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Abstract	The construct of metacognition is well-established in psychology and education disciplines, yet much is still unknown. One method receiving well-deserved popularity is by using confidence ratings assigned immediately after a cognitive act to study regulative aspects of metacognition. Prior research has demonstrated evidence of the stable and reliable construct of self-confidence in adults. However, no studies examined the existence of self-confidence among primary school children and its predictive validity within a school environment. In this chapter we present the results of a study that examined the existence of self-confidence in children aged 9–12 years (N = 183). The students also completed a brief-current form of the Parental Bonding Instrument to gauge their perceptions of the level of parental care and overprotection, within the parent-child relationship. Standardised school grades and fluid intelligence scores were also collected. The results from this study demonstrated the existence of self-confidence in primary school children and determined its importance for school achievement, irrespective of a student's cognitive ability, age and gender. The results also suggest that parental care has an important influence on both school achievement and levels of confidence.

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Chapter 13
Self-Confidence and Academic Achievements in Primary-School Children: Their Relationships and Links to Parental Bonds, Intelligence, Age, and Gender

[AU1] **Sabina Kleitman and Tanya Moscrop**

1 Introduction

Decision-making has occupied the minds of many esteemed researchers in different disciplines. What has attracted researchers to the study of decision-making is its potential to provide theoretical and diagnostic frameworks, with application to areas as diverse as psychology, education, economics and law. Within the field of decision-making, *knowledge calibration* is a major paradigm. It concerns the self-monitoring, in terms of confidence judgments, that people assign to events (answers to questions, decisions, predictions) and their correspondence to the accuracy of those events (see Harvey, 1997 for a review). In fields of education and psychology, these confidence judgments have been referred to as self-confidence ratings and are argued to initiate an essential component of *metacognition*, that is, self-monitoring (for a review, see Stankov, 1999).

This chapter focuses on an important aspect of knowledge calibration, test-taking situations, where people are given multiple-choice questions and are asked to quantify the level of their confidence in each answer. The decision-making paradigm stresses general tendencies and views confidence ratings as a reflection of certain decision-making processes that are supposed to follow the normative laws of different theories of probability. At the same time, the individual differences approach, while acknowledging general tendencies in the way people assess their confidence, emphasises person-driven factors that predispose people to give higher or lower confidence judgments. Findings from different fields of research are overviewed and the results of studies coming from our laboratory are presented in light of metacognitive theory. The individual differences approach is used to provide the framework for an integrative model of confidence judgments. Their predictive validity in school achievements and their determinants are discussed.

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1.1 Metacognition and Knowledge Calibration Paradigm

Metacognition refers to the executive processes involved in reflecting on one's own thinking; that is, "thinking about thinking" (Flavell, 1979) or "knowing about knowing" (Metcalfe & Shimamura, 1994). Most theories distinguish between two major components of metacognition – knowledge about cognition and regulation of cognition; the latter consisting of monitoring and control of cognition (Brown, 1986; Nelson & Narens, 1994; Schraw & Dennison, 1994; Schraw & Moshman, 1995). Monitoring of cognition, the focus of this chapter, is defined as the ability to watch, check and appraise the quality of one's own cognitive work in the course of doing it (Schraw & Moshman, 1995). Confidence judgments reflect these instances by deliberately evoking subjective feelings of certainty that one experiences in connection with decision-making and action-regulation (Allwood & Granhag, 1999; Stankov, 1999).

The main emphasis of the knowledge calibration paradigm is placed upon the different aspects of the association (or calibration) between confidence ratings and actual performance (for a review see Harvey, 2001). Metacognitive self-monitoring [AU2] is reflected in the different measures illustrating this correspondence (for reviews see Stankov, 1999; Stankov & Kleitman, 2008). However, all these calibration-type measures are initiated by confidence scores, which are the essential ingredient of such calculations. Moreover, while accuracy of performance and overall confidence levels can be manipulated by environmental factors (see Harvey, 1997), the systematic individual differences reflect that the Self-Confidence factor remains stable and unaffected by such manipulations. For instance, Kleitman and Stankov (2001) employed representative and non-representative (or misleading, so called "tricky") general knowledge items (Gigerenzer, Hoffrage, & Kleinbolting, 1991; Juslin, 1994) as well as items capturing diverse domains of cognitive range, namely reasoning, perceptual, and general knowledge. These manipulations resulted in important differences in measures, reflecting the calibration matters. However, the Self-Confidence factor still emerged despite the experimental manipulations. This finding suggests the habitual nature of the process of assessing one's own competence to deal with uncertainty in test-taking situations. Thus, understanding the psychological factor that underlies the stability of self-confidence could provide a powerful window into metacognitive self-monitoring and knowledge calibration.

Although there is an important conceptual overlap between self-confidence and self-efficacy judgments, there is a major distinction between the two in terms of broadness. Self-efficacy refers to a belief that if one is engaged in a particular behaviour, one will achieve a positive and desired outcome (Bandura, 1997). It is a form of confidence in one's own ability to perform on a specific task or within a particular domain. A closer examination of the empirical evidence which supports the constructs of self-confidence and self-efficacy suggests that self-efficacy, in comparison to self-confidence, tends to be domain specific – it is limited to a particular task or a domain (e.g., mathematics, verbal and/or physical domain). Self-confidence, however, has consistently been shown to be a general factor that

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extends across different tasks and domains (for a review see Kleitman, 2008). Moreover, while self-efficacy is modifiable (Bandura, 1997), confidence ratings are shown to remain unaffected despite many experimental manipulations (Allwood & Granhag, 1999; Kleitman & Stankov, 2001).

Some of the important questions needing to be addressed are "When does this self-confidence trait begin to stabilise in the course of our lives?", "Who or what is responsible for this stability: Genetics? Parents? Teachers? Peers?", "Which individual or collective experiences contribute to it?", "Do levels of confidence foster educational achievements *incrementally* to cognitive abilities (and other traditional factors in education such as age and gender)?" This chapter aims to answer three questions: (a) Do primary school-aged children already display the habitual general levels of self-confidence across different cognitive domains? (b) Do family dynamics predict confidence levels? (c) What is their predictive validity in the school setting, incremental to the traditional factors?

1.2 *Self-Confidence as an Aspect of Metacognitive Self-Monitoring*

This work relies on a definition that captures the main purpose of self-monitoring, that is, the ability to judge the quality of one's own performance in the course of doing it. In such an instance, immediately after responding to an item in a test, participants are instructed to give a confidence (or "sureness") rating indicating how confident/sure they are that their chosen answer is the correct one (see Fig. 13.1). It is important to distinguish this assessment of self-confidence from the putatively similar personality trait(s) that is/are presumed to arise from the responses to items such as "I feel self-assured when I have to give a speech to a large group of people", "I'm self-confident" and "I'm self-assured". The confidence rating procedure follows the cognitive act of providing a response to a typical cognitive test item, rather than relying on a general perception of one's own habitual way of acting. We now have overwhelming psychometric evidence that this numerical method – which probes the *actual* cognitive act rather than relying on a subjective perception of it – is a more accurate measure of the self-confidence trait

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Fig. 13.1 A four-point confidence rating scale used in the Class test

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(Stankov, 1999; Kleitman, 2008). This trait reflects the *habitual* way in which adults assess the accuracy of their cognitive decisions.

1.3 Confidence Judgments[1]

The procedure is simple. Specifically, immediately after responding to a question, people are asked to rate on a percentage or probability scale, how confident they are that their answer is correct. The level of confidence is expressed in terms of percentages and/or verbal statements. The starting point (the lowest confidence) on a rating scale is defined in terms of the number of alternative answers (k) given to a question (100/k). Thus, there are different starting points for questions with two and five alternative answers (50% and 20%, respectively). That is, in multiple-choice questions with five alternative answers, 20% is a starting point because 20% is the probability of answering the question correctly by chance. This is explained to a participant and often indicated on the rating scale (Allwood, Granhag, & Jonsson, 2006; Allwood, this volume). Consequently, the confidence rating scales may include both percentages and labels (e.g., "guessing", "fairly sure", "absolutely certain"), respectively. The confidence ratings for all attempted test items are averaged to give an overall confidence score.

The scales for this type of confidence ratings – including both percentages and labels – could take several forms (Allwood et al., 2006; Allwood, this volume). Importantly, it has been demonstrated that the outcomes of research remain stable regardless of the type of scale used for confidence ratings (Allwood et al., 2006; Allwood, this volume).

1.4 Empirical Findings

There are numerous findings in relation to confidence judgments, especially in the adult population. In this chapter, we review the research findings that stem from psychological and educational traditions, using the individual differences framework

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[1] Moore and Healy (2008) provide a comprehensive review of different types of confidence judgments, such as unique confidence judgments that people provide immediately after responding to a test's item, and general ratings of one's state of knowledge/performance in comparison to the others. Immediate confidence judgments could be given in two broad formats: (a) in terms of unique probabilistic numbers along a "confidence scale" or/and as a verbal category along a typical Likert-type scale (e.g., ranging from "unsure" to "very sure") and (b) as confidence intervals asking participants to estimate for instance 90% confidence intervals around their answers. The former judgments are more prevalent than the latter, comprising 64% of research on knowledge calibration (Moore & Healy, 2008), and in a series of studies were demonstrated to reflect a thought level higher than knowledge – the metacognitive level – within the taxonomy of cognitive/metacognitive analysis (Kleitman, 2008). The confident judgments of the first broad format are at the focus of this chapter.

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of research. However, a comprehensive review of all the findings gathered using the knowledge calibration paradigm is outside the scope of this chapter, and is available elsewhere (Harvey, 1997).

1.4.1 Self-Confidence Trait

Confidence judgments have high internal consistency (reliability estimates are typically higher than 0.90) (see Kleitman, 2008 for a review) and robust test–retest estimates (Jonsson & Allwood, 2003). There is overwhelming empirical evidence showing individual differences in confidence ratings (for a review see Kleitman, 2008). The correlations between accuracy and confidence scores from the *same* test are significant (average between 0.40 and 0.50). Nevertheless, correlations between confidence ratings from a broad battery of cognitive tests reflecting diverse cognitive abilities have been consistently high enough to define a strong Self-Confidence factor. That is, people who are more confident on one task, relative to other people, also tend to be more confident across other tasks. Thus, when measured across different items, cognitive tests, and knowledge domains, a Self-Confidence factor emerges to reflect the *stability* of confidence judgments.

Table 13.1 summarises such results from a study by Kleitman and Stankov (2007). Specifically, some tests sample several different scores, namely accuracy of performance, confidence and the so-called speed scores. That is, in addition to the typical correct/incorrect scoring (accuracy measure for each item), at least on some tests (here Verbal Reasoning, Syllogisms, Esoteric Analogies, and General Knowledge tests) people were asked to indicate their confidence levels in each answer. In addition, the time taken to answer each item was collected on computerised tests (here Verbal Reasoning, Syllogisms, and Esoteric Analogies) and is referred to as test-taking speed, or 'speed' scores. These scores are averaged across the test to index test-taking speed for each test. When factor analytic techniques are used (either exploratory or confirmatory; here confirmatory), several latent traits or factors typically emerge. These are cognitive ability or intelligence factors defined by the relevant accuracy measures – here the results were separated into Fluid Intelligence (Gf) and Crystallized Intelligence (Gc) factors;[2] Test-taking Speed or Speed factor, defined by the speed scores; and the Self-Confidence factor, defined by the confidence scores. The fourth factor (its relevance will become apparent later) was defined by the self-report measures, that is, the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994) and our own Memory and Reasoning Competence Inventory (MARCI; Kleitman & Stankov, 2007), sampling different aspects of metacognition.

[2] The Horn-Cattell theory is a hierarchical model that defines intelligence in terms of independent broad abilities (Carroll, 1993). According to the model, fluid intelligence (*Gf*) reflects basic abilities in reasoning, while crystallized intelligence (*Gc*) reflects the effects of acculturation. The model regards *Gf* and *Gc* as second-order factors, while *g* refers to a general intelligence, a higher-order factor (Horn & Noll, 1994).

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Table 13.1 The findings of the Kleitman and Stankov (2007) study regarding the structure of accuracy, confidence, test-taking speed, and metacognitive measures scores

Factors	Gf	Gc	Confidence	Speed	Metacognitive processes	h^2
Accuracy						
Quantitative switching	0.50					0.25
Verbal reasoning	0.34	0.42				0.39
Syllogisms	0.54					0.30
Esoteric analogies	0.53	0.21		0.26		0.47
General knowledge		0.82				0.67
Probability reasoning	0.48					0.23
Conditional reasoning	0.64					0.42
Confidence						
Verbal reasoning		0.22	0.57			0.42
Syllogisms			0.64			0.40
Esoteric analogies			0.90			0.81
Sureness	–0.31		0.39		0.22	0.28
General knowledge		0.57	0.40			0.58
Test-taking speed						
Verbal reasoning				0.46		
Syllogisms				0.69		
Esoteric analogies				0.93		
Metacognitive measures						
MAI					0.69	0.47
Memory inventory	0.19				0.37	0.17
Reasoning inventory	0.38				0.54	0.44
Factor correlations						
Gf	1	0.34	0.34	–	–	
Gc		1	0.20	–	–	
Confidence			1	–	0.41	
Speed				1	0.30	
Metacognitive processes					1	

Note: MAI = metacognitive awareness inventory; memory inventory = memory competence score of the memory and reasoning competence inventory; reasoning inventory = reasoning competence score of the memory and reasoning competence inventory; Gf = fluid intelligence factor; Gc = crystallised intelligence factor; confidence = self-confidence factor, speed = test-taking speed factor; metacognitive processes = metacognitive processes factor

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The Self-Confidence factor is well established in Differential Psychology and is argued to reflect a latent trait which underlies processes higher than the 'knowledge' level of cognition, representing an essential component of a regulatory, self-monitoring aspect of metacognition (Stankov, 1999). Kleitman (2008) empirically demonstrated the veracity of such a claim. In a series of studies, the unique nature of the Self-confidence trait was determined. When a diverse number of cognitive tests was employed, the robust Self-Confidence factor always emerged, defined by the confidence ratings which people assign to their answers. The factor was broad enough to include Sureness judgements (see Table 13.1) – confidence ratings which participants assigned to a set of non-cognitive items, asking people to express their opinion

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on events that may or may never happen (e.g., a likelihood that a cure for AIDS will ever be found). This generality of the Self-confidence factor provides key evidence of broad, perhaps basic, human factors which predispose people to adopt a particular level of confidence across different cognitive acts (whether verifiable or not).

While sharing meaningful positive relationships with the *Gf* and *Gc* ability factors (here the *r* values are 0.34 and 0.20, respectively), the Self-Confidence factor extended beyond these factors. As evident from Table 13.1, the Self-Confidence factor also had a meaningful positive association with the Metacognitive Processes factor ($r=0.41$). This suggests that people who hold higher beliefs in the competence of their cognitive abilities (as captured by MARCI) and in the quality of their metacognitive awareness in general (as captured by MAI), assign higher confidence ratings to their answers and opinions. It is worth noting that people's beliefs regarding their reasoning competencies were related to the actual performance on a variety of tests that relied on reasoning abilities – it had a meaningful loading on the Gf factor (see Table 13.1). This highlights the veracity of such beliefs. Importantly, confidence judgments were predicted by the Reasoning score of MARCI and this prediction remained significant after controlling for relevant accuracy scores, the common factor for both, confidence levels and the Reasoning score of MARCI. Together, these findings are important as they attest to that confidence ratings reflect processes, meaningfully related to, but other than the 'knowledge' level of cognition, verifying the *metacognitive* nature of confidence ratings.

Many other established psychological constructs have been investigated as predictors of the self-confidence trait. These constructs include personality and a variety of *global* self-esteem and self-concept measures (see Kleitman & Stankov, 2007 for a review). However, no consistent associations with these constructs have been established. Nevertheless, there are known predictors of the Self-Confidence factor, such as intelligence (Stankov, 2000), age (Stankov & Crawford, 1996), gender (Pallier et al., 2002), *specific* self-concept measures (Efklides & Tsiora, 2002; Kröner & Bierman, 2007; Kleitman & Stankov, 2007), and parental rearing techniques (Want & Kleitman, 2006).

1.4.2 Intelligence

As a Predictor

As mentioned above, one of the well established predictors of self-confidence is performance accuracy (measured on the same cognitive task which is used to measure self-confidence levels) where greater accuracy has been shown to predict greater confidence (Kleitman & Stankov, 2007). Thus, individuals who perform better on a given cognitive test assign higher confidence ratings to their answers. This result typically extends to the performance on other cognitive tests, as performances on individual cognitive tests tend to correlate positively with one another, a phenomenon known as positive manifold (Carroll, 1993). Thus, an intelligence factor (or factors) shares a significant and psychologically meaningful positive relationship with self-confidence.

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As a Control Variable

This relationship that self-confidence shares with intelligence may be falsely inflated; thus it requires clarification. In other words, accuracy of performance in cognitive tests employing confidence ratings is a common factor (a variable assumed to affect the influence and the outcome) which influences both confidence ratings and intelligence. Accordingly, Kleitman and Stankov (2007) argue that to accurately assess a relationship between self-confidence and any intelligence-related measure, the accuracy of cognitive performance needs to be controlled (its common influence must be partitioned out). Thus, it is necessary to control for performance accuracy when examining the influence that any psychological factor has on self-confidence.

Moreover, intelligence influences academic achievement measures (Veenman, Wilhelm, & Beishuizen, 2004). Thus, in the present investigation, intelligence is considered in two ways. Firstly, it is considered as an important predictor of both self-confidence and academic performance. Secondly, it is considered as a common factor needing to be controlled for, when the influence of self-confidence on academic achievements is examined.

1.4.3 Age

As a Predictor

Prior research has established that older adults tend to have higher levels of self-confidence than their younger counterparts (Stankov, 1999; Stankov & Crawford, 1996; Want & Kleitman, 2006). To date, no such research has been undertaken with children. However, if a similar trend exists in children, older children would be expected to exhibit greater levels of self-confidence than their younger counterparts. However, in self-concept research, younger children compared to older children are found to be "overoptimistic" when assessing their abilities; while older children have a better calibrated self-concept in relation to their academic performance (for a review, see Efklides & Tsiora, 2002). Therefore, if a similar trend existed in children, younger children could have greater (and less realistic) levels of self-confidence than their older peers. Thus, age was included as a predictor variable; however, no directional predictions in relation to self-confidence were made.

As a Control Variable

As any intelligence test manual will attest (e.g., Raven, Raven, & Court, 2003), on average, older children tend to achieve greater cognitive accuracy scores when given the same testing instrument (when data is used without an adjustment for norms, as it is in this study). Given that, greater performance accuracy is a known predictor of self-confidence among adults, it is expected that greater performance

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will also influence children's levels of self-confidence. Thus, it is important to control for age when examining the relationships between intelligence, performance accuracy, and self-confidence. If the control is not exercised, older children may exhibit inflated levels of the Self-Confidence factor as a consequence of their superior test performance. Moreover, it is important to control for age when predicting academic achievement (Marsh & Kleitman, 2002). Therefore, the effect of age will be statistically controlled for when considering the effects of all other variables in the present study.

Age as a Developmental Factor in Shaping the Broadness of Metacognitive Processes

It is currently unknown at what age confidence ratings develop into a general, stable trait. However, modern research and theories of cognitive development allow predictions regarding developmental trajectories for metacognitive processes to be made. Metacognitive awareness is suggested to develop around the age of five, while metacognitive skill is not thought to develop until around 11 years of age (Veenman & Spaans, 2005). This view stems from cognitive theories stating that by age of 11, typically, children should be able to realise that their own thoughts can influence their performance on a task (Alexander, Carr, & Schwanenflugel, 1995; Miller & Weiss, 1982). Moreover, Flavell, Miller, and Miller (1993) suggest that at this age, thinking becomes a conscious and reflective metathinking – where a child begins to think about thinking itself, rather than about the objects of thinking (see also Veenman & Spaans, 2005). Thus, self-monitoring capacity, initiated by the Self-Confidence factor, is expected to be more finely developed in children by age 11.

The present study aims to clarify the existence of the self-confidence trait in children. Accordingly, the study examines children in Grades 4 and 6 (aged 9–11 and 11–12 years, respectively), that is, grades with endpoints at the age of 11 (the age suggested as being developmentally important for shaping metacognitive processes), thus allowing for a study of developmental trends of the self-confidence trait.

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1.4.4 Gender

As a Predictor

Findings from previous research investigating the differences between males and females and their levels of the Self-Confidence factor have been mixed. While some researchers (Pallier et al., 2002) have found that females have lower levels of confidence than males, others (Stankov, 1999) argue that there are no gender differences in confidence judgments. Further research is needed to determine the link between gender and self-confidence in children. Thus, gender is included as a possible predictor variable in the present study. Yet, given that the existing evidence is mixed, no directional predictions were made.

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As a Control Variable

Gender-specific patterns generally exist among intelligence and academic performance results, particularly within tests involving the application of mathematical skills, where boys tend to outperform girls (Geary, 2006). Thus, similarly to age, gender was statistically controlled for, allowing results examining predictive relationships between self-confidence and aptitude to be interpreted irrespective of gender.

1.4.5 Parent-Child Bonding

The bond between a parent and a child is the most common affectional bond in the human relationships. It significantly impacts upon many facets of human life, particularly childhood development (Bowlby, 2005). Parent-child bonds provide a child with a stable foundation, upon which they can confidently explore the world (Bowlby, 1970, 2005; Parker, 1990). Conversely, the disruption of a secure parent-child bond is known to have adverse affects on a child's development; research has consistently linked poor emotional attachment and lack of security between parent and child to psychiatric disorders in childhood (Berk, 2003; Bowlby, 1970, 2005; Parker, 1990) as well as more generalised dysfunctional cognition; whereby poor attachment precipitates the development of dysfunctional schemas about the self, in turn developing to negative cognitive self-statements that are ineffective when dealing with stressful life situations (Ingram, Overbey, & Fortier, 2001). Moreover, poor attachment to parents has been shown to have significant negative correlations with language development (Van IJzendoorn, Dijkstra, & Bus, 1995); communication and cognitive engagement (Moss & St-Laurent, 2001); and academic competence (Diener, Isabella, Behunin, & Wong, 2007). Thus, parent-child dynamics are a significant source of a child's attainment of social competence and an important factor in their cognitive development.

Given this link between parental bonds and a child's optimal cognitive development, it is expected that parent-child bonds will have a significant impact upon metacognitive development. To date, only one study has empirically linked metacognitive self-confidence ratings with parent-child bond dynamics. This study, by Want and Kleitman (2006), focused on parental levels of care and overprotection. *Care* reflects the level of warmth and affection a parent displays to their child, versus the level of coldness and rejection; and *overprotection* refers to the level of excessive control and intrusiveness a parent exhibits versus the level of autonomy or freedom a child has in the relationship (Parker, Tupling, & Brown, 1979). Low levels of care and high levels of overprotection are regarded as unhealthy in terms of optimal child development, as both are reported as predisposing factors in the onset of "most psychiatric conditions" (Parker, 1990, p. 281; see also Higgins & Silberman, 1998; Pomeranz & Ruble, 1998).

The Want and Kleitman (2006) study sampled the adult population and showed that individuals, who retrospectively reported higher maternal overprotection in

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their childhood, had lower levels of self-confidence. However, the link between parental bonding and self-confidence in children is yet to be investigated. The investigation presented in this chapter intended to examine this link.

1.4.6 Metacognition and Education

Knowing the limits of one's own knowledge, and being able to regulate that knowledge, are two essential components of self-regulated and successful learning (Schraw, Crippen, & Hartley, 2006). If students are aware of their own strengths and weaknesses and can apply such knowledge to their learning, they have the means to improve their cognitive achievements. For example, if a student knows of being weak in a particular subject area, he/she could plan to spend more time studying it. In a test-taking situation, if a student is unsure that an answer is correct, he/she knows to come back and check it if time permits. In the realm of education, students who are aware of, control, and reflect about their own thinking, are referred to as self-regulated learners (Zimmerman, 1990).

1.5 The Present Study

It is consistently demonstrated that self-regulated learners outperform their non-reflective counterparts in academic performance measures (Butler & Winne, 1995; Pintrinch & De Groot, 1990). However, empirical evidence regarding the link between the trait of self-confidence and real-life academic achievements is scarce. In fact, research examining the predictive power of self-confidence on any psychological and educational factors is limited (for reviews, see Stankov, 1999; Stankov & Kleitman, 2008). Consequently, just as the predictive factors influencing levels of self-confidence in children are unknown, so too is the predictive nature of the Self-Confidence factor itself. The present study examined the predictive nature of the Self-Confidence factor on real-life, school-based achievements.

It was hypothesised that students with high levels of self-confidence will have greater school achievement outcomes. However, this relationship should be approached with caution, as it is also possible that good academic achievements result in having more self-confidence. In fact, it is quite possible that both of these relationships co-exist. While causal links may not be determined in the present study (in fact, this study focuses on predictions only), for purposes of data analyses it was hypothesised that higher levels of self-confidence predict greater school achievement levels, and not vice-versa (Hypothesis 1). This is expected due to the time precedence of development of the Self-Confidence factor to *current* school achievement marks.[3]

[3] If self-confidence is an intrinsic trait, thus, similar to personality and intelligence, it is a more stable characteristic than academic achievements at a given time.

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In summary, the present study had three broad aims. First, it aims to test the factorial stability of the self-confidence construct in primary school-aged children in Grades 4 and 6. Second, the study aimed to clarify the predictive power that intelligence, age, gender and parent-child bonding patterns have on levels of self-confidence and academic achievement. Finally, the study aimed to examine the predictive nature of self-confidence on school academic achievements, whilst controlling for cognitive ability, gender and age.

1.5.1 Hypotheses

The respective hypotheses are listed below.

Hypothesis 1: The Self-Confidence factor would exist as a distinct broad factor in children across all ages; however, the stability of the factor is expected to be more apparent in children in Grade 6 rather than in Grade 4.

Hypothesis 2: Intelligence should positively predict self-confidence and academic performance.

Age is hypothesised to be an important predictor of levels of self-confidence and academic achievement.

Hypothesis 3a: No directional predictions are made in relation to self-confidence and they will be clarified in the present study.

Hypothesis 3b: Age is predicted to share a positive relation with performance on the test of Gf.

Hypothesis 3c: Age is predicted to share a positive relation with achievement.

Hypothesis 4: Gender is hypothesised to be a possible predictor variable for self-confidence and achievement. However, given that the existing evidence is mixed, no directional predictions are made.

Hypothesis 5: Higher levels of parental overprotection will predict lower levels of self-confidence and achievement.

Hypothesis 6: Higher levels of parental care will predict higher levels of self-confidence and achievement.

Hypothesis 7: Higher levels of self-confidence will predict higher achievement.

For each variable, the above relations are hypothesised to exist incrementally to the other variables considered in this study.

1.5.2 Statistical Analyses

To investigate the first aim (see Hypothesis 1), confirmatory factor (CFA) analysis was performed (see Fig. 13.2 in Sect. 3). The theoretical model predicted two latent factors, namely Accuracy and Self-Confidence. To investigate the two latter aims (see Hypotheses 2–7), path analysis was utilised. The path model is presented in Fig. 13.3 (see Sect. 3). In this model the independent (exogenous) variables were

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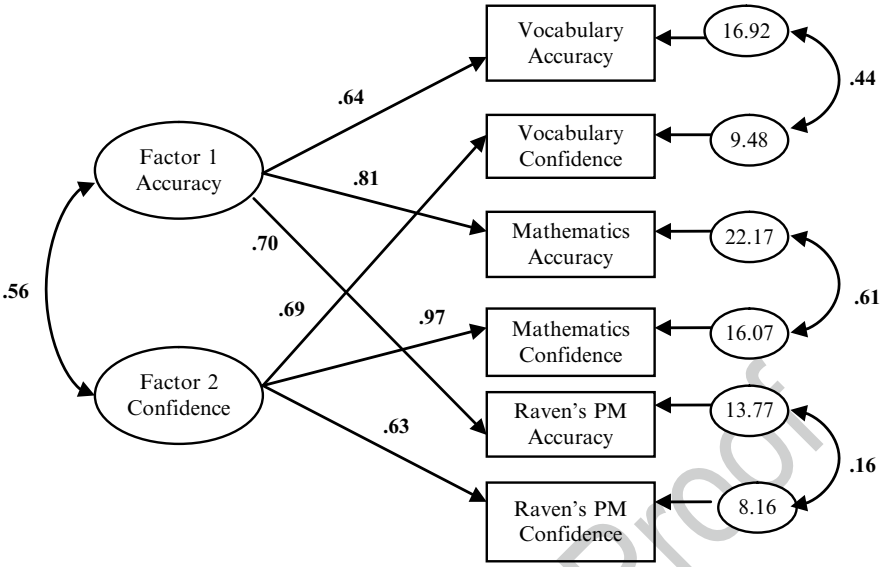

Fig. 13.2 Results of the confirmatory factor analysis (Model 3)

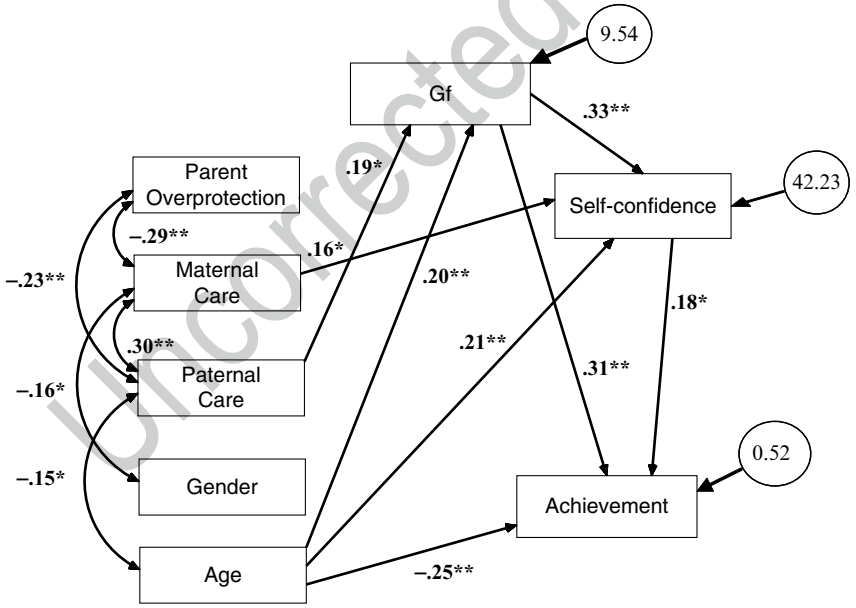

Fig. 13.3 The path analysis model. *Note:* Only significant regression weights (standardised) and correlations are presented. *Curved lines* with *double-headed arrows* represent correlations (Pearson *r)*; *straight unidirectional lines* represent regression estimates (betas and gammas).The confidence variable is a total of the average of the confidence ratings from the Vocabulary and Mathematics tests only, and the achievement composite is the sum of teachers' ratings of standardised grades for mathematics, spelling and reading.*$p < 0.05$; **$p < 0.01$

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parental rearing styles (care and overprotection assessed for each parent), gender, and age. The dependent (endogenous) variables were achievement (indexed by grades) and self-confidence (the first-order factor of the CFA model). In accordance with the outlined theoretical model and hypotheses, relationships between the variables achievement and self-confidence were considered while controlling for intelligence (see Fig. 13.3). That is, all possible relationships between exogenous variables and intelligence were built in the path model in addition to all possible relationships between exogenous variables, self-confidence, and achievement (see Fig. 13.3). Finally, as hypothesised, relationships between age and gender with achievement were investigated. Path analysis enabled the investigation of all the abovementioned relationships simultaneously. The word "effect" may be used only for the sake of simplicity, and referring only to the *predictive* nature of the relationships between the different constructs.

2 Method

2.1 Participants

Participants in the study were 197 primary school students; 93 students from Grade 4 and 104 from Grade 6. Participation was voluntary. There were three students who were absent from school for a whole day of testing, six students who had substantial incomplete or missing data, and five students who voluntarily withdrew from the study. These 14 students were eliminated from all the analyses producing the final sample of 183 participants in total (Grade 4 = 85; Grade 6 = 98, 101 males). Students ranged in ages from 9 years and 1 month to 12 years and 11 months.

Participants' age ranged from 9 years 1 month to 12 years 11 months ($M = 10.4$ years, $SD = 1.07$). In Grade 4 students' ages ranged from 9 years 1 month to 11 years ($M = 9.4$, $SD = 0.47$) and in Grade 6 it ranged from 11 years to 12 years 11 months ($M = 11.31$, $SD = 0.43$).

Each participant was enrolled in a mainstream (general ability) class at co-educational public school within the Western Sydney region (New South Wales Department of Education [NSW DET], 2007).[4] Ethics approvals for this research were gained from both Human Research Ethics Committee (HREC) of the University of Sydney and the State Education Research Approval Process (SERAP) for New South Wales, Australia.

[4] Schools within the same region were asked to participate in order to control for socioeconomic status (SES). Additionally, to control for fluency in English, schools with a high enrolment of NESB (Non-English Speaking Background) students were not approached to participate.

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2.2 Measures

2.2.1 Parental Bonding Instrument: Brief Current

The Parental Bonding Instrument – Brief Current (PBI-BC) (Klimidis, Minas, & Ata, 1992a) is an 8-item version of the original 25-item PBI (Parker et al., 1979). The PBI has been extensively validated; however, there are important limitations to the retrospective reports. The PBI requires adults to report on rearing practices which occurred years ago, measuring only adults' recollections of the events that took place in their childhood. Thus, their objectivity and their accuracy are suspect. Recognising this limitation, the PBI-BC is a psychometrically validated brief current version (Klimidis et al., 1992a, 1992b). It measures the same two parenting dimensions, with high care and low overprotection reflecting healthy parent-child relations. The instrument allows for real-time reflections of parent-child bonding to be measured, rather than retrospective recollections measured on the original PBI. The authors report that these eight items have reasonable reliability indices. Specifically, Cronbach's alphas were 0.80 and 0.72 for the paternal care and overprotection subscales, respectively, and 0.75 and 0.72 for the equivalent maternal subscales. Thus, the PBI-BC was used to measure children's perception of current patterns of parental bonding behaviours, for each parent, over the past 3 months. The students had to evaluate the extent to which each statement described their concurrent family dynamics using a three-point Likert scale ranging from 1 (never) to 3 (usually). For example, "My mother/father tries to control everything I do"; "My mother/father makes me feel better when I am upset". Higher scores on each scale reflect greater perceived levels of that dimension within the respective parent-child relationship.

Thirteen participants provided answers based on a step-parent's behaviour rather than the indicated biological parent (step-father $N=11$; step-mother $N=2$). This data was included as a bonding source in the current study. Ten participants provided data for one parental figure only (no paternal figure $N=9$; no maternal figure $N=1$). Such responses were treated as valid data (Amato, 1993). The remaining participants provided responses for a maternal and paternal biological parent; of these cases, 49 participants had biological parents who lived apart.

2.2.2 Standard Raven's Progressive Matrices Test

The Raven's Progressive Matrices (RPM) (Raven, 1938; 60 items) test is a non-verbal test of abstract reasoning that has been consistently and reliably used as a measure of fluid intelligence (Gf) over the past 40 years, with reliability estimates generally ranging between 0.76 and 0.87 (Raven, Raven, & Court, 2003). The RPM test requires individuals to select the piece of puzzle that correctly completes a larger pattern. For the first two sets there are six possible options to choose from, while for the final three sets, the difficulty increases and there are eight options. The mean accuracy score calculated for the test represents the overall percentage of

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items answered correctly. The high reliability estimate for the RPM (Cronbach's $\alpha = 0.88$ for the overall sample) is consistent with its well established psychometric properties (Raven, Raven, & Court, 2003).

2.2.3 Class Test

It covered two subject areas, vocabulary (Synonym Vocabulary test) and mathematics. The tests were assembled by the researchers based on the NSW school curriculum. The spectrum of item difficulty was broad in order to accommodate for the achievement levels of both grades. Each question was multiple-choice with four-response alternatives. The mean accuracy score computed for each test represents the overall percentage of items answered correctly.

Synonym Vocabulary Test

It is a 16-item test. Students were asked to select, from four possible alternatives, which word is closest in meaning to the keyword. Example item is "The word SMART means the same as A (CLEVER; correct answer); B (SILLY); C (SLOW); D (NICE)". Items were a combination of mainstream curriculum and high ability items. The high-level items were taken from an academic selective test, designed to discriminate between high achieving Grade 5 students seeking placement in an advanced class for Grade 6 (NSW DET, 2003). The remaining ten items were designed aiming at an age-appropriate difficulty level determined by the school syllabus (Board of Studies of NSW [BOS NSW], 2007). Reliability (Cronbach's $\alpha = 0.71$) for the overall sample was reasonable.

Mathematics Test

It is a 19-item test that was designed around the mathematics curriculum outcomes for both Grades 4 and 6, and required the application of a broad range of mathematical skills, such as numerical and basic geometrical calculations. Nine items were adopted from an Opportunity Class test (NSW DET, 2003). Examples items are: "What number is missing in the number sentence $6 \times \square = 36$? Answers: A 4; B 10; C 6 (correct answer); D 2; "Julie buys some boxes of oranges for $190 and sells them for $220. If she makes profit of $5 on each box, how many boxes did she sell?" A four; B six (correct answer); C eight; D nine. No calculators were permitted during testing sessions. Reliability (Cronbach's $\alpha = 0.69$) for the overall sample was reasonable.

2.2.4 Confidence Rating Scales

Confidence ratings were collected in the RPM, Synonym Vocabulary, and Mathematics tests. These tests contained multiple-choice questions with four, six or

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eight response choices. Immediately after completing each item, students were asked to rate how confident they were that they had chosen the right answer. The confidence rating scales included both numerical and verbal statements and were based on the culmination of the prior works of Allwood et al. (2006), Clarke (1990), Roebers and Howie (2003), and Schwarz and Roebers (2006) (see Fig. 13.1). Proportions were also included to highlight that due to the question format (multiple-choice), children had a chance of correctly answering the questions by guessing or eliminating some of the alternatives.

To ensure all participants received the same information, standardised instructions for confidence rating (CR) were used. Prior to testing, the researchers ensured that students understood confidence as being how sure they were, and then explained the meaning of each possible response option on the confidence rating scale, from "very unsure" to "very sure". To minimise socially desirable responding, the instructions reiterated that there was no one correct way to respond; that different people would have different levels of confidence, and that it was acceptable to be very confident, not very confident, or anywhere in-between. Averaged confidence scores were then calculated for each cognitive task, with higher values reflecting higher levels of confidence. This resulted in three confidence scores for each participant, one each from the Vocabulary, Mathematics, and RPM tests.

Reliability estimates for confidence scores were uniformly high (for the overall sample ranging from Cronbach's $\alpha = 0.84–0.96$) and were all consistently higher than the reliability estimates for accuracy scores from the same test. These results are consistent with research in adult populations (Kleitman & Stankov, 2007) and offer initial support for the stability of confidence ratings in children.

2.2.5 Achievement Scores

Standardised class marks for mathematics, reading, and spelling were collected from relevant class teachers who were naïve to the aims of the study. These marks reflected individual student achievements within the current school year, relative to their peers from the same grade level across New South Wales, Australia according to standards that are set by the NSW DET and the BOS NSW, Australia. Achievement scores were collected as either an A to E mark, based on New South Wales common rankings, or as a percentage. Both were then converted to a final score ranging from 1 to 5, such that higher scores reflected higher levels of achievement for all data analyses.

2.3 Procedure

All testing took place within the school and it was administered to small groups of 15–30 students during 3 days. This extended procedure was utilised to ensure minimal disruption to school activities, student learning and to avoid cognitive strain on

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the participants. All instruments were given in a pen-and-paper format and standardised instructions were given prior to each session. No time restrictions were applied, although 1 h was the maximum time required for any single testing session.[5] The PBI-BC was completed on the first day of testing, the Class test on day two, and the RPM test on the third day. The Class test was given before the RPM test to allow students to become familiar with the simpler four-point confidence rating scale, before introducing the more complex 6- and 8-item CR scales.[6]

3 Results

3.1 Missing Value Analysis (MVA)

Prior to all analyses, any other missing data within tests was imputed using the Expectation Maximisation (EM) method in the SPSS 15.0. The EM iterative algorithm provides estimates of imputed values for missing data on the basis of the Maximum Likelihood (ML) procedure; and is a superior method of imputation that offers minimal discrepancy from the original covariance matrix (Little & Rubin, 1989). For ML to be employed, the following three requirements must be met. First, the percentage of missing data needs to be small (less than 5%). Second, the missing data must be identified by the researcher as continuous and multivariate normal in the absence of missing data. Finally, the pattern of any missing data must be random (Byrne, 2001). This was the case with the current data. A small percentage of *meaningful* missing data was evident for the PBI for the participants who did not have a paternal ($N=9$) or maternal figure ($N=1$). These values were not imputed.

3.2 Descriptive Statistics and Reliabilities

Reliability estimates for each test (Cronbach's α) and descriptive statistics for both accuracy and confidence scores are reported in Table 13.2 for the overall sample, and by each grade.

For the overall sample, the mean accuracy for each of the cognitive tasks was high, namely 61.24% for RPM, 80.69% for Vocabulary, and 60.93% for the Mathematics component. Not surprisingly, Grade 6 students performed better than Grade 4 students, and their confidence levels were also higher. The average

[5] No prior research has established additional time needed to incorporate confidence scores. Thus, although the RPM test has time limits to enable the inclusion of confidence ratings in the test, they were not applied. Consequently, the norms of the test were not applicable.

[6] The copies of the response categories for 6- and 8-point confidence rating scales are available from the first author.

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t2.1 **Table 13.2** Reliability estimates and descriptive statistics for cognitive tests

t2.2		Overall sample ($N=183$)			Grade 4 ($N=85$)			Grade 6 ($N=98$)		
t2.3		Cronbach's α	*M*	*SD*	Cronbach's α	*M*	*SD*	Cronbach's α	*M*	*SD*
t2.4	*Accuracy*									
t2.5	RPM	0.88	61.24	13.24	0.91	58.77	13.47	0.89	63.38	12.73
t2.6	Vocabulary	0.71	80.69	14.74	0.70	75.35	15.70	0.67	85.33	12.14
t2.7	Mathematics	0.69	60.93	16.42	0.65	54.89	15.77	0.68	66.17	15.19
t2.8	*Confidence*									
t2.9	RPM	0.96	87.93	10.61	0.96	85.37	12.57	0.93	90.15	7.97
t2.10	Vocabulary	0.84	85.39	11.28	0.87	83.48	12.95	0.76	87.05	9.35
t2.11	Mathematics	0.91	80.66	13.98	0.92	76.99	15.88	0.88	83.85	11.23

t2.12 *Note*: RPM = Raven's Progressive Matrices test; vocabulary = synonym vocabulary test; math = mathematics test

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Confidence scores across tasks ranged from 80 to 88% for the overall sample, from 77 to 85% in Grade 4, and from 84 to 90% in Grade 6. These results indicate that the difficulty level of each test was within the participant's cognitive limits, and that children were adjusting their confidence levels to the level of their performance across the grades. Accordingly, the differences between the overall confidence and accuracy scores (Over-/Underconfidence Bias scores[7]) were reasonably stable across the grades. Specifically, the differences were 26.60, 8.13, 22.1 in Grade 4 and 26.77, 1.72, 17.68 in Grade 6 for RPM, Vocabulary, and Mathematics tests, respectively. That is, the difference between the grades in these Bias scores was negligible for the RPM test (−0.17, $p > 0.05$) and small, yet statistically significant, for the Vocabulary and the Mathematics tests (6.41, $p < 0.01$ and 4.42, $p < 0.05$ respectively).

3.3 Confirmatory Factor Analysis

To investigate the structure of cognitive and metacognitive measures, a confirmatory factor analysis (CFA) was carried out using the Maximum Likelihood (ML) method from the AMOS 7 program (Arbuckle, 2006). Analyses were based on the accuracy and confidence scores derived from the RPM, Vocabulary, and Mathematics tests. Previous research suggests that if tests of a similar nature are given to adults, when factor analysis is performed, there would be two separate factors – Accuracy and Self-Confidence. To investigate whether the same holds within a child sample, three models were examined. Model 1 was a one-factor model, in which all scores were combined to define one broad Accuracy/Self-Confidence factor. Model 2 was a two-factor model, in which one factor was defined by all accuracy scores (Cognitive Abilities factor), and the second factor was defined by all confidence scores (Self-Confidence factor). Model 3 was based on the two-factor model theory, with its error terms within the same cognitive test correlated.

Chi-square (χ^2) is one of the most commonly used fit indexes. Small values relative to the degrees of freedom indicate statistically nonsignificant differences between the actual and the implied matrixes, signalling no discrepancy between the hypothesised model and the data. However, this statistic is sensitive to sample size. Thus, following the current practice, the root-mean-square error of approximation (RMSEA) and its 90% confidence interval (90% CI) were used to assess approximate goodness of model fit in the population; values lower than 0.05, with a narrower confidence interval, suggested good fit (Hu & Bentler, 1999). The relative

[7] Over-/Underconfidence Bias score is a difference between mean of confidence ratings and percentage of correct responses across all test items. Overconfidence is reflected via a positive bias and underconfidence is reflected by a negative bias. Confidence judgments are considered to be more realistic when the bias score approaches zero. As a rule of thumb, if the bias score lies within a ±5 limit, it is assumed to have little psychological significance and is argued to reflect a reasonably good calibration (Stankov, 1999).

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likelihood ratio of χ^2 to degrees of freedom (χ^2/df) statistic is also reported; values less than 2 are considered to indicate good fit (Kline, 1998). In addition, Goodness of Fit Index (GFI) was used to reflect the relative amount of covariance accounted by the model, where values 0.90 and above 0.95 suggest acceptable and good fits, respectively (Hu & Bentler, 1999). Finally, the Tucker-Lewis index (TLI) and Comparative Fit index (CFI) were used, which are incremental fit indexes that have been shown to be relatively independent of sample size (Marsh, Balla, & McDonald, 1988). Values greater than 0.90 and 0.95 are considered to reflect acceptable and good fits, respectively (Hu & Bentler, 1999).

When comparing two different models, two things are important: the overall improvement in the fit indices as well as the statistical significance of the changes in the χ^2 statistics ($\Delta\chi^2$) relative to changes in degrees of freedom (Δdf) or $\Delta\chi^2/\Delta$df. The statistically significant p value for the latter statistic indicates a significant improvement for the postulated nested model, hence signalling the model's better fit (Byrne, 2001).

3.3.1 Evidence for Broad Confidence and Cognitive Processes

At first, Models 1 and 2 were fitted to both Grade 4 and Grade 6 data separately. Results demonstrated near identical model fits for each grade; thus the data was then combined and a single overall model (Model 3) was applied.[8] Table 13.3 summarises the fit indices statistics for the three models.

As expected, the one-factor model (Model 1) did not adequately describe the self-monitoring data. While Model 2 represented a statistically significant improvement to Model 1, $\Delta\chi^2/\Delta df = 103.68$, $p < 0.01$, it still had a poor fit and was not an acceptable representation of the current data. Thus, the theoretical model (Model 3) was tested with correlations of error terms within each test. By employing this method, the fit of Model 3 was significantly improved, $\Delta\chi^2/\Delta df = 14.93$, $p < 0.01$. Moreover, the majority of the fit indices were within the ranges that signal a good model fit, $\chi^2/\text{df} = 3.23$, GFI = 0.97, TLI = 0.92, and CFI = 0.97. Note, however, that RMSEA and its CI were still greater than the desirable maximum (RMSEA = 0.11, 0.05 < 90% CI < 0.17). This demonstrates that although most of the goodness-of-fit statistics are within the ranges that signal a good model fit, the model might be

Table 13.3 Goodness of fit indices for the three CFA models

	χ^2	df	$\Delta\chi^2/\Delta df$	χ^2/df	GFI	TLI	CFI	RMSEA	90% CI
Model 1	134.62**	9	–	14.96	0.82	0.52	0.71	0.28	0.24–0.32
Model 2	60.94**	8	103.68**	7.62	0.91	0.77	0.88	0.19	0.15–0.24
Model 3	16.14**	5	14.93**	3.23	0.97	0.92	0.97	0.11	0.05–0.17

**$p < 0.01$

[8] Results of CFA models performed on each grade are available on request.

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problematic when it is generalised to a different sample. This might be a direct result of having a limited number of tests employed in this study (only three). Overall, however, when the error terms from the same cognitive task were correlated, the two-factor accuracy/confidence model had a reasonable fit. Model 3 was accepted as the model with the best fit to the data (see Fig. 13.2).

All loadings were statistically significant ($p < .01$) and were high, ranging from 0.63 to 0.97. All communality statistics (available on request) ranged between 0.40 and 0.93; indicating that these variables share a meaningful percentage of variance in common with the extracted factors (Byrne, 2001). As expected, Model 3 supports the existence of two broad factors: (a) Factor 1: *General Ability*. As expected, this factor was defined by the Accuracy scores from the RPM, Vocabulary, and Mathematics tests. It is a broad factor in terms of the cognitive processes that are captured. Although the Vocabulary Accuracy score (the only marker of Gc) had a high loading on this factor, the loadings from the RPM and Mathematics tests were more pronounced, indicating that Gf was reflected more in this Ability factor due to the reasoning processes captured in the latter two tests. (b) Factor 2: *Self-confidence*. As with adults, a distinct Self-Confidence factor exists among the current sample of children. This factor is exclusively defined by the high loadings of the Confidence scores from all three cognitive tests.

3.3.2 Evidence from Parental Care and Overprotection

The reliability coefficients (Cronbach's α), descriptive statistics and correlation coefficients for the PBI-BC are displayed in Table 13.4.

Research based on adolescent populations report reliability coefficients (Cronbach's α) of at least 0.70 for the Care and Overprotection scales in the

Table 13.4 Reliability estimates, descriptive statistics and correlation coefficients (Pearson *r*) for the Parental Bonding Instrument (PBI) subscales

	Cronbach's α						
	PBI-BC Original	PBI-BC Adjusted	*M* (*SD*)	PC	MO	PO	Parent overprotection
Maternal care	0.49	0.71	8.23 (1.23)	0.30**	–0.34**	–0.14	–0.29**
Paternal care	0.59	0.70	7.84 (1.50)	1	–0.09	–0.30**	–0.23**
Maternal overprotection	0.40		6.88 (1.74)		1	0.57**	0.90**
Paternal overprotection	0.35		6.61 (1.67)			1	0.88**
Parental overprotection		0.62	6.73 (1.52)				1

PC paternal care; *MO* maternal overprotection; *PO* paternal overprotection
Possible scores for care range from 3 to 9. Possible scores for overprotection range from 4 to 12
**$p < 0.01$

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PBI-BC (Klimidis et al., 1992a). In this study, however, when the instrument was used with younger children, reliability estimates were affected, ranging from 0.35 to 0.59 (see Table 13.4). Notably, one question on the Care scale "My mother/father seems emotionally cold to me" was misunderstood by the present cohort of participants. During the testing procedure, children often asked the researchers to explain what the word "cold" meant. The statistics confirmed concerns associated with this item (Question 2), and it was deleted from the scale for all major analyses, resulting in reliability increases from 0.49 to 0.71 for the Maternal Care subscale and from 0.59 to 0.70 on the Paternal Care subscale (see Table 13.4). The Maternal and Paternal Overprotection subscales returned low reliabilities (0.35 and 0.40, respectively). Moreover, looking at the correlation coefficients for the PBI subscales, the correlation coefficient between the Maternal and Paternal Overprotection subscales was reasonably high ($r = 0.57$, $p < 0.01$). This finding identified a possible multicollinearity problem if both were to be used simultaneously in path analysis. To remedy both of these problems, the Maternal and Paternal Overprotection subscales were combined to create a Parental Overprotection scale. In doing so, the reliability coefficient of the composite 8-item scale improved to 0.62.

The mean levels of care reported for both mothers and fathers in the present sample were high ($M = 8.23$, $SD = 1.23$ and $M = 7.84$, $SD = 1.50$, respectively) and reflected greater perception of care rather than rejection within each parent-child relationship. Perception of levels of maternal care was higher than that of paternal care, indicating that mothers were perceived as more caring than fathers. Both of these results were consistent with previous research findings (Klimidis et al., 1992a; Parker et al., 1979). Overall, children reported low and similar levels of overprotection for mothers and fathers (Maternal $M = 6.88$, $SD = 1.74$; Paternal $M = 6.61$, $SD = 1.67$). This pattern was consistent with previous research findings (Klimidis et al., 1992a; Parker, 1983, 1990), and it indicated that students felt they were in autonomous rather than controlling relationships and this perception was similar for both parents. This pattern also confirmed the decision to combine Maternal and Paternal Overprotection subscales into the Parental Overprotection scale. From this point on, any reference to Overprotection refers to the Parental Overprotection composite scale.

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3.3.3 Evidence from Achievement Measures

Table 13.5 summarises descriptive statistics and correlation coefficients for the achievement scores.

The levels of achievements ranged between 2.51 and 2.97 (out of 5) and were similar across grades and across different subject-matters. Importantly, there was a pattern of strong positive correlations present between achievements in Mathematics, Spelling, and Reading (ranging from 0.69 to 0.84, $p < 0.01$). Thus, the scores were combined into the single Achievement composite.

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t5.1 **Table 13.5** Descriptive statistics and correlation coefficients (Pearson *r*) for achievement scores

t5.2		Descriptive statistics						Correlations	
t5.3		Overall sample ($N=184$)		Grade 4 ($N=86$)		Grade 6 ($N=98$)		Overall sample ($N=184$)	
t5.4									
t5.5	Tests	*M*	*SD*	*M*	*SD*	*M*	*SD*	Spelling	Reading
t5.6	Mathematics	2.83	0.91	2.66	0.90	2.97	0.90	0.71**	0.69**
t5.7	Spelling	2.68	0.89	2.51	0.96	2.83	0.80	1	0.84**
t5.8	Reading	2.66	0.95	2.49	0.98	2.82	0.90		1

t5.9 $^{**}p<0.01$

711 *3.4 Path Analysis*

712 To investigate the hypotheses two to seven of the present study, path analysis was
713 conducted using the Maximum Likelihood (ML) method from the AMOS 7 pro-
714 gram (Arbuckle, 2006) using the correlation matrix summarised in Table 13.6.

715 Relationship between independent and dependent variables is referred to as beta
716 (β), while relationship between dependent variables is referred to as gamma (γ).[9]
717 Prior to examination of the betas and gammas, correlations between independent
718 variables that were not statistically significant ($p>0.05$) were fixed to zero; thus
719 only significant correlations are reported (see Fig. 13.3).[10] Then, the relationships
720 between independent and dependent variables were determined.

721 All possible regression coefficients (betas and gammas) were built into the
722 model. This was done to insure that the effects of each variable on self-confidence
723 and achievement were calculated while statistically controlling for known common
724 causes (intelligence, age and gender; see hypotheses above). The only exception
725 was the variable indexing parent-child relationship dynamics which in this model
726 cannot be classified as the "common causes". However, as existent research data
727 did not allow exact predictions in regards to these variables and self-confidence and
728 achievement, the path model included all possible relevant regression paths. For the
729 sake of clarity, only significant coefficients ($p<.05$) are displayed in Fig. 13.3. The
730 focus is on the discussion of significant *direct* effects (the effect one variable has
731 on another without any intervening variables). Path analysis also allows calcula-
732 tions and interpretations of the indirect effects (the effect a variable has on another
733 via a third intervening variable within the model). Only most meaningful indirect
734 effects will be discussed here.

735 In the path analysis model, the independent (exogenous) variables are parental
736 rearing styles (maternal care, paternal care, and parental overprotection), gender,
737 and age. The dependent (endogenous) variables are the Achievement and Self-
738 confidence scores. Fluid intelligence (Gf) is a common factor affecting these

[9] The unstandardised estimates are available on request.

[10] This is a recommended procedure for complex models examined on a relatively small sample size as it maximises degrees of freedom without affecting the model parameters of fit indices (Byrne, 2001).

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t6.1 **Table 13.6** Correlation coefficients (Pearson *r*) for the variables used in the path model

t6.2			1	2	3	4	5	6	7	8	9	10	11	12	13
t6.3	1	Age	1.00												
t6.4	2	Gender	0.03	1.00											
t6.5	3	M care	0.10	−0.13	1.00										
t6.6	4	P care	−0.10	0.06	0.28	1.00									
t6.7	5	Parental OP	−0.13	−0.07	−0.28	−0.21	1.00								
t6.8	6	Voc corr	0.28	−0.06	0.06	0.12	−0.09	1.00							
t6.9	7	Maths corr	0.34	0.09	0.13	0.20	−0.16	0.54	1.00						
t6.10	8	RPM corr	0.17	0.08	−0.04	0.14	−0.03	0.44	0.55	1.00					
t6.11	9	Voc conf	0.17	0.00	0.12	0.17	0.01	0.42	0.38	0.25	1.00				
t6.12	10	Maths conf	0.28	0.14	0.16	0.14	0.00	0.23	0.55	0.42	0.65	1.00			
t6.13	11	RPM conf	0.29	0.13	0.13	0.01	0.08	0.08	0.25	0.33	0.42	0.61	1.00		
t6.14	12	Achievement	−0.15	−0.01	0.03	0.19	−0.03	0.38	0.41	0.35	0.27	0.19	−0.02	1.00	
t6.15	13	Confidence	0.25	0.08	0.16	0.17	0.00	0.34	0.52	0.38	0.89	0.93	0.58	0.25	1.00
t6.16	14	Accuracy	0.36	0.02	0.11	0.19	−0.14	0.86	0.89	0.57	0.45	0.45	0.19	0.45	0.50

t6.17 *Note*: M care = maternal care; P care = paternal care; Parental OP = parental overprotection; voc correct = vocabulary test accuracy; maths corr = mathematics
t6.18 test accuracy; RPM Corr = Raven's Progressive test accuracy; voc conf = vocabulary test confidence; maths conf = mathematics test confidence; RPM
t6.19 conf = Raven's Progressive test confidence; achievement = achievement composite based on mathematics, spelling and readings scores; confidence = confi-
t6.20 dence composite excluding Raven's Progressive Matrices confidence score; accuracy = accuracy composite based on vocabulary and mathematics accuracy
t6.21 scores. All correlations higher than 0.15, $p < 0.05$; all correlations higher than 0.19, $p < 0.01$

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constructs, thus its influence needs to be statistically controlled for in the investigation of the relationship between achievement and self-confidence. Relationships between dependent variables were also considered to examine the predictive influence that self-confidence has on educational achievements while controlling for Gf (see Fig. 13.3). Similarly, given the assumptions of path analysis, when all variables are incorporated in the model, the impact of each variable represents the impact of the variable that exists after controlling (or partitioning out) the influence of all other variables in the model. The inclusion of achievement as an outcome variable means that the influence of care and overprotection levels as well as gender and age on a child's achievement levels can also be examined. As noted earlier, this study was *not* intended to investigate causality. The words "effect" and "influence" here are used only for the sake of simplicity, and referring only to the *predictive* nature of the relationships between the constructs.

Finally, the confidence score is the sum of the mean confidence judgments provided for the Vocabulary and Mathematics tests only. The confidence score from the RPM test was not included to prevent the problem of statistical dependency (as confidence judgments provided for the RPM test are conceptually and empirically related to the accuracy of actual performance on this test, $r=0.33$, $p<0.01$). Given that the RPM was used as the measure of Gf, if the confidence scores from RPM test were to be included, this would inflate the relationship between Gf and self-confidence. This would impose problematic and misleading interpretations.

3.4.1 Correlations Between the Independent Variables

Care scores were positively correlated ($r=0.29$, $p<0.01$, see Fig. 13.3). Parent overprotection scores had small, yet similar and significant negative correlations with both care scores ($r=-0.29$ and $r=-0.21$, $p<0.01$), indicating that children linked higher levels of parental control to a lesser degree of parental care. Maternal care had a small, yet significant negative relationship with gender ($r=-0.16$, $p<0.05$). There was also a small, yet significant, negative correlation between paternal care and age ($r=-0.15$, $p<0.05$). However, these two tendencies were not pronounced.

3.4.2 Direct Effects

As shown in Fig. 13.3, as expected (Hypothesis 2) Gf positively predicted both dependent variables. Higher levels of Gf positively predicted self-confidence and achievement, indicating that students with greater Gf have greater levels of self-confidence and are achieving better results at school.

Moreover, age significantly predicted all three dependent variables, namely Gf, self-confidence, and achievement (Hypotheses 3a, 3b, 3c). It exhibited a positive effect on both self-confidence and Gf. Thus, older students had greater levels of self-confidence and (as predicted) performed better on the same test of Gf. However, contrary to our expectations (see Hypothesis 3c), age had a negative

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effect on achievement levels. A separate correlation analysis within each grade was performed to investigate these results further. They revealed that the relationship between age and achievement was negligible, but *positive* within each grade ($r=0.04$ and $r=0.12$, $p>0.05$ in Grade 4 and Grade 6, respectively). Moreover, there was some overlap in ages in each grade, and unusually, older students within grades were performing at a lower level than their younger counterparts. That is, in Grade 6, several older students were judged to be performing, on average, at a lower standard level than expected for this grade. Furthermore, within a framework of a path analysis, the effect of age on achievements was examined after controlling for the Gf of a student. Thus, on the overall sample, this negative beta indicated that after taking into account students' Gf, older students within a grade were judged by their teachers as achieving at a lower "state standard" level than the younger students within the same grade. Thus, the negative relationship does not mean that, on average, the older students have an inferior level of cognitive ability, as the opposite was demonstrated by the positive relationship between age and Gf.

Gender was hypothesised to be a *possible* predictor variable for self-confidence and achievement (Hypothesis 4). However, as shown in Fig. 13.3, gender did not directly predict any of the dependent variables in the model.

We expected (Hypothesis 5) that parental overprotection will predict lower self-confidence and achievement scores. Our results did not support this prediction. In fact, parental overprotection score did not directly predict any of the dependent variables.

As expected in Hypothesis 6, greater levels of maternal care positively predicted higher levels of self-confidence. Thus, children receiving greater levels of care from their mother tend to have greater levels of self-confidence than those children receiving lower levels of maternal care. Contrary to expectations (Hypothesis 6) paternal care did not have the same influence on self-confidence levels. However, paternal care did positively predict Gf, indicating that children who report receiving higher levels of care from their father are exhibiting higher levels of cognitive ability than those students who report receiving lower levels of paternal care.

A notable finding here is the direct positive effect that self-confidence had on achievement. As predicted in Hypothesis 7, those students exhibiting greater levels of self-confidence tend to perform better at school. This prediction holds for both boys and girls of all ages, irrespective of their Gf and parenting bonds.

The path analysis model had a good fit, $\chi^2(5,\ N=183)=5.23$, $p=0.39$, $\chi^2/df=1.05$, RMSEA = 0.02 (0.01 < 90% CI < 0.11), GFI, TLI, and CFI = 0.99. This model accounted for 6.7% of the variance in Gf, 22.7% in self-confidence, and 21.1% in achievement.

4 Discussion

Metacognition is one of the three fundamentals of self-regulated learning, along with cognition and motivation (Schraw et al., 2006). Efficient test-taking behaviour and test-taking outcomes signify academic success and the metacognitive confidence

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judgments students assign to their on-going performance are at the core of this test-taking behaviour. The present study sought to identify the crucial ages at which self-confidence judgments begin to emerge as a *habitual* response pattern, or a trait, which is stable across different cognitive tasks. It also aimed to determine predictors of self-confidence, while investigating the predictive validity of self-confidence in school settings.

Our results do not permit to draw definite conclusions as to whether confidence judgments are task- or domain-specific in early childhood and at what age do they develop into the more general, stable trait evident in adults. It was hypothesised that self-confidence would exist as a distinct broad factor in children across all ages, although the stability of the Self-Confidence factor was expected to be more apparent in children aged 11 and over, that is, in Grade 6 rather than in Grade 4. This expectation was rooted in the theories of metacognitive development which stress the importance of age 11 in the development of metacognitive skill when children begin to think about thinking itself realising that these thoughts can influence their performance (Alexander et al., 1995; Flavell et al., 1993; Miller & Weiss, 1982; Veenman & Spaans, 2005). The results indicate that children in each grade exhibit identical trends associated with confidence ratings. Results also demonstrate that self-confidence ratings have high reliability within each test (Cronbach's $\alpha > 0.80$); a level of internal consistency greater than that was found for performance accuracy measured on the same test. Confidence ratings separated clearly from performance accuracy scores, defining a distinct Self-Confidence factor. Thus, self-confidence exists as a stable and identifiable metacognitive factor in children as young as 9–12 years of age, just as it does in adults.

This novel finding signifies that metacognition, in the sense of self-confidence, is a *stable* component of a child's thinking repertoire by Grade 4. Thus, this study provides a foundation for the improvement of teaching at the classroom level. For example, metacognitive self-monitoring skills should be seen as appropriate additions to the classroom curriculum before Grade 4, with an aim to foster these skills before they become habitual. Moreover, knowledge that a child as young as nine is already habitually assessing their own thinking is a crucial and powerful tool, one which can undoubtedly assist both school counsellors and child psychologists. If a child has the capacity to be a self-regulated learner, perhaps he/she has the capacity to self-reflect upon one's feelings and thoughts preceding these feelings. Self-reflective thinking and awareness of one's cognitions are vital skills which can be developed and fostered in the realm of counselling. Future studies need to explore these directions.

The study also aimed to identify the determinants of the self-confidence trait, by examining a key external influence of the early social environment, that is, one's relationships with parents. Want and Kleitman (2006) demonstrated that retrospective reports of high levels of maternal overprotection during childhood negatively predicted self-confidence in the adult population. However, no such studies had previously been conducted with children. The present study was the first to examine the relationship between parental bonds with each parent and the Self-Confidence factor in primary school children. The study was also the first

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to analyse current, rather than retrospective, reports of parent-child bonding in relation to levels of self-confidence, thus strengthening the validity and reliability of bonding reports and their reported influences on metacognitive development. These influences were studied while controlling for age, gender and fluid intelligence of a child.

The results indicate that irrespective of a child's age, gender, and fluid intelligence, maternal care predicts positively the levels of self-confidence, with higher levels of maternal care associated with greater levels of self-confidence. Similarly, Want and Kleitman (2006) found that maternal bonds, and not paternal bonds, *directly* predicted self-confidence levels in adults. Consistency of these results may form the foundations to suggest that mother-child bonds have a greater influence on metacognitive development than father-child bonds. Perhaps, then, the prediction that maternal care has on levels of self-confidence is intertwined with the vulnerabilities of a child's self-evaluations. It should be also noted that these self-evaluations are more strongly influenced by maternal rather than paternal levels of care. Future studies need to assess a possible mediation that self-concepts may have within the relationships of parental bonds and self-confidence. In terms of predictions, it should be emphasised that paternal care directly predicts fluid intelligence, which itself predicts self-confidence. Therefore, paternal care *indirectly* predicts self-confidence, via its link with fluid intelligence. This result recognises the importance of healthy father-child bonds for a child's optimal cognitive and metacognitive development.

Consistent with the hypothesis and research completed in adult populations, age demonstrated a significant relationship with self-confidence; older children displayed higher levels of self-confidence than their younger counterparts, irrespective of fluid intelligence or gender. Moreover, age positively predicted fluid intelligence, which itself, positively predicted levels of self-confidence. Thus, age has direct and indirect influences on self-confidence levels. While current results demonstrate that children as young as nine have developed stable self-confidence levels, older children on average are more confident, and only some portion of variance is attributable to advances in fluid intelligence.

As predicted, fluid intelligence was a strong positive predictor of the self-confidence composite. This is consistent with prior research in adult populations, where cognitive ability (measured on the same test employing confidence ratings) has been found to predict self-confidence (Kleitman & Stankov, 2007). The present study accounts for this relationship and, therefore, parallel fluid intelligence ratings to confidence ratings were not included in the self-confidence score utilised in the path model. The results still suggested that greater fluid intelligence predicts greater self-confidence. This relationship was not falsely inflated as a result of concurrent achievement, which can often be a weakness of research employing concurrent measures.

Also, as expected, fluid intelligence exhibited a positive influence on school-based achievement reflected by standardised grades. Interestingly, this influence was as strong as the influence fluid intelligence exhibited on self-confidence. Although the present results do not clarify causality of this relationship, it nevertheless

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demonstrates the importance of studying the developmental link between fluid intelligence and metacognition.

Gender did not predict any of the dependent variables in the model. Previous research has demonstrated mixed results for the role of gender in self-confidence. The present results add weight to the argument that gender does not influence children's self-confidence and achievement.

The most notable finding of the study is the positive relationship between self-confidence and school achievement that is incremental to a child's age, gender, and levels of fluid intelligence. As mentioned earlier, space constraints prevented examination of the over/under-confidence bias scores which index self-monitoring. A separate paper is devoted to this construct and its link to academic achievements (Kleitman & Moscrop, 2009). However, preliminary findings indicate that a smaller discrepancy between confidence and accuracy scores predict better achievements. Together, these findings imply that irrespective of the gender, age, and intelligence characteristics of a child, greater and more realistic self-confidence maximises effective learning. Students exhibiting these trends not only possess the regulative capacity to know what they know and how well they perform, they also utilise their knowledge and skills to learn how to learn.

4.1 Limitations and Future Directions

Contrary to expectations and earlier findings (Want & Kleitman, 2006), overprotection levels within parent-child relationships did not predict self-confidence levels. This result may be attributed to the young age of the participants in the current study. Perhaps, as a young child, one perceives that he/she needs higher levels of overprotection, discipline and direction, as one is not yet engaged in an autonomous, independent lifestyle (Berk, 2003). Another possibility for these results might be linked to the complex nature of parental overprotection which can be classified into two components, namely psychological and behavioural control. Psychological control refers to "attempts to intrude into the psychological and emotional development of the child", while behavioural control refers to "parental behaviours that attempt to control…children's behaviour" (Barber, 1996, p. 3296). It is possible that these two different types of control may hold differential influences on cognitive and metacognitive development. In fact, Bean, Bush, McKearney, and Wilson (2003) found that behavioural control predicted an increase in academic achievement, whereas psychological control predicted their decrease. The use of the PBI-BC prevented us from delineating these control tendencies. There were other concerns with this measure. Reliability issues were raised in the use of the PBI-BC in young child populations, surrounding the complex wording of some of the questions. In fact, one question was removed from the Care scale due to poor reliability statistics. Thus, future studies should examine the two types of control separately, using a more reliable measure of concurrent parental-child bonds.

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Although sampling technique in the present study was limited, the resulting sample of the primary school children exhibited the trends similar to those demonstrated in other research in regards to parent-child relationships, cognitive abilities, age and gender. Therefore, the current sample can be seen as an appropriate indicator of the wider population.

The exploratory nature of the present study limits the scope of conclusions drawn. The path analysis model used in the present study focused only on the *predictive* relationships between the variables. A longitudinal research study with a greater control for known common causes (e.g., previous achievement) could greatly assist in determining causal links between these variables. Future research would also benefit from a larger selection of variables to mark each construct to have more than only the bare minimum (three) of potential markers for each latent factor. Moreover, in this study we only controlled for students' fluid intelligence. Ideally, both fluid and crystallized intelligence should be controlled for. Finally, future studies should examine a possible mediation role that certain self-concept measures (see Efklides, & Tsiora, 2002; Kleitman & Stankov, 2007; Kröner & Bierman, 2007) could play in parent-child bonds and in self-confidence relationships.

4.2 Conclusion

While future studies need to investigate the causal nature of the relationships between different constructs examined in this research and earlier ages in an attempt to identify the key age at which decision-making processes become entrenched, this study provides the foundation for identifying the development of habitual self-confidence. The results from this study not only indicate that self-confidence exists as a stable construct in children as early as 9 years of age, they also shed light on the predictive validity of the self-confidence trait in school settings. The results also extend the understanding of the factors which predict children's cognitive and metacognitive development and academic outcomes from the family unit. This knowledge offers great promise to educators, psychologists and parents alike, providing them with the potential to foster growth of decision-making abilities of children with a broad aim to improve their educational outcomes.

[AU5]

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