.068(0.032) + \nu_{6k} + \nu_{6jk}$

$\begin{bmatrix} \nu_{0k} \\ \nu_{0jk} \\ \nu_{4k} \\ \nu_{4jk} \\ \nu_{6k} \\ \nu_{6jk} \end{bmatrix} \sim N(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.039(0.013) \\ 0.405(0.016) \\ -0.002(0.008) \\ 0.016(0.007) \\ 0.022(0.015) \\ 0.003(0.008) \\ 0.003(0.020) \end{bmatrix}$

$\begin{bmatrix} \nu_{0k} \\ \nu_{0jk} \end{bmatrix} \sim N(0, \Omega_\nu) : \Omega_\nu = \begin{bmatrix} 0.509(0.009) \end{bmatrix}$

$-2\text{loglikelihood(OLS Deviance)} = 28427.940(11199 \text{ of 11666 cases in use})$

**Figure 9.24** Reward pursuits were significantly lower than praise pursuits with declines across grades being evidenced for both. Most notably variation existed between males and females but not in the pattern of development across grades.

Model 4 (see Figure 9.24) added the fixed effect of sex and the relevant interactions. Extrinsic goals in Model 4 found a significant linear effect of grade coefficient, $\beta_2 (-.148/.016 = -9.25, p > .001)$ and a significant quadratic effect of grade coefficient, $\beta_3 (.035/.011 = 3.18, p > .01)$, that is, evidence of recovery of the combined nature of extrinsic goals was found. Testing the level’s hypothesis found no significant differences emerged between males and females in the combined extrinsic goals, sex coefficient, $\beta_6 (.019/.036)$, nor in the interaction between males and
females for reward pursuits or praise pursuits, the Index1 X sex coefficients $\beta_1$ (-.068/.032 = -2.13 not significant at .01). Significantly a 2-way interaction emerged across grades with a different pattern of development for praise pursuits and reward pursuits, gradelin X Index1 coefficient, $\beta_4$ (-.112/.019 = -5.89, $p > .001$) but no other significant interaction effects occurred. No significant differences emerged in the 3-way interactions of grade X Index1 X sex (see Figure 9.24). The test of parallelism was therefore not supported for sex between praise pursuits and reward pursuits across the grades. That is steeper declines for reward pursuits than praise pursuits across the grades occurred.

Table 9.7 The newly developed SMOSA for grades (7, 8, 9, 10 & 11) for males and females and the total sample for reward pursuits, praise pursuits and extrinsic goals.

<table>
<thead>
<tr>
<th>Scale means</th>
<th>grade 7</th>
<th>grade 8</th>
<th>grade 9</th>
<th>grade 10</th>
<th>grade 11</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female reward</td>
<td>.39(361)</td>
<td>.00(684)</td>
<td>.57(963)</td>
<td>-.56(647)</td>
<td>-.72(265)</td>
<td>-.25(2920)</td>
</tr>
<tr>
<td>Male reward</td>
<td>.47(333)</td>
<td>.06(645)</td>
<td>-.27(922)</td>
<td>-.50(579)</td>
<td>-.64(185)</td>
<td>-.17(2665)</td>
</tr>
<tr>
<td>Total reward</td>
<td>.43(694)</td>
<td>.03(1330)</td>
<td>-.29(1885)</td>
<td>-.53(1226)</td>
<td>-.69(450)</td>
<td>-.21(5585)</td>
</tr>
<tr>
<td>Female praise</td>
<td>.18(361)</td>
<td>.01(683)</td>
<td>-.12(959)</td>
<td>-.21(655)</td>
<td>-.26(269)</td>
<td>-.09(2927)</td>
</tr>
<tr>
<td>Male praise</td>
<td>.20(337)</td>
<td>-.02(645)</td>
<td>-.18(931)</td>
<td>-.27(589)</td>
<td>-.29(185)</td>
<td>-.12(2687)</td>
</tr>
<tr>
<td>Total praise</td>
<td>.19(698)</td>
<td>-.01(1328)</td>
<td>-.15(1890)</td>
<td>-.24(1244)</td>
<td>-.27(454)</td>
<td>-.10(5614)</td>
</tr>
<tr>
<td>Total extrinsic</td>
<td>.18(1394)</td>
<td>-.09(2658)</td>
<td>-.26(3777)</td>
<td>-.41(2470)</td>
<td>-.43(904)</td>
<td>-.21(11203)</td>
</tr>
</tbody>
</table>

The number of students for each cell is placed in brackets.

In Model 4 sex (complex level analysis) was added to the equation and the slopes did not vary significantly between males and females (.003/.020 not significant) at the student within school level analysis. The sex covariance of intercept X slope was also not significantly different between affiliation pursuits and social concern pursuits (-.022/.015). Comparing Model 3 with Model 4 (28452.84 – 28427.94) a reduction in the loglikelihood statistic occurred, $\chi^2 = (9) 24.90$, which was not significantly different, with the addition of sex (including the complex level analysis) and its relevant interactions. As can be seen in Table 9.8, the progressive
multilevel models for extrinsic goals on grade, sex and their respective interactions (linear and quadratic) and the interactions of Index1 have been placed in this table for easy perusal of the progressive models’ findings. Means for each reward pursuits, praise pursuits and extrinsic goals across grades and between males and females are presented in Table 9.7.

![Graph](image)

**Figure 9.25** Both reward pursuits and praise pursuits show declines across grades.

Figure 9.25 shows graphically the pattern of development in extrinsic goals, namely reward pursuits and praise pursuits. A disparate pattern emerged across grades in high school between these two factors. The reported levels of extrinsic goals varied at the lower-order factors across grades. There were significant differences in the linear and quadratic effects of grades but no significant differences between males and females in extrinsic goals or at any of the interaction effects with sex. These findings add further support for the SMOSA as a more comprehensive model. Using this model that differentiated between the lower-order factors of extrinsic goals, a significant difference emerged across grades between reward pursuits and praise pursuits in the interaction of grades (linear) and the lower-order factors (Index1).
Therefore, adding support to the need to differentiate the lower-order factors when evaluating the nature of change across grades between these factors.

**Table 9.8 Progressive multilevel models for extrinsic goals on grade, sex and their respective interactions (linear and quadratic)**

<table>
<thead>
<tr>
<th>Parameter est.</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.175</td>
<td>-.081</td>
<td>-.054</td>
<td>-.065</td>
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<tr>
<td>Fixed effects</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1</td>
<td>-.189(.014)</td>
<td>-.190(.016)</td>
<td>-.155(.023)</td>
<td></td>
</tr>
<tr>
<td>Gdelin</td>
<td>-.146(.011)</td>
<td>-.148(.016)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gdequad</td>
<td>-.027(.007)</td>
<td>.035(.011)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td>.019(.036)</td>
</tr>
<tr>
<td>Fixed effects with 2-way interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1XGdelin</td>
<td>-.117(.013)</td>
<td>-.112(.019)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1XGdequad</td>
<td>.014(.010)</td>
<td>.006(.014)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1Xsex</td>
<td>-.068(.032)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXGdelin</td>
<td>.004(.021)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SexXGdequad</td>
<td>-.014(.014)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed effects with 3-way interactions</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1 X Gdelin X sex</td>
<td>-.008(.025)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index1 X Gdequad X sex</td>
<td>.015(.019)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loglikelihood statistic</td>
<td>29373.25</td>
<td>29197.78</td>
<td>28452.84</td>
<td>28427.94</td>
</tr>
<tr>
<td>Random effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>.034(.012)</td>
<td>.034(.012)</td>
<td>.040(.013)</td>
<td>.039(.013)</td>
</tr>
<tr>
<td>Student $\sigma^2$ (intercept var)</td>
<td>.418(.016)</td>
<td>.422(.016)</td>
<td>.416(.015)</td>
<td>.405(.016)</td>
</tr>
<tr>
<td>Student $\sigma^2$ (covariance gdelin X Index1)</td>
<td>-.001(.007)</td>
<td>-.002(.008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student $\sigma^2$ (gdelin X Index1 var)</td>
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<td>.016(.007)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student $\sigma^2$ (covariance Index1 X sex)</td>
<td>.022(.015)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student $\sigma^2$ (Index1 X sex var)</td>
<td>.003(.020)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>.572(.009)</td>
<td>.560(.009)</td>
<td>.510(.009)</td>
<td>.509(.009)</td>
</tr>
</tbody>
</table>

All significant parameter estimates are in **bold**.

**Overall Summary**

Review of the findings from the four profile analyses, found support for the use of the lower-order factors in the SMOSA. The lower-order factors of the commonly higher-order constructs, mastery goals, performance goals and social goals reported significant Index1 X sex interaction effects, that is, males and females differed between the lower-order factors for mastery goals, performance goals and social goals. Significant 2-way interactions were identified between the lower-order factors in each of the four profile analyses. Mastery goals and extrinsic goals identified...
significant 2-way interactions for Index1 X the linear effect of grade, that is, across
grades a different pattern of development emerged in the lower-order factor structure
for mastery goals and extrinsic goals. As Gorsuch suggested by evaluating the lower-
order factors, greater explanatory power would be provided rather than relying on the
associated higher-order constructs. Assessing patterns across grades during high
school for three of the higher-order constructs found that differences emerged
between males and females. Extrinsic goals and mastery goals found differences in
the lower-order factors across grades becoming more disparate.

Overall, further support was obtained for using the more comprehensive 12
factor model of the SMOSA after evaluating the four profile analyses through their
respective lower-order factors. The complex nature of motivation was found to be
better evaluated when a more comprehensive (12 factors) yet parsimonious (53 item)
model was used. The comprehensive nature of the SMOSA incorporated the lower-
order factors of mastery goals, performance goals, social goals, extrinsic goals as well
as the inclusion of a measure of Perceived Academic Capability and three measures
for self concept. Support was found for the SMOSA as a tool that allowed for the
mapping of the profile of development across high school for this adolescent
population. The differences identified suggest that the relationship with other lower-
order factors within the multidimensional profile may interact in different ways when
the lower-order factors are utilised. Importantly, evaluating the higher-order
constructs alone would eliminate valuable information associated with the lower-
order factors, such as differences between males and females in achievement
motivational profiles across high school.
Chapter 10

Discussion

The purpose of this thesis was to systematically evaluate a multidimensional model of achievement motivation using a conceptual model that included self-perceptions across adolescence in a single scale, with a focus of assessing whether differences emerged across grades or between males and females in the 12 factors. Several procedures were undertaken to evaluate the SMOSA and enable its use to map the patterns of change across grades, sex and the possible interactions of grades X sex. After normalisation and standardisation of the 12-factor model, the psychometric properties of the SMOSA were assessed through rigorous testing using both confirmatory factor analysis as well as construct validation using invariance tests across both grades and sex. The use of polynomial contrasts enhanced the mapping of this construct because it allowed not only the linear effects but also the quadratic effects to be evaluated. Support was found at each stage of testing for the SMOSA’s construct reliability and validation.

Once the psychometric properties were established, the next stage of assessment and evaluation was undertaken to identify whether differences emerged in the SMOSA’s 12 factors across grades, sex and for the interactions (grade X sex). These findings supported the multidimensionality of the SMOSA. The final stage of testing involved assessing whether the use of the lower-order factors provided greater explanatory power than the use of the higher-order constructs through profile analyses. Differences emerged when the comprehensive approach was evaluated using the lower-order factors for each of the higher-order constructs of mastery goals, performance goals, social goals and extrinsic goals.
Support for the Psychometric soundness of the SMOSA

Support was found for the comprehensive (12 factors), yet parsimonious (53-item) structure of the SMOSA. Distinctiveness within the subscales was identified through testings of confirmatory factor analyses and tests of invariance for grades as well as sex. Satisfactory goodness-of-fit indicators for the overall model as well as testing construct validation through invariance tests for grades and sex were found. The psychometric properties of the SMOSA provided equivalence between groups at both grade and sex testing. The most restrictive models, that is, the totally invariant models assessing sex and grades reported values at .03 for RMSEA and not less than .98 for the NNFI and RNI across grade and sex. Thus, support was achieved for the soundness of the SMOSA as an instrument to assess the differences in these groups when mapping the patterns of change across the 12-factors of the SMOSA. One limitation was noted with the scale with high uniquenesses found for two items from the social concern factor. However, due to the lack of improvement in the final model with the deletion of these two items (either individually or together) and given that the conceptual underpinnings of the item’s relative value required inclusion, the a-priori 53-item model was used in subsequent analyses. Future research may wish to review the wording of these two items with particular reference to the areas of cross-loadings (see chapter 7). The newly developed SMOSA was found to be both reliable and valid through rigorous statistical analyses for use with this adolescent population (see chapter 7).

Support was also found for use of the SMOSA through multi-level analyses across grades and sex. While many hypotheses were assessed, these fell into three broad categories across the twelve factors. The first mapped the patterns of change across grades through linear and quadratic evaluations. The second assessed whether
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Two significant sex X grade interactions (linear and quadratic effects) emerged among the twelve factors.

**Grade differences for the 12-factors in response to the first hypotheses**

Significant linear and quadratic (naturally ordered through contrast analysis) effects of grades emerged across the twelve factors. While significant linear declines were evidenced for all 12 factors, significant quadratic effects were also found for 9 of the 12 factors. Strong systematic declines were only evidenced without quadratic effects for two of the twelve factors; affiliation pursuits and English self-concept.

While general academic self-concept also reported significant linear declines, on review (see Figure 8.71) there was evidence of a plateauing of those declines between grades 9 to 11 although this was not significant.

Significant quadratic effects were found for task pursuits; social concern pursuits; maths self-concept and PAC. Recovery occurred in the latter grades for these factors (see graphs in Chapter 8). While effort pursuits, competition pursuits, leader pursuits, reward pursuits and praise pursuits also reported significant quadratic effects across grades, on review of the graphs, the reported significant quadratic effects represented a reduction in the rate of the reported decline rather than evidence of recovery by grade 11. These findings highlight that variation among the profiles of the motivational pursuits across grades was found using the multidimensional approach of the SMOSA.

Perhaps of most concern in this set of findings was the strong systematic decline in English self-concept across grades previously not reported in past research? Marsh’s (1989) findings outlined a significant quadratic effect occurring across grades in English self-concept in his longitudinal research in the late 80’s using an Australian
sample. Additionally, more contemporary research by Jacobs and colleagues (2002) using an American sample found a significant quadratic effect emerged across grades 1 to 12 with recovery occurring around grades 9 and 10 in language arts competence beliefs after earlier systematic declines. A similar pattern of development as Marsh’s study was also found by Cole and colleagues (Cole et al., 2001) where both males and females recovered in the latter part of high school. This verbal factor of competence was reported as having the only curvilinear effect across grades in their longitudinal research (Cole et al).

**Comparison of the 12 factor scale’s levels after standardisation**

The findings of variation in the patterns of change (direction) across grades among the 12-factors of the SMOSA supported the first premise of this thesis on the multidimensionality of motivation. Equally important, however, was that variation in the reported levels emerged among the factors of the SMOSA. Standardising all 12 factors of the SMOSA through z-score transformation enabled evaluation of the comparative highs and lows of the complete scale, while systematically allowing for the relative values of each factor to be evaluated. Task pursuits were rated as the most salient (highest level) factor in the SMOSA across all grades and leader pursuits, the least salient factor. As can be seen in Figures 8.81 to 8.85, Task pursuits and effort pursuits were consistently the factors in the SMOSA that had the highest responses, generally at 1 standard deviation above the mean across all grades. Perceived Academic Capability was the next highest factor and general academic self-concept was close behind. Task pursuits, effort pursuits, PAC and general academic self-concept were all above the mean (0.0) across all grades for both males and females. Social concern pursuits were also rated above the mean across all grades but only for females.
Each of the abovementioned factors related to facilitative learning and positive self-perceptions. Therefore on these factors the motivational pursuits in this Australian-based sample represented a healthy motivational climate emerging overall in the represented schools. Task pursuits and effort pursuits were the lower-order factors of a mastery goal. High levels in mastery goals have been related to adolescent’s school engagement, perseverance in academic tasks, the development of new skills to understand their work and the evaluation of their own sense of improvement not contingent upon external factors (McInerney & McInerney, 1998; Hidi & Harackiewicz, 2000). Support has been found for the link with strong perceptions of capability and competence with mastery goals (Ames & Archer, 1988; Anderman et al., 2001; Anderman, Hicks, & Midgley, 1998; Anderman, Maehr, & Midgley, 1999; Bandura, 1989, 1997; Bandura & Locke, 2003; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). This thesis found that similar levels in general academic self-concept, PAC, task pursuits and effort pursuits did emerge.

In addition, social concern pursuits were also characteristically high in this sample but only for females. Social concern (social responsibility) pursuits also have been linked with facilitative learning in the literature. Wentzel (1989) suggested that “social motivation and social cognitive functioning need to be recognised as potentially critical factors influencing classroom performance of high school students” (p. 141). More importantly, her research found that social goals were unique in identifying the high-achieving students compared to low-achieving students. The factors that were high on the SMOSA, (above the standardised mean) were all related to facilitative learning from an educational perspective.

The least salient factor consistently reported was leader pursuits and the second lowest factor of the SMOSA was competition pursuits. The remaining factors of
affiliation, English self-concept, reward pursuits and praise pursuits all started above the mean but fell below the standardised mean across the progression of grades. Of particular concern with these findings were the relative values of English self-concept and maths self-concept. Review of the graphs for English self-concept (Figure 8.57) found that by grade 9 the standardised mean for English self-concept was below the mean (0) showing a systematic pattern of decline with no evidence of recovery in the latter grades for males or females. Review of the graphs for maths self-concept (Figure 8.64) showed that from grade 8 the standardised mean was below the mean (0).

**Sex differences in the second set of hypotheses for each of the 12-factors**

Differences emerged for eight of the twelve factors of the SMOSA between males and females. The four factors that did not report significant differences between males and females were affiliation pursuits, reward pursuits, praise pursuits and PAC. Differences emerged, with females being significantly higher in task pursuits, effort pursuits, social concern pursuits and English self-concept. Each of these factors as previously discussed have been linked to facilitative learning in the literature.

Males were significantly higher than females in competition pursuits, leader pursuits, maths self-concept and general academic self-concept. Males reported higher competition pursuits and leader pursuits which equates to less facilitative components of learning. In addition, females were considerably higher in the more facilitative factors of task pursuits and effort pursuits. However, in the evaluation two points are important. Firstly, the relative levels of performance goals for competition pursuits and leader pursuits were reported as the lowest indicators of the SMOSA across all grades by both males and females. Secondly, a focus on viewing this aspect outside the complete context may support males’ negative approach to engagement and
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learning at school, yet research by Bouffard and colleagues (Bouffard, Boisvert, Vezeau, & Larouche, 1995) would also need to be considered, where they found that males’ emphasis on performance-based goals was positively associated with the use of meta-cognitive strategies and self-regulation. While past research suggests that the adoption of performance-based goals was not facilitative for females, the reverse effect on the pattern of development may occur for males. That is, males may be motivated by different goals than females and they may be more engaged at school in a competitive or performance-based climate. Therefore, while the literature notes different outcomes for these goals, the focus on the positive learning strategy of mastery goals is of particular interest. Males’ less facilitative approaches occurred through task pursuits and effort pursuits, which is of greater concern.

Findings for other factors reported that maths self-concept appeared systematically lower for females across grades than the standardised mean but not consistently lower for males. Maths self-concept is positive aspect of engagement because it represents the perception of competence in maths performance. This factor has been reported in past research as presenting to a stereotypical pattern occurring. Past research suggests a gender bias for males as being higher in the self-reporting of maths self-concept with males being more confident than females (Anderman et al., 2001; Jackson, Hodge, & Ingram, 1994; Marsh, 1989; Marsh, Parada, & Ayotte, 2004). This view is based on a social construction of gender, which presents an interesting challenge to contemporary research. As suggested individual motivational pursuits and self perceptions were found to be similar to the reported stereotypical patterns found in past research. Females were higher in mastery goals (task pursuits and effort pursuits) with higher social concern pursuits and males were higher in performance goals (leader pursuits and competition pursuits). The extrinsic goals of
reward pursuits and praise pursuits were not significantly different between males and females in the initial evaluations using multilevel modelling and therefore a differentiation did emerge.

Apart from performance goals, males reported higher levels in maths self-concept and general academic self-concept. One proviso indicates caution with extrapolations in this finding which relates to male’s tendency to over-estimate their self evaluations compared to females when rating levels of competence or capability (Huston & Alvarez, 1990). Although not significantly different but worth noting, females generally underestimated their levels of competence or capability but surpassed males in PAC levels by grade 11. Therefore, even though males tend to over-estimate their capability levels, by grade 11 females rated their levels higher in PAC and females also reported higher levels in the facilitative aspects of task pursuits and effort pursuits. This raises concern for the comparison between males and females because males’ facilitative components of motivational pursuits and self-perceptions were declining in the latter grades of high school. As Brendon Nelson (2004) suggested females’ are outperforming males in 90% of school subjects by Year 12.

Differences between males and females in the random effects models

The use of MLwiN analyses allowed for visual representation by graphing the time within student level responses of the degree of individual variation that occurred across grades, to better evaluate the patterns that emerged between males and females. Differences emerged between males and females in the random slope models for task pursuits (see Figure 8.10). Most noticeably, these individually graphed responses identified that the range of scores showed greater spread for males compared to females in the facilitative aspect of task pursuits. Similar levels were reported for males and females at the highest point of responses in most factors, that is for a cohort
of males and females high values were found. Reviewing the spread of responses, more males reported lower levels of task pursuits than females and by grade 11 a greater fanning out in the pattern of responses occurred for males compared to females (see Figure 8.10). Social concern pursuits also showed a greater range of responses for males than females. Again, while similar response levels occurred for a cohort of male and female students at the higher level, a greater spread in responses occurred for males compared to females in the lower levels.

The largest range of individual responses (that is the greatest spread or variability in responses) was found in English self-concept, maths self-concept and general academic self-concept. The highest reported response levels in maths self-concept were for males but highest in English self-concept for females. More importantly, the spread across the self-concept indicators was most pronounced for males at the lower levels across all these factors. Therefore, while the students who reported the highest levels on the SMOSA inventories were not generally differentiated by sex, across the range of responses there was a much larger degree of variability for males. The lower reported responses for individuals, identified differentiation between males and females with males consistently found to have lower ratings in these measures. This suggests that the degree of motivation across the set of male responses varied greatly and while some males reported high levels of motivation, for the majority this was not the case.

**Grade X sex interactions for the third hypothesis for the 12-factors**

There was only one significant sex X grade (linear) interaction that emerged. Task pursuits reported a significant 2-way interaction, with females consistently higher than males. Systematic declines were evidenced in a linear fashion for males across grades, however, the rate of decline lessened for females with a trend towards
recovery evidenced in female’s task pursuits around grade 11 (see Figure 8.9). This was statistically significant in the interaction of the linear effect of grade X sex. No other significant sex X grade (linear) interaction effects or sex X grade (quadratic) interaction effects were identified for any of the 12 factors of the SMOSA. This only adds to the concern for adolescent males because these findings suggest that while initial declines were evidenced for both males and females, females consistently reported higher levels across the grades with recovery found towards the end of high school. On average however boys continued to decline. Task pursuits have been aligned to intrinsic motivation within the literature and more specifically in this inventory, task pursuits were the student’s perception of achievement when personal improvement was obtained.

The effect of grades among the 12 factors – what is facilitative?

Importantly, the scales associated with facilitative learning individually showed evidence of recovery across grades (quadratic effects of grades) for nine of the twelve measures. The systematic motivational declines often suggested, as being representative of adolescence were not found in this research. Instead of an emphasis on declines in motivational pursuits across adolescence, the recovery of the facilitative factors and the successive declines in the less facilitative factors presented a more positive image of the progress across high school for this adolescent population. The individual scales are further outlined review to appropriately evaluate this claim. Task pursuits were the most salient factor in the SMOSA and reported recovery. Across the literature task pursuits have been identified as being facilitative towards learning (Midgley, Kaplan, & Middleton, 2001). Similarly, the other mastery goal of effort pursuits associated with perseverance even when the work is challenging was also systematically high compared to other factors of the SMOSA.
and this factor also had a quadratic linear effect of grade. The scales of PAC and general academic self-concept were also systematically high with PAC showing a curvilinear effect in the latter grades and general academic self-concept had a strong trend towards recovery. These factors all reinforce the positive nature of this sample’s achievement motivational profile.

Previous literature supports the interdependence of mastery/intrinsic goals with the role of competence or capability. From White’s Generalized Theory of Effectance Motivation through all the self theories of Bandura (1997), Marsh (1992) and Harter and colleagues (Harter, Whitesell, & Kowalski, 1992) through to the social Cognitive theories of Achievement Goal Theory (Maehr, 2004). Deci and Ryan reviewed the literature and explained the differences between the task/ego involvements of Achievement Goal Theory with intrinsic/extrinsic motivation of Self Determination Theory in response to Butler’s claims. They claimed that these theories provide a complementary rather than contradictory approach to the meaning and perception of motivation (Deci & Ryan, 1989). Both theories relate to the link between perceptions of competence or capabilities and facilitative learning in these forms of motivational pursuits.

Affiliation pursuits, reward pursuits, leader pursuits and competition pursuits all showed significant linear declines across grades in this study. Each of these factors has been variously associated with less facilitative patterns across grades and therefore, declines in these measures would be generally equated to adaptive patterns of development. Reward pursuits lessened in the rate of decline by grade 11 with a significant quadratic effect being identified. This may be partially explained because of the initial low levels and relative strength of reward pursuits that decline across grades and therefore lessening in the rate of decline was probably expected.
Importantly, this did not represent an improvement in reward pursuits but rather just a decline in the rate of the initial strong descent. The less facilitative components of the SMOSA reported lower levels and systematic declines across grades however, the factors relating to more adaptive approaches in learning reported simultaneous recovery across grades.

The remaining factors of praise pursuits and social concern pursuits have been variously associated with academic engagement. A social concern pursuit has been previously aligned with academic engagement (Wentzel, 1989). Praise pursuits have been associated with either enhancing or undermining intrinsic motivation depending on the internalisation of the meaning to the student of praise. Past research has suggested that the variation depended on whether the student perceived praise pursuits in the form of verbal rewards, as informational versus controlling (Deci, Koestner, & Ryan, 1999). While this research suggested that males generally viewed praise pursuits as informational, females viewed them as controlling. Perhaps because females are more mastery goal focussed they are not motivated by externalised forms of extrinsic rewards, such as praise and acknowledgments.

Maths self-concept reported recovery across the grades and this finding aligned with previous literature’s focus. Although the respective levels were systematically lower. The primary concern however, emerging from the analysis of individual profiles related to English self-concept. Significant linear declines across grades were identified for males and females with no trend towards recovery in the latter grades being found. Both males and females fell below the standardised mean (0) across the grades for English self-concept. This is in contrast to Marsh’s (1989) findings during adolescence of a U-shaped curvilinear effect across grades with recovery evidenced in his research on English self-concept (Marsh, 1989; Marsh & Ayotte, 2003).
Therefore, student’s perception of their ability to perform in English was systematically declining across grades with no evidence of recovery. Given that there is overwhelming literature supporting a high correlation of English self-concept to English performance outcomes; this current finding is cause for concern.

*Curriculum changes may explain the differences found in English self-concept*

Review of the patterns that emerged across the 12-factors of the SMOSA reinforces the instrument’s broader applicability. The primary difference emerged in the patterns of development for English self-concept; measured using a well-established inventory (Marsh’s ASDQIIIs). The disparate patterns found may be related to changes in the curriculum for English in New South Wales, Australia during the time of collection of the data between 1999 and 2001. Investigation into the possible causes highlighted that syllabus changes were implemented to the English secondary school curriculum in early 2000 (Miller, 2004). These changes may partially explain the differences that emerged between these findings and previous research in the pattern of development of English self-concept during adolescence.

The subject of 2-unit Contemporary English was dropped being replaced by the subject of Standard English. Teachers have suggested that the newer subject of Standard English, is far more difficult and challenging and is a radical departure from the previous content of Contemporary English (Miller, 2004). The new syllabus was implemented to grade 11 students in 2000 with drastic changes made to what was taught and how students were assessed (Ayres, Beechey, & McCormick, 2002). In particular Miller (2004) investigated teacher’s perceptions of the implementation of changes to the English syllabus, showing that assistance and training was required “to ensure that teachers can help disadvantaged students to achieve these demanding syllabus outcomes” (Miller, 2004). Critical evaluation and response were prescribed
expectations of the new syllabus and for some students, this may be extremely challenging, especially the lower achieving students.

Review of current research findings supports the concerns raised in Miller’s and Ayres, Beechey and McCormick’s investigations. As mentioned, rather than the hypothesised recovery in English self-concept measures, systematic declines were found. On closer examination of the random slopes model for English self-concept (Figure 8.61) that allows review of the Time within student level analysis to be assessed, gradual declines for males and females were found even for the students with reported higher levels of English self-concept. Perhaps, more importantly though the spread in the range of responses was greater in the latter grades for students who reported lower English self-concept responses. The pattern of systematic decline across grades in this research was in contrast to previous findings of reported recovery.

Findings from the Profile analyses

The final set of analyses involved profiling the higher-order constructs of mastery goals, performance goals, social goals and extrinsic goals into their lower-order factors. Differences emerged between the lower-order factors of the higher-order goal constructs in each of these profiles. Firstly, strong positive correlations were found between the lower-order factors for three of the four higher-order constructs; mastery goals, performance goals and extrinsic goals. This is in line with previous research by McInerney, Marsh and Yeung (2003) which suggested that “social concern is not substantially correlated particularly with Affiliation” (p. 10). The design of the present research found that separation of the four constructs of mastery goals, performance goals, social goals and extrinsic goals into their lower-order factors provided greater explanatory power because differences emerged
between males and females and/or across the grades in each set of profile analyses for the four constructs, that is, the lower order factors were shown to have explanatory power over and above the use of the higher order factors alone. Each profile analysis provided further support for the multidimensional structure of the SMOSA. Significant two-way interactions were identified for Index1 (separation of the higher-order construct into its lower order pursuits) X the linear effect of grade for mastery goals and extrinsic goals and for Index1 X sex in mastery goals, performance goals and social goals.

Strong positive correlations also emerged for task pursuits with social concern pursuits, praise pursuits and PAC. The positive nature in mentoring of others was reinforced as social concern pursuits were strongly correlated with task pursuits and effort pursuits. More importantly as suggested by Butler’s theory of a Differentiated Concept of Ability, the measures of PAC and effort pursuits were strongly correlated. PAC was also strongly associated with task pursuits. PAC and general academic self-concept were also strongly correlated (.56) and the other two self-concept measures were correlated with general academic self-concept. Support for the broader factor structure was also reinforced because differences arose between the lower-order factors of the performance goals with task pursuits as well as the lower-order factors of extrinsic goals and the lower-order factors of performance goals.

Random effects and Complex level analyses findings

Separation of the residuals into a nested model structure allowed for the variation to be analysed at each of the three levels of analysis that is Time, student and school levels. As Rowe (2005) suggested, ignoring the clustering effects that occur in educational research may cause underestimation of the regression coefficients and standard errors resulting in the possibility of a violation of the
assumption of independence with large samples. Differences may be assumed when these differences are not there due to misestimation of the parameter estimates and standard deviation (Rasbash, Steele, Browne, & Prosser, 2004). Therefore, to accommodate the different levels of variance emerging within this research, analysis using the three levels of Time, Student and School was undertaken.

Affiliation pursuits reported a zero coefficient at the School level analysis and the variability for all other pursuits was comparatively small among schools in this adolescent population ranging from 0% to 7%. This was initially surprising because the degree of variation among schools in motivation may be a factor that many parents find important when placing their children in other schools outside their geographical area. However, the sample of schools in the present study was limited to eleven public schools. Thus future research should incorporate a more diverse sample. The greatest variability was at the Time level analysis ranging from 46% (general academic self-concept) to 61% (praise pursuits). The variation across grades at the Time level analysis although initially surprising was probably due to a maturational effect, attributable more as a factor of the phenomenon of the construct, motivation, than being indicative of the instability of the measure. This claim is partially supported by the low inter-correlations found when testing the cohort effects in overlap of specific grade levels. Among the 36 comparisons (3 grade level comparisons for 12 factors each) the largest effect size was .015, for the factor of effort pursuits at grade 9 (3 cohorts). No individual factor emerged across all three analyses and Cohen and Cohen’s (1983) conclusion that measuring an abstract phenomenon such as motivation will not provide the same degree of reliability as a constant such as age appears to be supported in these findings.
The use of multilevel modelling allowed for mapping of the patterns of change to be graphed showing the individual variation among students across grades for each factor. The maturational effect (degree of variation) that emerged across grades was also supported at the random effect levels and the multidimensional nature of the SMOSA (12-factors) was supported with significant differences emerging in the profile analysis section (chapter 9). Finally, using a complex level analysis, that is allowing for variation in the slope as well as at the intercept level found support for the use of the profile analyses.

**Profile Analysis for mastery goals**

The profile analysis conducted on mastery goals supported the premise that the lower-order factors of task pursuits and effort pursuits provided greater explanatory power for the patterns of development across grades (Index1 X grades) and between males and females (Index1 X sex) than the higher-order construct of mastery goals alone. Division of the mastery goal structure into its lower-order factors allowed for clarification of the patterns that developed across grades simultaneously for the lower-order factors but assessed whether deviation occurred between males and females, by degree and/or when (at what grade) students approached these pursuits. Notably, differences were also found in the pattern of responses between task pursuits and effort pursuits when comparing the random slopes model at level 2, the Time within student level, individual response set in mastery goal’s profile analysis. Task pursuits had a narrower pattern of responses compared to effort pursuits (see Figure 9.7), that is the pursuit of effort or perseverance showed greater variability in the reported value of engagement at school in this adolescent population. Effort pursuits were lowest between grades 9 and 10 with a trend towards recovery by grade 11.
Task pursuits recovery however, showed stronger recovery in the latter grades (see Figure 9.4 to compare the task pursuits’ and effort pursuits’ relative values).

Significant differences were found at grade level as well as between males and females in the lower-order factors of the mastery goals of task pursuits and effort pursuits. Task pursuits and effort pursuits had stronger early declines across grades for males compared to females. Females’ task pursuits showed minimal declines comparatively and stronger evidence of recovery in the latter grades. Figure 9.6 outlines males’ deficits as having the lowest levels of effort pursuits and comparatively females having the highest level of task pursuits. Females reported higher levels on average in both pursuits and the patterns of development for task pursuits and effort pursuits became more disparate across grades between males and females. The separation of these pursuits occurred with a strong trend towards a significant 3-way interaction for Index1 X grade X sex although not significantly at the .01 level, which was the conservative level set for this thesis.

*Profile Analysis for performance goals*

The profile analysis for performance goals found a significant Index1 X sex interaction. Differences emerged with females having the lowest levels of leader pursuits and males having the highest in competition pursuits. Noticeably, all four interaction pursuits fell below the standardised mean with the exception of males in Year 7. Males were consistently higher than females in both competition pursuits and leader pursuits across all grades. This lends further support to previous research findings that males are more performance oriented than females. However, it also suggests that between these two performance goals, females were less motivated by the concept of winning or being in charge compared to males. While literature suggests that if males consistently focus on being the best or in charge, then they
may not be engaging in the process of learning and understanding to the same
degree as females, however, other research suggests caution in this limited
conclusion. This research finds support for both perspectives. Firstly low levels were
reported suggesting these were generally not salient motivating factors; however, the
degree of variation suggests that for some males these were positively viewed
aspects of their motivational profile.

Given this finding, a review of the range of individual responses for these
factors was warranted. As suggested the most pronounced factors were the levels
between competition pursuits and leader pursuits in the random slope model for the
Time within student level analysis. Leader pursuits consistently reported lower
levels compared to competition pursuits. Figure 9.13 showed a great degree of
variability across the grades among the reported responses with a percentage of
students reporting above the mean and therefore, as motivating features of their
adolescent profile. The significant difference in sex between these two factors may
initially support the argument that males are less facilitative, given their high
respective levels, however, as Bouffard and colleagues argued, "although adhesion
to a learning [mastery] goal has a positive impact on self-regulation both for girls
and boys, for the latter, adhesion to performance goals can also be helpful" (p. 317).
These researchers found that the use of performance goals were positively
associated with the use of meta-cognitive strategies for males. Therefore, they
suggest that performance goals may be beneficial in learning for some males, in
competition pursuits and leader pursuits compared to other motivational pursuits. To
fully elucidate this finding, however further analyses, which are beyond the scope of
this investigation would be required. The great degree of variability in these
performance-based responses suggests that for some males these are features
necessary to engage in the process of learning while for other adolescents this may not be the case.

Profile Analysis for social goals

A significant two-way interaction for social goals in the Index1 X sex was found. Females reported consistent declines for affiliation pursuits and strong recovery for social concern pursuits. Males’ patterns of development in the social goals of social concern pursuits and affiliation pursuits did not deviate to the same degree (see Figure 9.18). Females reported the highest social concern pursuits but the lowest level for affiliation pursuits. Overall a moderate correlation was found between the two lower-order factors in these social goals, which is in line with research by McInerney, Marsh and Yeung (2003). The high inter-correlations between social concern pursuits and the self-perceptions of PAC, English self-concept and general academic self-concept as well as the low correlations between these self perceptions factors and affiliation pursuits support the premise that social concern pursuits may be more conducive to these positive aspects of learning compared to affiliation pursuits. Separately evaluating the inter-correlations for the lower-order factors rather than relying on the higher-order constructs, adds support to the claim that greater identification and understanding of the types of pursuits that work in conjunction with one another in achievement motivation may be achieved. While separation of the lower-order factors was not as pronounced for males a significant difference emerged for females in the social goals. The tendency for females to report higher levels of social concern pursuits than their affiliation pursuits suggests females reported a greater degree of independence in the classroom context. This feature has been viewed as conducive to better learning strategies and facilitative within an academic environment (Wentzel, 1999a).
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Although some students may see affiliation pursuits as salient features during adolescence and being in a group of peers as a major priority in school it is not conducive to achieving independent learning strategies (McInerney, Simpson & Dowson, 2003; King, 2000). Females presented a stronger pattern of decline in affiliation pursuits than males and recovery in mentoring strategies in the latter grades in social concern pursuits.

Wentzel (1999) found social concern pursuits contributed significantly to performance outcomes even after taking into account academic capability and that mentoring of others, assisted in adolescent’s own academic success. Social goals have been linked to adolescent’s learning and engagement through aspects of autonomy (Gagne & Deci, 2005). However, the two lower-order factors appear to have differential mechanisms driving the individual toward active engagement within the school context, and different profiles emerged for males compared to females. Figure 9.18 clearly shows that disparate patterns for females emerged between the two lower-order pursuits of social goals. Females reported systematic declines and comparative low levels in affiliation pursuits across the grades but relatively high levels and recovery in social concern pursuits. Conversely males’ patterns of development of these two social goals did not deviate to the same degree as females.

The range in the individual pattern of responses (random slopes model, the Time within student level) showed that for some students both factors were salient in their motivational profile. Differences however, did not emerge between social concern pursuits and affiliation pursuits in their patterning of development at the individual response level.
There has, however, been some debate in relation to the facilitative effects that affiliation may have on achievement. Urdan and Maehr (1995) point out that most students in groups had naturally formed relationships with others that held similar educational beliefs and achievement levels, and that “the motivational level of the group stayed fairly constant over the course of a school year despite considerable fluctuation in group membership” (p. 220). These peers may have either a positive or negative influence. Thus, affiliation can either facilitate or inhibit academic achievement.

Profile Analysis for extrinsic goals

The profile analysis for extrinsic goals also reported a significant two-way interaction effect for Index1 X the linear effect of grade. Different patterns of development were found across grades between praise pursuits and reward pursuits. Consistent declines were found for reward pursuits however, praise pursuits evidenced recovery and a widening of the gap emerged by grade 11 between these two factors (see Figure 9.24). Males and females did not significantly deviate between these two factors as featured in previous profile analyses for mastery goals, performance goals and social goals. The disparate pattern that emerged between these two factors across grades found greater deviation emerging as students progressed. There were significant differences in the linear and quadratic effects of grades but no significant differences in sex or for the interaction effects of grades X sex in extrinsic goals.

Reward pursuits continued to decline across grades for both males and females whereas praise pursuits evidenced recovery. Acknowledgment or praise was a feature students reported as motivating in the later grades, whereas material rewards were not. The undermining of intrinsic goals by extrinsic goals was a feature of Cognitive
Evaluation Theory and SDT. SDT suggests that depending on the type of extrinsic goal and the underlying reason for the receipt of the extrinsic goals, variation in the internalisation or meaning will differentially impact on whether extrinsic rewards are viewed as facilitative. Praise pursuits may be viewed as more facilitative if they are informational rather than controlling. Praise pursuits showed a lessening in the rate of decline compared to reward pursuits. Again, further analyses outside the scope of this thesis would be needed to evaluate the meaning of these constructs individually.

Although Achievement Goal Theory would suggest that students’ choices, attitudes and performance in achievement situations are influenced by the particular goals they pursue (Bouffard, Vezeau, & Bordeleau, 1998; Grant & Dweck, 2003; Maehr & Braskamp, 1986; Pintrich, Marx, & Boyle, 1993; Urdan & Maehr, 1995).

**Differences in males and females patterns of development – who is more facilitative in their learning**

Evaluation of the patterns of development for males and females in this research immediately highlighted that disparate patterns emerged at each level of analysis. Differences emerged in mapping the patterns of change across the individual factors in eight of the twelve factors, in the grade (linear) X sex interaction effects for task pursuits and in three of the four profile analyses. Significant differences emerged in the 2-way interactions between the lower-order factors of the higher-order constructs across grades (Index1 X grades) and/or between males and females (Index1 X sex) for all four profile analyses.

Recovery in the facilitative factors and declines in the non-facilitative factors emerged for females with a reverse effect generally being found for males. These findings may then be in line with the argument presented by van Houtte (2004) regarding the global “underachievement of boys in comparison with girls” (p. 159). Her findings suggest that boys are less study oriented than girls and that their study
culture impacts on their performance. She concluded that boys react to their
underachievement by “overdoing their masculinity …[and] opposing school” (p. 171).
In addition, the negative effect of the study culture was pronounced particularly in
low-achieving boys who tended to intensify the stereotype bias that application to
study was not cool in her research. One proviso with this generalised overview is that
for a cohort of male students, those higher achieving students had a profile similar to
females (see the various random slopes models presented). In addition, for some of
the factors of the SMOSA disparate interpretations emerged between research
findings. For example, some researchers suggested performance goals may be viewed
as facilitative towards learning for males but a reverse effect for females (Bouffard,
Boisvert, Vezeau, & Larouche, 1995). Therefore, a simple division along sex may not
provide an appropriate dissemination of the current findings, when beliefs about
certain goal pursuits by sex vary in their functionality.

Is the Gender Intensification hypothesis supported

Separation of the higher-order constructs into the individual factors added
further support to the argument that the gender gap is widening. The elegance of this
enquiry detailed where the effects were most salient. These findings may be
particularly relevant given the reported underperformance of males in comparison to
females in a majority of school subjects by grade 11 (Nelson, 2004; van Houtte,
2004). A majority of males were not actively engaged at school which appeared to be
a consistent finding across all grades in high school (van Houtte, 2004). Boys were
not engaged or motivated towards academic endeavours and their comparative
reported declines in performance were testament to this. Finally, the claims made by
Huston and Alvarez (1990) regarding the gender intensification hypothesis may, on
the surface be supported by these research findings. The gender gap appeared to be
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widening, with males having lower levels of the facilitative factors and higher levels of the less adaptive factors of the SMOSA. Previously reported stereotypical patterns emerged for each of the factors identified. Males were higher in maths self-concept, competition pursuits, leader pursuits, general academic self-concept and overall PAC. Females were higher in English self-concept, task pursuits, effort pursuits and social concern pursuits and no significant sex effect emerged for the other factors of rewards pursuits, affiliation pursuits and praise pursuits.

Marsh (1989) suggested that self-concept is multifaceted and becomes increasingly differentiated with age. This research supported Marsh’s claims that the gender gap appeared to be widening across the dimensions of self-perceptions. Support for the gender intensification hypothesis for self-concept measures was synonymous with Marsh’s findings regarding gender stereotypes that of higher levels for maths self-concept for males and higher English self-concept for females. However, the findings are in contrast to Jacobs et al (2002) research which found that the gender gap decreased from childhood to adolescence. Overall, greater explanatory power was provided with the use of the more comprehensive profiling of adolescent motivation particularly using the broader framework that represents the lower-order factors of motivation and self perceptions. The evaluation of differences between males and females highlighted that disparate patterns of development across grades occurred among the 12-factors of the SMOSA.

Social Identity theory may provide an explanation regarding the lower performance of males compared to females

Although not specifically tested in this research, mechanisms relating to Social Identity Theory may also help explain the less facilitative forms of motivation emerging for a percentage of males. The emerging patterns of less facilitative learning for males in their motivational pursuit’s, highlights that identification with a group
Achievement motivation may create in-group homogeneity. Social Identity Theory suggests maintenance or protection occurs in the underlying process involved to maintain the status quo. This perhaps best qualifies why Social Identity Theory (SIT) may theoretically encapsulate what is happening with regard to males’ underperformance in a majority of school subjects and likewise why males reported lower levels of motivation in the mastery goals of task pursuits and effort pursuits. While a cohort of males reported high level responses for the facilitative factors of the SMOSA there was a greater spread in responses by males compared to females at the lower end of the scales. A majority of male students reported the lowest levels in each of the facilitative factors of the SMOSA.

A central assumption to SIT is that in-group bias is motivated by a desire to see one’s own group, and hence oneself positively. This finding also relates well to the possible over-estimation of self-concept and PAC levels in this study. Reinforcement within the in-group of negative stereotyping occurs because we use close others as a standard for social comparison (Blanton, Crocker, & Miller, 2000; Schunk, 2000). Therefore, the strength of our social identity and the associated process of self-stereotyping, provides consensus for in-groups and out-groups through (a) enhancement of the perception of in-group homogeneity, (b) the production of the expectations of agreement with in-group members, and (c) by providing a basis and need for social bonding. This equates well with van Houtte’s conclusions suggesting a negative effect in the study culture of low-achieving boys who intensified the stereotype bias because for them application to study was not important.

Another theory perhaps less investigated but that may also provide explanation relating to the alienation and separation sometimes experienced with underperformance in academic domains has been disseminated through the
Disidentification Hypothesis put forward by Steele (Osbourne, 1995). Steele’s Disidentification Hypothesis outlined by Osbourne suggests that poor performance threatens to confirm negative stereotyping which in turn sets up a path cognitively to protect the student’s self-perceptions and evaluations. Osbourne’s example was related to African-American research, where he suggested students who do not perform will disidentify or become alienated with school to protect their self-esteem. In fact, “although the disidentification process acts to protect self-esteem in domains in which one is psychologically vulnerable, it also results in impaired performance” (Osbourne, 1995, p. 450). Ultimately, rewards would not have the same impact on an academically, disidentified individual as someone in the academic domain.

Who has the most facilitative profile – males or females?

The mastery goals of task pursuits and effort pursuits and the significant interaction effect of grade X sex reported higher levels for females compared to males for both factors. The profiling of mastery goals also found females were significantly higher than males. Females had lower levels in both competition pursuits and leader pursuits which have been reported as facilitative towards learning for females. Females were significantly higher in social concern pursuits and showed consistent declines in affiliation pursuits. Females reported higher English self-concept levels and for the other self-perception measures the tendency for males to overestimate their abilities and females to underestimate may partially explain why females reported comparatively lower evaluations in those self-perceptions. In addition females reported recovery in PAC that surpassed males in Year 11. The overall pattern of development for females therefore was evaluated as more facilitative towards learning compared to males in these motivational and self-perception indicators. As mentioned previously, higher levels in the performance goals of
competition pursuits and leader pursuits may be related to more facilitative patterns of learning for males.

To further evaluate these factors for males along the same format may not be as productive in their development of the factors in the SMOSA without review of several findings of past research. Several factors have been variously associated with differing outcomes towards facilitation for males compared to females. For example, Deci, Koestner and Ryan found that praise pursuits (in the form of Positive feedback) enhanced intrinsic motivation for males, yet this same factor undermined intrinsic motivation for females. However, praise pursuits and reward pursuits were not significantly different between males and females in the present findings. Generally, males reported lower levels (below the standardised mean) for these factors compared to their responses of the more facilitative pursuits of mastery goals.

For a majority of the facilitative components, females had a more conducive pattern of development than males especially when evaluating the patterns of progress across grades. This arose not just in the mean evaluations but also through the individual responses found in the random slopes models (level 2). To evaluate these components theoretically, Achievement Goal Theory originally emphasised that “Students who adopt a mastery goal focus are more likely to engage in deep cognitive processing, such as thinking about how newly learned material relates to previous knowledge and attempting to understand complex relationships” (Anderman & Maehr, 1994, p. 295). Comparatively males had lower levels of task pursuits and effort pursuits than females across all grades. The mastery goals of task pursuits and effort pursuits were the most salient factors of the SMOSA for both females and males and levels of the performance-based goals were their least salient factors. A feature of this research not previously identified in past research and cause for
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concern was the disparity in the range of responses. Males had a greater range in responses fanning to the lower levels of the facilitative components of the SMOSA. Males had a lower set of responses for task pursuits, social concern pursuits and English self-concept. Males had a much larger spread in responses across the lower band of the standardised mean compared to females. Therefore, while a cohort of males presented similar levels in the motivated responses equating to a facilitative approach towards learning overall, a majority of males reported lower levels for each of these factors and were therefore not academically engaged.

PAC levels showed gradual improvement or strengthening across the grades and as seen in Figure 8.85, PAC levels were similar to effort pursuits across the grades. This may provide partial support for the theory of a differentiated concept of ability (Butler, 1999; Nicholls, 1984). The differentiated concept of ability identified that these two factors should move in unison and these findings lend some support to this claim. Although further research is required to specifically map the individual profiles and interactions of student’s PAC and effort pursuits, the strong correlation between these two factors reinforces this point in the current research and the similar mean response levels between these measures is also noteworthy.

Limitations of this thesis

Several limitations arose which need to be considered when interpreting the current research findings. Firstly, if standardised objective measures of performance such as SNAP and ELLA results had been collected with this data the relationship of adolescent’s motivational pursuits and their respective outcomes could have been evaluated. Secondly, an important issue that emerged from evaluating the psychometric soundness of the SMOSA found that two items may require further evaluation in future research. These items were included in the present research
because of the minimal standardised expected change to Lambda X if deletion of them occurred, however future research may wish to further explore possible wording of these items with a view to their cross-loadings.

Another limitation relates to the normative approach adopted in examining motivational pursuits. As Elliot and Thrash (2001) suggest, this is but one approach of three, the other two consisting of intrapersonal and absolute. They also point out that “within each achievement goal category, there may be a great deal of variability in the representation of the goal” (p. 146). These variabilities include approach and avoidance motivations, for all the different pursuits. Therefore, the limitation of this thesis in relation to the normative approach may also be considered as one of its strengths. The information from this thesis can be used to gauge where a specific student may lie within the norm, thus enabling educators to delve into the student’s idiosyncratic adoption of the goal/s and implementation of programmes that may lead to facilitative learning. Urdan and Maehr (1995) also relate to the importance of ‘tracking’ students, where low-achievement students may be placed with other students in high-ability groups, or groups that pursued more facilitative learning goals.

**Implications from this thesis and future directions for further research**

This thesis has improved our understanding of the benefits of having a more comprehensive measure of achievement motivation during adolescence. The disparate patterns emerging in the lower-order factors of the higher-order constructs suggested that crudely investigating information based on mean evaluations would limit the scope of future enquiry in providing information on what factors are most salient for students at varying grades as well as between males and females. Mapping the individual variation for each factor expanded previous research findings on the
specific range of responses important because a simple mean level analysis would have eliminated this valuable information. In addition, the inclusion of self–perception measures within a single scale meant that the patterns of development for both motivational and self-perception factors could be simultaneously graphed to show their association.

Future research could extend these findings by evaluating how these 12-factors create a profile, which in combination with performance outcomes could evaluate what factors may present the most facilitative approach to learning for males and females. Whether different motivational profiles emerge as more facilitative at varying grades and schools, that is, from studies that incorporates a greater variety of schools than utilised from this thesis. Additional research may also use an experimental design in adopting specific techniques to improve student’s Perceived Academic Capabilities to evaluate whether this may in turn improve performance outcomes and effort pursuits as suggested through the Differentiated Concept of Ability theory presented by Butler (1999) and Elliott (1999).
Support was found for the multidimensionality of the SMOSA at each stage of investigation. The 12-factor model provided satisfactory goodness of fit for the model using confirmatory factor analyses and sound construct validity through invariance testing across both grades and sex. Disparate patterns of development emerged across the 12 factors and also differences emerged between the 2-way interactions of the lower-order factors (compared to the higher-order construct commonly used) across grades and/or sex.

Differing patterns emerged across grades and also between males and females among the twelve factors. The systematic mapping of achievement motivational pursuits across grades using a 12-factor model such as the SMOSA had not been undertaken prior to the present enquiry. Using a multidimensional measure to map the patterns of change that adolescents pursue across grades and identifying whether males and females differed in their patterns of development was argued to be crucial.

Significant systematic declines across grades were only found in affiliation pursuits and English self-concept. This aspect of systematic declines in English self-concept was cause for concern because past research has found quadratic effects emerging across grades. General academic self-concept reported a non-significant plateauing in the rate of decline between grades 9 to 11. Significant recovery was found for task pursuits, social concern pursuits, maths self-concept and PAC. Significant change in the rates of decline emerged in the latter grades for effort pursuits, competition pursuits, leader pursuits, reward pursuits and praise pursuits. Therefore, 9 out of 12 SMOSA factors had significant differences emerge in their patterns of response across grades.
Females and males significantly varied in their degree of responses among the factors of the SMOSA. Females presented the most facilitative response set among the variables and the most facilitative component of the SMOSA. That is females were systematically higher than males. Task pursuits reported a significant (grade X sex) interaction with females reporting much higher responses across all grades in task pursuits and effort pursuits. Therefore, at each grade females valued the mastery components of learning compared to males.

Given the association between motivational factors, self perceptions and performance outcomes the current findings may provide partial explanation for the reported underperformance of males compared to females in 90% of all school subjects. Males reported lower responses to the facilitative factors of task pursuits, effort pursuits and social concern pursuits than females. Individually, males were less motivated to persevere with a given pursuit (effort pursuits) and were less oriented towards seeing improvement in their class work (task pursuits). According to Achievement Goal Theory, females therefore were more intrinsically motivated towards the application of learning. In addition females were higher in social concern pursuits. This factor also has been positively linked to academic success even after taking into account the perceived academic capability of the student (Wentzel, 1991). The association of social goals to adolescent’s learning and engagement has been presented as indicative of aspects of autonomy and self regulation (Gagne & Deci, 2005). The factors relating to the extrinsic goals of reward pursuits and praise pursuits did not emerge as being significantly different between males and females in this sample. Therefore, while Deci, Koestner and Ryan (1999) found that disparate relationships in the use of Praise would emerge by enhancing males’ intrinsic
motivation yet undermining females’ intrinsic motivation, however, this did not emerge in the current sample.

This research highlighted that the multidimensionality of the SMOSA provided greater explanatory power to the understanding of achievement motivation in this adolescent sample across grades and between males and females. Gorsuch’s (1983) argument suggesting that the lower-order factors of instruments may provide more specific information was supported in the current research. Although, males and females presented similar trajectories across grades in each of the factors, except for social concern pursuits, they simultaneously reported significantly different levels for eight of the twelve factors. These were predominantly along the stereotypical lines portrayed in past literature. Support was also found for a widening of the gender gap, with males reporting lower levels in the facilitative aspects related to achievement motivation. One of the main features that emerged from these findings relate to the systematic declines across grades for English self-concept. Evaluation of the changes in the state government’s syllabus during the time of collection of the data may have been partially responsible for the disparate pattern of responses compared to past research. The more facilitative components of social concern pursuits were emphasised for females but not for males. This research found that expanding Achievement Goal Theory through a social cognitive framework to include measures of competence and capability, social goals and extrinsic goals provided a more comprehensive profile to gauge achievement motivational pursuits during adolescence. Understanding the emerging patterns of development in achievement motivation can equip educators with the necessary information to provide students with optimal paths for engagement, to achieve an understanding of what is involved in the process of the task.
This research reinforced the need to investigate adolescent motivation through a comprehensive instrument such as the SMOSA. Support for the reliability and validity of the SMOSA up to invariance testing for sex and grades was found. Using the SMOSA to map the patterns of development across grades provided a clearer understanding of the differences that emerged between males and females and among the 12 factors. Incorporating aspects of self-perceptions as well as eight motivational measures provided a better understanding of the complexities involved in adolescent’s motives to achieve.
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