The Structure and Function of Primary and Secondary Academic Control

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FACULTY OF GRADUATE STUDIES

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The Structure and Function of

Primary and Secondary Academic Control

BY

Tara Lynn Haynes

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirement of the degree

Of

MASTER OF ARTS

Table of Contents

List of Tables....iii

List of Figures....iv

Abstract....v

Introduction....1

Perceived Control....2

Two-Process Model of Control....3

Primary/Secondary Control in Academic Settings....9

Method....13

The 'Buffers and Barriers' Longitudinal Study....13

BB core variables....14

STS variables....16

Procedure: BB Data Collection....16

Sample Profile....20

Measures....23

Age-based Groups....23

Academic Control Measures....25

Primary academic control....25

Secondary academic control....26

Academic Outcome Measures....27

Academic emotions....27

Grade point average....28

Results....28

Preliminary Analyses....28

Data normality....29

Outlier analysis....29

Correlations....29

Rationale for Analyses....32

Factor Structure of Primary and Secondary Control....36

Primary control EFA....36

Primary control CFA and test of factorial invariance....37

Secondary control EFA....41

Secondary control CFA and test of factorial invariance....42

Academic Function of Primary and Secondary Control....49

Discussion....59

Structure of Primary and Secondary Control....60

Function of Primary and Secondary Control....64

Strengths and Limitations....70

References....73

Appendices....82

List of Tables

1. BB Cohort Demographic Information....15

2. BB-STS Demographic Information....17

3. Age-based Sample Characteristics....22

4. Correlations among all Study Variables....30

5. Eigenvalues and Percent Variance of Single Primary Control Factor by Age-group....38

6. Primary Control Measurement Model Comparisons....40

7. Eigenvalues and Percent Variance of five Secondary Control Factors by Age-group....43

8. Secondary Control: Factors 1 and 2....44

9. Secondary Control Measurement Model Comparisons....48

10. Primary Control and Emotions Model Comparisons....52

11. Secondary Control and Emotions Model Comparisons....54

List of Figures

1. BB Data Collection....18

2. Study Sample....21

3. Age Composition of the 21+ group....24

4. Hypothesized Primary Control Factor Model....39

5a. Hypothesized Secondary Control Factor Model....45

5b. Reformulated Secondary Control Factor Model....47

6. Primary Control, Academic Emotions, and Academic Performance: Baseline Model....50

7. Secondary Control, Academic Emotions, and Academic Performance: Baseline Model....51

8. Primary Control, Academic Emotions, and Academic Performance: Structural Model....55

9. Secondary Control, Academic Emotions, and Academic Performance: Structural Model....58

Abstract

This study examined the factor structure and developmental function of primary and secondary control within an academic context. Three phases of development were considered corresponding with students' age in years: Transition (17-18 years); Decision (19-20 years); and Commitment (21+ years). Results of both exploratory and confirmatory factor analyses suggest a single-factor solution for primary control and a two-factor solution for secondary control. Tests of factorial invariance suggest identical factor structures across the three age groups for both primary and secondary control. The function of primary control and the two types of secondary control as predictors of academic-related emotions and academic achievement (GPA) was examined with structural equation modeling. Findings suggest direct and indirect (emotion-mediated) relationships between primary control and GPA. The two types of secondary control were indirectly related to GPA (emotion-mediated), though in very disparate ways. The conceptual and practical implications of findings are discussed.

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The Structure and Function of Primary and Secondary Academic Control

Introduction

The perception that one can control and influence outcomes either directly or indirectly in one's environment is typically regarded as essential for adaptive functioning (Heckhausen and Schulz, 1995). Although perceived control is commonly conceptualized as the result of direct modification of one's environment, control theorists (e.g., Rothbaum, Weisz, & Snyder, 1982) recognize that individuals also maintain control indirectly, by adjusting to the environment through modified cognitions, expectations, etc. In order to differentiate between these two types of control, the labels *primary control* and *secondary control* have been adapted to reflect active/direct and passive/indirect control respectively (Rothbaum et al., 1982).

The current study examined the structure and function of both primary and secondary control within the specific domain of achievement striving. In particular, the possibility that primary and secondary control may develop as students mature, an idea stemming from the theoretical perspective of Heckhausen and Schulz (1995), was assessed by comparing the factor structure of both primary and secondary academic control across three age-based student groups. In addition, the developmental function of both primary and secondary control was examined across each age-based group in terms of the associations of both types of control with academic-related emotions (positive and negative) and actual academic achievement (GPA). The conceptual and practical implications for the maintenance of perceived academic control via primary and secondary means are examined and discussed.

Perceived Control

Research consistently demonstrates the benefits of perceived control in terms of greater motivation, increased psychological well-being, and improved functioning (Perry, Hall, & Ruthig, 2005). Perceived control also has direct consequences for the reduction of stress (Folkman, 1984), and has been linked to physiological outcomes such as blood pressure level (Hawkley et al., 2005), general physical health status (Chipperfield, Perry, & Menec, 1999), and even mortality among the elderly (Chipperfield, 1993). In addition, research also outlines the devastating effects of *loss of perceived control* in terms of negative emotions (Scheck & Kinicki, 2000), ruminative thought (Lyubomirsky, Tucker, Caldwell, & Berg, 1999), helplessness (Miller & Seligman, 1975), anxiety (Muris, Meesters, Schouten & Hodge, 2004) depression (Abramson, Garber, & Seligman, 1980) and physical health setbacks (Peterson & Seligman, 1987; Wallace, Bergeman, & Maxwell, 2002).

Within the literature loss of perceived control is commonly referred to as ‘helplessness’ (Abramson et al., 1980; Seligman, 1975). Traditional helplessness paradigms define loss of control in terms of two typical responses: (1) Cognitive responses in the form of attributions implying uncontrollability and, (2) The absence of direct, controlling behavioral responses - typically replaced with inward behavioral responses in the form of passivity, submissiveness, and withdrawal. Until relatively recently, an individual who displayed the above combination of cognition and behavior was invariably assumed to experience helplessness (for a review see Miller & Norman, 1979). In conjunction with the assumption of helplessness, theorists have typically inferred a lack of *motivation for regaining* control in such situations, again citing the lack of outward responding as evidence. In a pivotal theoretical paper Rothbaum et al. (1982) challenged the assumption of helplessness and argued that "the motivation to feel in control may be expressed not only in behavior that is blatantly controlling, but also subtly, in behavior that is not" (p. 7). As such, Rothbaum et al. proposed a model of perceived control whereby individuals maintain feelings of control through two processes termed primary control and secondary control. Although many definitions of perceived control exist (for a review see Skinner, 1996), for the purposes of the current study perceived control will be viewed from the perspective of Rothbaum et al.'s two-process model of control.

Two-Process Model of Control

The central concept outlined in Rothbaum et al.'s (1982) theory is that individuals are motivated to feel in control in many instances previously thought to invariably produce helplessness. Perceived control can be achieved not only directly by bringing the environment in line with one's desires, but also indirectly by bringing oneself in line with the environment. Thus, these authors view perceived control as attainable through two processes: *Primary control* refers to perceptions of control that are gained through *primary* means (i.e., beliefs, strategies, etc.) which typically involve the direct manipulation of the environment (e.g., persistence, task modification, etc.). *Secondary control* is offered as an alternative to helplessness, and is conceptualized as perceptions of control that are gained through *secondary* means involving an adjustment of the self to the uncontrollable environment (e.g., through modifying one's attributions, expectations, etc.). Both primary and secondary control processes can involve action and cognition, however it is typically observed that primary control striving targets the external environment, in the form of active behavior (e.g., studying for an exam), while secondary control targets the internal self in the form of cognitions and/or emotions (e.g., downgrading the importance of failure) (Heckhausen & Schulz, 1995).

Rothbaum et al.'s (1982) definition of primary control largely overlaps with the traditional conceptualization of perceived control as the direct manipulation of one's environment. As such, a large body of literature documents the implications of perceived primary control for the psychological functioning and well-being of humans. Greater perceptions of primary control are generally associated with lower levels of depression (Abramson et al., 1980) and stress (Folkman, 1984). In addition, there is evidence to suggest that perceptions of control attained via primary sources are related to actual physiological outcomes (Langer & Rodin, 1976; Rodin & Langer, 1977), health care service usage (Chipperfield & Greenslade, 1999), and even survival rates among the elderly (Bailis, Chipperfield, & Perry, 2005; Chipperfield, 1993; Menec, Chipperfield, & Perry, 1999; Rodin & Langer, 1977).

Relative to primary control, the secondary control research literature is small and still developing. The vast majority of secondary control research studies have been conducted within the contexts of health and aging (e.g., Chipperfield et al., 1999). Empirical findings indicate the benefits of secondary control in terms of outcomes such as parental adjustment to childhood cancer (Grootenhuis, Last, DeGraaf-Nijkerk, & VanDer-Nel, 1996), psychosocial adjustment to Parkinson's disease (McQuillen, Licht, &

Licht, 2003), reducing depressive symptoms in HIV positive individuals (Thompson, Nanni, & Levine, 1994), assisting incarcerated men cope with HIV diagnosis (Thompson, Collins, Newcomb, & Hunt, 1996), and aiding middle-aged adults in adjustment to age-related physical changes (Thompson, Thomas, Rickabaugh et al., 1998). In a pivotal longitudinal study, Affleck, Tennon, Croog, & Levine (1987) provide compelling evidence regarding the value of secondary control in terms of actual physical health outcomes and survival. The authors interviewed men who had recently suffered a heart attack. Eight years later health records revealed that those men who initially reported benefiting in some way from the heart attack (e.g., spending more time with grandchildren) had significantly lower incidence of second heart attacks and a higher survival rate, as compared to men who did not report any benefits associated with the experience of a heart attack.

As outlined above, research confirms that both primary control and secondary control are instrumental in terms of adaptive functioning. There appears to be consistent evidence concerning the importance of primary control in terms of the actual actions that are necessary for actual goal attainment (e.g., studying in order to succeed academically). In addition, secondary control is important to goal attainment in that it appears to fulfill two functions: amelioration of loses in psychological well-being that are likely to result from threats to primary control (Rothbaum et al., 1982) and, preservation of motivation for future primary control striving (Heckhausen & Schulz, 1995). That is, while primary control appears to directly impact objective outcomes (such as academic achievement), secondary control appears to have an *indirect* relationship with success outcomes through psychological well-being variables (i.e., emotions) and/or motivation.

Debate continues in the literature with regard to the adaptiveness of heavy reliance on secondary control given the possibility (and appropriateness) of primary control responding. Control theorists argue that in such cases there may be costs to the preservation of psychological well-being through secondary control. That is, using *only* secondary control (e.g., in place of primary control) may result in a lack of active behavior aimed at goal attainment. This lack of active engagement in one's environment can have disastrous effects in goal-striving situations (e.g., failure to attain one's goal) (Heckhausen & Schulz, 1995).

Initially Rothbaum et al. (1982) proposed that control (both primary and secondary) is attained via the following four types of control-striving strategies: interpretation, prediction, vicarious association, and illusory connection. Within the context of primary control there has been little research concerning Rothbaum et al.'s specific distinctions. While several identifiable primary control strategies may exist (Heckhausen & Schulz, 1998), primary control appears to be somewhat unidimensional in that most primary control strategies have in common effortful or persistent behavior aimed at goal attainment. Emphasis in the literature has remained on this single dimension of primary control, a perspective which is adopted in the current study of primary control. Rothbaum et al.'s distinction between the four types of control striving has received slightly more attention within the context of secondary control (i.e., relative to primary control). Indeed, research typically suggests that secondary control is multidimensional (Hladkyj, Perry, Pelltier, & Taylor, 2000; Heckhausen & Schulz, 1998). As such, the current study examined the possibility of the existence of Rothbaum et al.'s four factor structure in the data. Below is a summary of Rothbaum et al.'s hypothesized four factors.

The *interpretive* form of secondary control is conceptualized as the cognitive restructuring of a negative, uncontrollable event so as to deduce meaning, knowledge, and/or importance from the event. That is, through reinterpretation people seek to render uncontrollable outcomes more tolerable and acceptable. Consider a student who receives a poor grade on an important assignment, but believes he has learned a valuable lesson from the feedback on the assignment. This student may retain a sense of control over academic outcomes based on his re-interpretation of the situation.

Predictive secondary control involves prediction of the occurrence of negative, uncontrollable events and is typically associated with attributions to severely limited ability. For example, consider a student who has performed poorly on a math exam and concludes that he is not gifted in math (attribution to limited ability). The student lowers his expectations for the next exam and a sense of control may be maintained through the fulfillment of *negative* expectations (moderate grades).

Vicarious secondary control is the association of the self with powerful others and is typified by attributions to external others (i.e., teachers, God, boss, etc.). Vicarious secondary control allows for an individual to align him/herself with others, thereby sharing in a collective control. Consider a student who earns a C+ on an important paper. The student relays her experience to others in the class and discovers several other students received the same grade. A sense of control may be maintained through the commonalities and union of the larger group.

Illusory secondary control embodies attempts to associate with chance and is generally accompanied by attributions to luck, chance, or fate. Rothbaum et al. (1982) suggest that illusory control may also involve active behavior in chance situations (e.g., a gambler blowing on dice). In an academic setting, a student who attributes poor performance to bad luck may use superstitious strategies such as wearing a lucky shirt or sitting in a particular chair. A sense of control is gained through alignment of the self with the 'force of chance' so that the individual may share in the control exerted by that force.

Since Rothbaum et al.'s (1982) original distinction between primary and secondary control, several theorists, most notably Heckhausen and Schulz (1995; 1998), have further expanded on the two-process model. In their Life-Span Theory of Control, Heckhausen and Schulz (1995) apply primary and secondary control to developmental transitions and goals and in so doing, posit lifespan developmental trajectories for both primary and secondary control. Specifically, these authors suggest that as humans age they become more experienced in dealing with threats to primary control. As such, older and more experienced individuals are more adept with, and gain more benefit from, secondary control. A growing body of research supports this claim with empirical evidence repeatedly demonstrating a connection between age and *secondary* control (e.g., Band & Weisz, 1990; Chipperfield et al., 1999; Heckhausen, 1997).

In order to address this developmental feature of secondary control, age was treated as an independent variable in this study, and the possibility that the factor structure of secondary control differed across student age groups was examined. In particular, given Heckhausen and Schulz's (1995) suggestion that secondary control develops as individuals gain experience, it was predicted that secondary *academic* control among relatively young students would be largely undeveloped as compared to older students. This would result in a highly disparate secondary control factor structure across students of different age groups.

Primary/Secondary Control in Academic Settings

Objectively, most students accepted to university have the capacity to succeed in academic situations in terms of academic competency, ability, etc. In addition, academic outcomes are typically considered highly contingent upon appropriate academic behaviors such as attending class, taking notes, and studying for exams. As such, primary control is typically considered a highly adaptive strategy for goal attainment in academic settings (for a review see Stipek & Weisz, 1981). Indeed, research repeatedly demonstrates the importance of perceived primary academic control for university students' achievement in terms of motivation and academic performance (e.g., Perry & Dickens, 1984; Perry & Magnusson, 1989), final course grades in introductory psychology (Perry, Hladkyj, Pekrun, & Pelltier, 2001) and actual grade point averages (Perry, Hladkyj, Pekrun, Clifton, & Chipperfield, 2005). The university environment can encompass challenges, however, that can serve to undermine perceptions of primary control through failure, thereby creating a situation in which secondary control may be employed. As such, the current study will examine primary and secondary control within an academic setting, accounting for Heckhausen and Shulz's (1995) emphasis on the development of control processes by investigating both control processes across three age-based student samples as outlined below.

When young (17-18 years) university students make the transition from high school to university, they can face unanticipated challenges such as unfamiliar academic tasks, heightened academic competition, a new physical environment, new social networks, and financial strain. These new realities may contribute to unexpected academic outcomes, notably in the form of failure, thereby threatening primary control. Perry et al. (2001) refer to this situation as a *paradox of failure* in which seemingly capable students have difficulty adjusting to the university setting. Indeed, roughly 27% of students entering university will not complete the first year (Desruisseaux, 1998; Geraghty, 1996). Further, among the students who successfully complete the first "transition" year of university, fewer than 55% will actually earn an undergraduate degree within an additional five years of study (Desruisseaux, 1998; Geraghty, 1996). For the purposes of the current study this group of students (17 – 18 years) will be labeled the Transition Group.

While students 17 – 18 years face issues related to the transition from high school to university, slightly older students (19-20 years) may encounter issues related less to transition, and more to their academic and career development. Decisions concerning university program, faculty, and major subject area may become more important to older students as they begin to realize the implications of attending university for future career opportunities, employability, etc. These challenging decisions, combined with ever-increasing financial responsibilities and the pressure to excel, can contribute to threats to primary control in the form of program uncertainty, course attrition, and career indecision. As such, these students (19 – 20 years) will be referred to as the Decision Group.

While younger students may struggle with the transition to university and career indecision issues, more mature students (21+) have slightly different concerns. Mature students can be one of many types of students: some may be adults who are making a career change, others may be students returning to university after dropping out, still others may be students who have completed several years of an undergraduate program and are nearing graduation, etc. Regardless, for these mature students obtaining an education can take on a high level of importance relative to younger students. Generally, mature students are conceptualized as highly committed to their chosen program, having made the challenging decision to return to university. As such, for these students, failure may be less likely and when it does occur, it may be less devastating for these "seasoned" students. For the current study these students (21+ years) will be labeled the Commitment Group.

Following from this general logic, two broad research questions arise: First, does the nature of primary/secondary control differ across the three age-based student samples (Transition, Decision, and Commitment)? That is, it is quite possible that the characteristics of primary and secondary control differ for the three student age-groups because of changing demands inherent in students' academic development. In statistical terms, this question will be addressed in terms of a test of factorial (measurement) variance of primary and secondary control across the three age groups. A second research question concerns the function of primary and secondary academic control in academic settings. That is, how do these constructs relate to academic emotions and performance (GPA) in an academic setting? This question will be assessed with a structural equation model examining the effects of primary and secondary control on academic-related emotions and GPA. Four hypotheses were formed to address the two research questions. *Hypotheses 1* and *2* address the first research question concerning the factor structure of primary and secondary academic control across the three age groups, while *Hypotheses 3* and *4* address the second research question and focus on the function of both types of control in terms of associations with academic-related emotions and actual academic achievement (GPA).

Hypothesis 1. It was expected that primary academic control would emerge as one factor for each age group, and that this single-factor structure would be highly similar across the groups. This hypothesis is based on the large body of literature suggesting the unidimensional conceptualization of primary control as effortful or persistent behavior aimed at goal attainment.

Hypothesis 2. Based on past empirical findings (Hladkyj et al., 2002; Hladkyj, Perry, and Renaud, 2005) and Rothbaum et al.'s (1982) theory, it was expected that secondary academic control would have a multidimensional factor structure. In addition, based on Heckhausen and Schuz's (1995) theoretical position regarding the importance of transitions in the development of secondary control, it was expected that the factor structure of secondary academic control across the age groups would not be constant. That is, there will be structural variance in secondary academic control across the age groups in terms of identified factors, item-to-factor loadings, and relationships between factors.

Hypothesis 3. Based on the voluminous body of research concerning perceived control in achievement settings, it was expected that perceived primary academic control would be directly and positively related to academic performance (GPA) across all three age groups.

Hypothesis 4. Alternatively, based on Rothbaum et al.'s (1982) and Heckhausen and Schulz's (1995) suggestions that secondary control facilitates performance indirectly through psychological well-being and motivation, it was expected that secondary control would be indirectly related to academic performance (GPA) through academic-related emotions. That is, secondary control was expected to have a positive, indirect, effect on GPA through its association with lower levels of negative emotion (i.e., *lower* levels of negative emotion represents *greater* psychological well-being) across all three age groups.

Method

The 'Buffers and Barriers' Longitudinal Study

The sample for this research was drawn from the Buffers and Barriers (BB) Project, a large ongoing longitudinal and cross-sectional study conducted by the Motivation and Academic Achievement (MAACH) Research Laboratory at the University of Manitoba. The broad focus of the BB project is to assess the experiences of university students and to determine methods of intervention to assist students who are at risk of academic failure. Questionnaire data is collected bi-annually from Introductory

Psychology students at the University of Manitoba. Presently, 11 biannual student cohorts exist, beginning with 1992 and continuing each year up to 2003 (no data for the year 2002) with the total combined sample amounting to 9402 students. Sample sizes vary by cohort with the smallest being N = 323 (1992) and the largest N = 1574 (2001). On average, the BB cohort samples are composed of approximately 60% females, 40% males. Ages typically range from 17 to 46+, with the vast majority of students between the ages of 17 - 19. See Table 1 for demographic information (N size, gender, and age) of each of the 11 BB cohorts.

BB core variables. In addition to cohort-specific variables, each year a common core of academic variables are assessed, resulting in a number of identical measures available across the twelve cohorts. The core variables of interest in the MAACH research laboratory have been grounded within two major social cognition theoretical frameworks: Attribution Theory (Weiner, 1985; 1995) and Perceived Control Theory (Seligman, 1975; Rothbaum et al., 1982). As such, the core measures are a reflection of these two theoretical backgrounds and include scales assessing academic attributions (ability, effort, test difficulty, etc.); academic-related emotions (pride, helplessness, guilt, etc.); academic expectations (perceived success, expected grades, etc.); academic motivation; and primary and secondary academic control.

The core set of measures common to all BB cohorts has made the creation of a larger, combined BB data set possible. The combined BB data set contains all overlapping measures from 1992 through to 2003. Further to this, a subset of academic variables were made available to the MAACH laboratory through the connection of the

Table 1

BB Cohort DemographicInformation

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2003
Age											
17-18	148	715	454	251	286	431	593	350	447	652	477
19-20	82	367	230	109	142	245	295	96	249	321	208
21-22	25	123	65	24	32	77	94	177	74	118	63
23-24	11	57	35	7	18	34	35	-	33	49	31
25-26	10	24	8	3	7	23	22	-	23	28	11
27-30	15	39	14	5	12	16	17	-	11	21	17
31-35	10	15	8	4	11	13	9	-	14	10	5
36-40	2	10	6	3	3	4	8	-	7	12	4
41-45	2	6	4	3	3	4	3	-	4	4	2
46+	1	1	4	2	5	1	7	-	2	5	3
Missing	17	217	3	2	5	5	10	168	24	40	3
Total	323	1574	831	413	524	853	1093	819	888	1260	824
Gender											
Female	200	820	488	262	319	511	651	425	575	757	504
Male	92	534	338	149	197	333	427	223	278	447	317
Missing	31	220	5	2	8	9	15	168	35	56	3
Total	323	1574	831	413	524	853	1093	819	888	1260	824

BB data to the University of Manitoba Student Tracking System (STS), a large institutional database containing all registered students' complete academic history from the time of enrollment through to degree attainment for up to eight years.

STS variables. The Student Tracking System contains roughly 230 individual variables for each case (i.e., student). For every student enrolled in university programs information is available for demographic characteristics (date of birth, citizenship, gender, marital status, etc.), information on high school achievement (average percentages in math, english, physics, chemistry, and overall) and university admission data (program of admission, prior institutions attended, prior degrees attained, and entrance exam scores). In addition to the administrative data there is an exhaustive academic history of each student. Variables such as grade point averages, voluntary course withdrawal hours, and credit hours are recorded in semester (term), sessional (year), and cumulative formats. As such, the BB-STS Merge is a large (N = 9329) dataset consisting of psychosocial variables (BB data) and academic institution variables (STS data) for 11 separate cohorts (1992 – 2003, no BB data for 2002). Nearly half of the students are 17 – 18 years in age and roughly 2/3 of all students are female (see Table 2 for demographic characteristics of the BB-STS Merge).

Procedure: BB data collection

See Figure 1 (BB Data Collection Procedure) for the time line sequence of the following five phases of BB data collection for any given academic year.

Phase 1. Students are recruited early in the academic year (October) and select a session day and time to complete BB Questionnaire 1. Sessions are approximately one

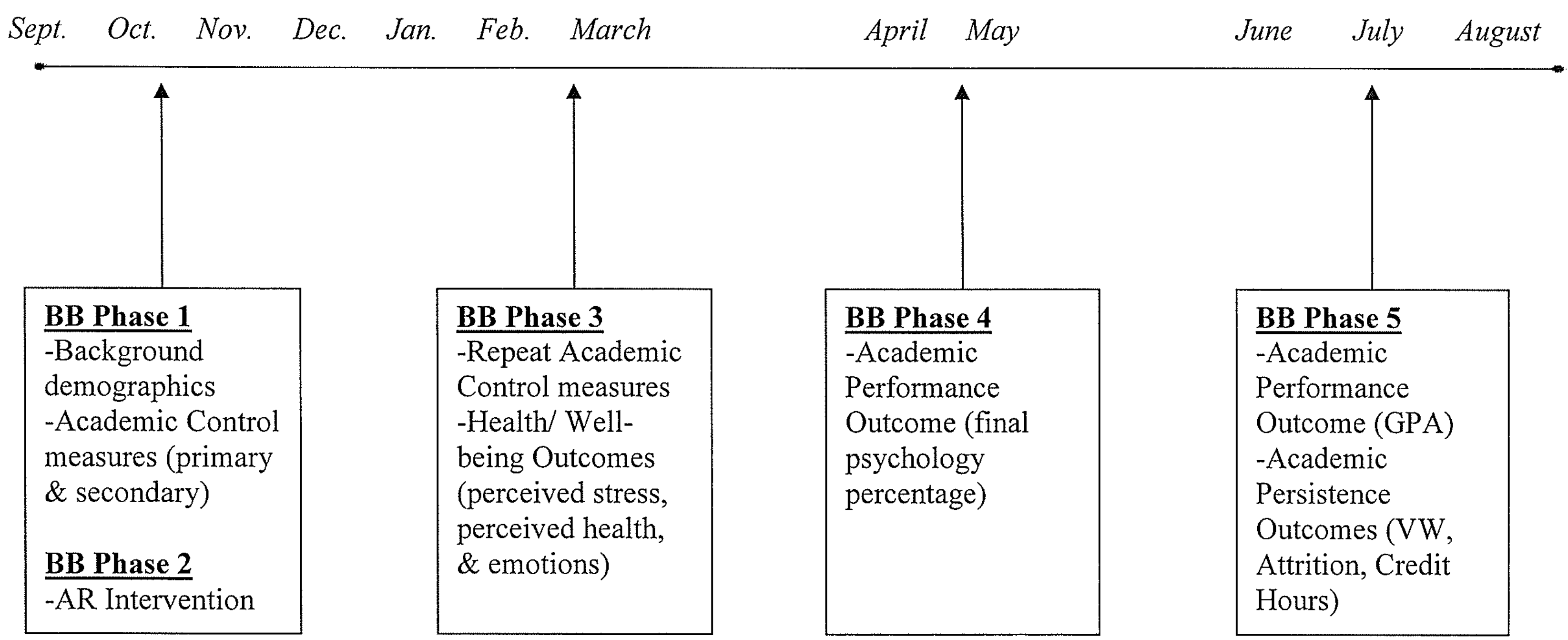
Table 2

BB-STS Demographic Information

	N	%
Age		
17-18	4440	47.6
19-20	2219	23.8
21-22	682	7.3
23-24	308	3.3
25-26	157	1.7
27-30	166	1.8
31-35	97	1.0
36-40	59	.6
41-45	34	.4
46+	31	.3
Missing	1136	12.2
Total	9329	100
Gender		
Female	5466	58.6
Male	3311	35.5
Missing	552	5.9
Total	9329	100

Figure 1

BB Data Collection



hour long and are conducted in a classroom setting with moderately sized groups ranging from 20 to 60 students. Participants complete 'consent to participate' and 'voluntary study withdrawal' information before beginning the BB Questionnaire 1, which contains assessments of background demographics, academic control (primary and secondary), and other psychosocial and academic-related measures.

Phase 2. Following the completion of BB Questionnaire 1 approximately half of the sample receive a cognitive psycho-therapeutic intervention aimed at enhancing students' academic performance through modified cognition and increased motivation. These interventions are termed Attributional Retraining (AR) and are based on Weiner's (1985; 1995) attribution theory of motivation and emotion. Specifically, AR interventions are aimed at changing maladaptive attributions for failure (e.g., low ability) to adaptive attributions (e.g., low effort). Shifts in cognition (i.e., attributions) are theorized to result in increased motivation, improved affective states, and increased performance. Several different forms of AR have been used across the 11 BB cohorts, the details of which are not relevant here (for a review see Ruthig, Perry, van Winkel, Stupnisky, & Hall, 2005).

Phase 3. In the middle of the second semester (late February), students select a second session day and time to complete BB Questionnaire 2. The procedure is similar to that of Phase 1, with students completing the questionnaire in small groups within a classroom setting. Typically, BB Questionnaire 2 is a follow-up to BB Questionnaire 1, containing a second assessment of identical academic-related measures in addition to specific outcome measures (e.g., psychological adjustment outcomes).

Phase 4. At the end of the academic year, students' grades in their introductory psychology course are collected (with informed consent). Typically data exists for all in-class psychology tests as well as a final, cumulative percentages based on all tests, assignments, etc.

Phase 5. Shortly thereafter, students' academic history data is accessed (with proper ethics permission) from the Student Tracking System (STS). The BB data is matched to the STS data via student identification numbers. Once the merge is complete student identification numbers are deleted, thereby protecting the identity of all individuals in the data set.

Sample Profile

The sample drawn from the BB-STS Merge for the proposed study includes the 1998, 2000, and 2001 BB cohorts. These specific BB cohorts were selected in order to maintain measurement consistency in the two variables of interest, specifically primary and secondary control. Each cohort contains data from students in each of three age-based categories: Transition, Decision, and Commitment. As outlined in Figure 2, the 17 – 18 age groups from each of the three BB cohorts (1998, 2000 & 2001) were combined to create the overall Transition sample. The same procedure was used to create both the Decision and Commitment samples. All three cross-sectional samples are represented by the shaded boxes at the far right of Figure 2, Combining the data from BB 1998, 2000, and 2001 resulted in complete BB Phase 1 data for 2972 students: 17 – 18 N = 1686 Transition students, 19 – 20 N = 822 Decision students, and 21+ N = 464 Commitment students. See Table 3 for demographic-related characteristics of each age-based sample.

Figure 2

Study Sample

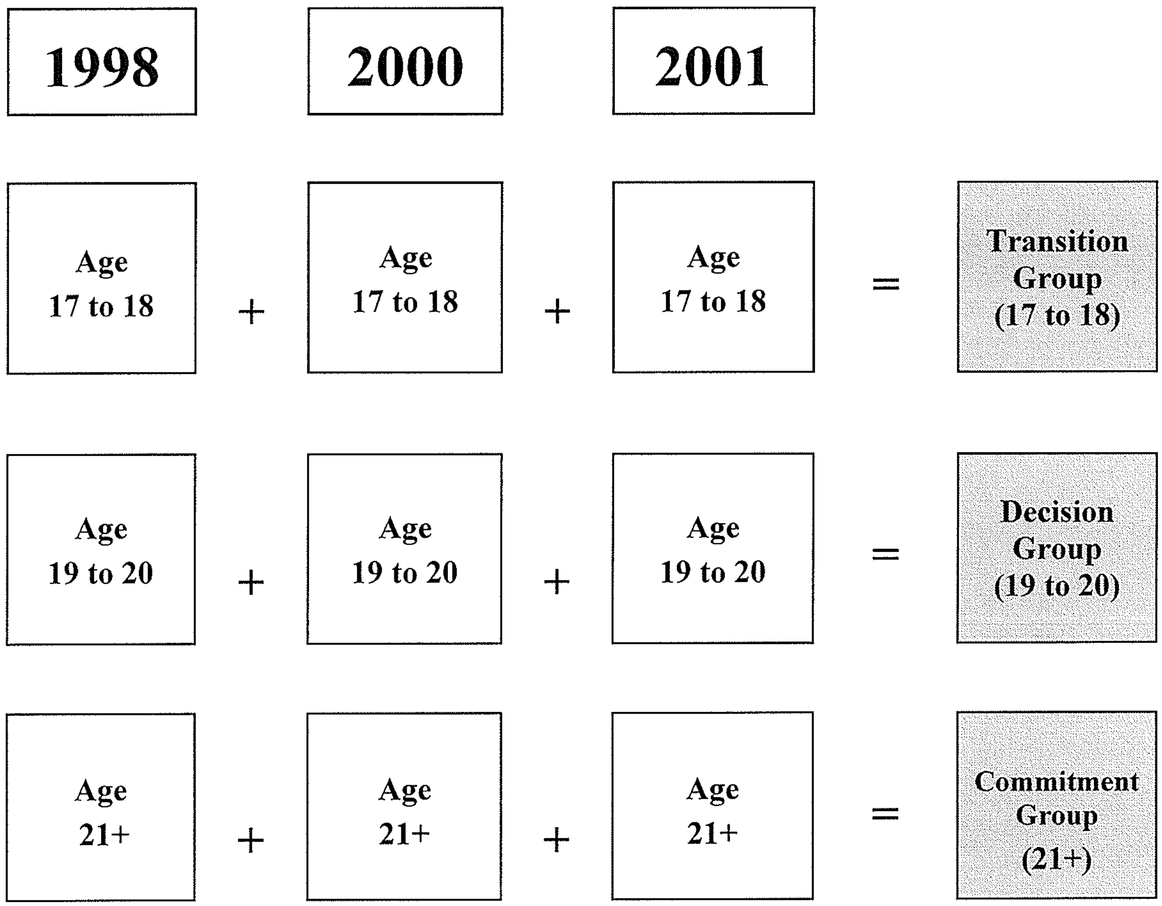


Table 3

Age-based Sample Characteristics

	17 – 18 yrs		19 – 20 yrs		21+ yrs		Total	
	N	%	N	%	N	%	N	%
Gender								
Female	1124	66.7	479	58.3	274	59.1	1877	63.2
Male	546	32.4	331	40.3	181	39.0	1058	35.6
Missing	16	.9	12	1.5	9	1.9	37	1.2
Total	1686	100.0	822	100.0	464	100.0	2972	100.0
Faculty								
Arts	215	12.8	176	21.4	126	27.2	517	17.6
Human Ec.	27	1.6	26	3.2	15	3.2	68	2.3
Engineering	3	.2	8	1.0	2	.4	13	.4
Mgmt.	251	14.9	90	10.9	42	9.1	383	12.9
Education	83	4.9	34	4.1	17	3.7	134	4.5
Science	164	9.7	169	20.6	36	7.8	369	12.4
Phys. Ed	93	5.5	47	5.7	26	5.6	166	5.6
Nursing	74	4.4	47	5.7	58	12.5	179	6.0
Social Wk	17	1.0	12	1.5	8	1.7	37	1.2
Other	740	43.9	206	25.1	127	27.4	1073	36.1
Missing	19	1.1	7	.9	7	1.5	33	1.1
Total	1686	100.0	822	100.0	464	100.0	2972	100.0
Program Year								
First	1633	96.9	467	56.8	369	79.5	2469	83.1
Second	53	3.1	260	31.6	58	12.5	371	12.5
Third	-	0	95	11.6	37	8.0	132	4.4
Total	1686	100.0	822	100.0	464	100.0	2972	100.0

Measures

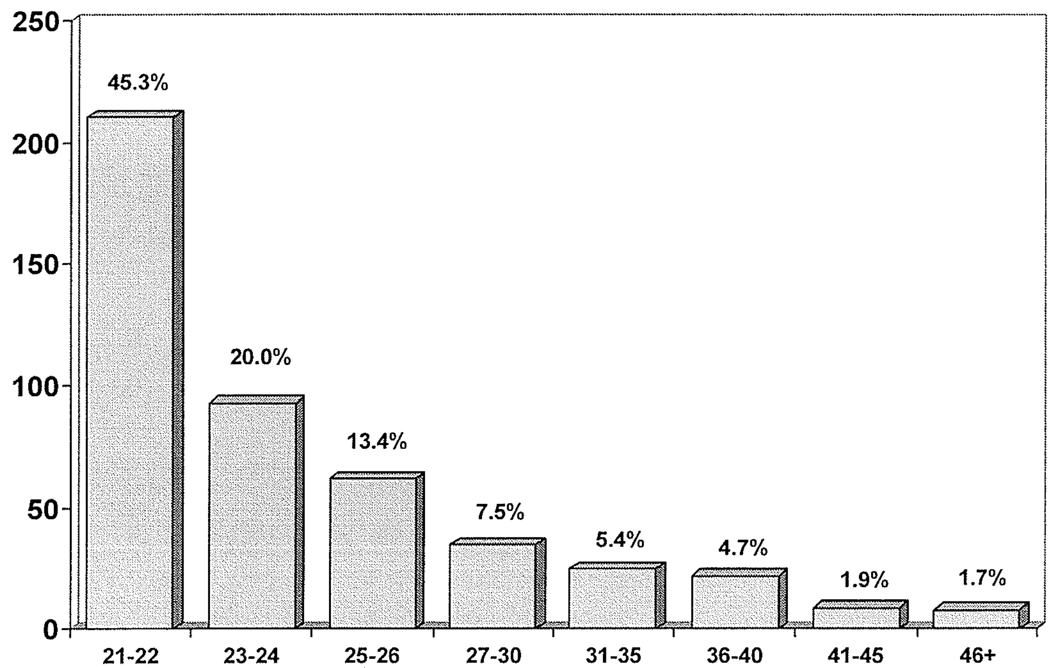
Age-based groups

In BB Phase 1, students indicate their age on a 10-point scale (*1* = 17 – 18, *2* = 19 – 20, *3* = 21 – 22, *4* = 23 – 24, *5* = 25 – 26, *6* = 27 – 30, *7* = 30 – 35, *8* = 36 – 40, *9* = 41 – 45, *10* = 46+). The age groups for the current study were created based on this measure with the 17 – 18 years Transition group consisting of all students who indicated a '*1*' on the above scale; 19 – 20 years Decision sample consisting of all students who indicated '*2*' on the above scale; and 21+ years Commitment sample consisting of all remaining students i.e., students who indicated any response '*3*' through '*10*' on the above scale (see Figure 3 for the frequencies in each age category of the 21+ group).

Research consistently demonstrates interactions between control strategy (primary/secondary) and age (Band & Weisz, 1990; Chipperfield et al., 1999; Heckhausen, 1997), suggesting a stronger capacity for secondary control as individuals age. The majority of this research has been conducted with elderly samples, and differences are typically observed between groups that vary in age as many as 20-30 years. In the present study the three age groups examined (17-18 years, 19-20 years, and 21+ years) could be deemed to be highly similar in terms of overall lifespan development. That is, it may be argued that the differences between an 18-year-old and a 21-year-old in terms of many important developmental tasks (i.e. marriage, children, jobs, etc.) is minimal. However, the current study examined primary and secondary control in an academic setting, a domain of development that is typically restricted to a relatively narrow age-range, but during which critical personal decisions are made. As

Figure 3

Age Composition of the 21+ group



such, it was considered important to examine whether or not primary/secondary control can be assessed equivalently for students of different ages.

Academic Control Measures

Within the primary/secondary control literature considerable attention has been devoted to the distinction between control-related beliefs and strategies. *Beliefs* can be thought of as the mental acceptance of and conviction in the truth, actuality or validity of something. S*trategies* are typically defined as behaviors, actions, or cognitions that are based on valued beliefs. As such, primary/secondary control beliefs are construed as an essential component of actual primary/secondary control strategies. This distinction is particularly pronounced in Heckhausen and Schulz's (1995) work, wherein the focus is solely on control *strategies*. The measures employed in the current study focus on control-related beliefs, which may or may not imply control-related strategies.

Primary academic control. Primary control was assessed using Perry et al.'s (2001) Perceived Academic Control (PAC) scale (see Appendix A). The scale consists of eight statements regarding the perception that one can directly influence events and outcomes in an academic setting. The statements (e.g., "I have a great deal of control over my academic performance in my introductory psychology course") are accompanied by a 1-to-5 Likert-style response scale (1 = strongly disagree, 5 = strongly agree). Items were reversed where appropriate and all eight items formed the basis of the construction of the latent primary academic control factor as will be outlined in greater detail in the results section. Recent research with the PAC scale (Perry et al., 2001; Perry et al., 2005; Hall, Perry, Ruthig, Hladkyj, & Chipperfield, in press) demonstrates high degrees of internal consistency (Cronbach's $\alpha = .80; .80; .78$ respectively). In addition, the construct validity of Primary Academic Control is evident in negative associations between scores on the PAC scale and academic-related anxiety and boredom, as well as positive associations between the PAC and intrinsic motivation ($r = .18$, $p < .05$), test grades in Introductory Psychology ($r = .34$, $p < .05$) and final Introductory Psychology course grade ($r = .27$, $p < .05$) (Perry et al., 2001).

Secondary academic control. Secondary control was assessed with an 18 item scale developed by Hladkyj, Pelletier, Drewniak, & Perry (1998) designed to reflect Rothbaum et al.'s (1982) four subtypes of secondary control as applied to an academic setting (see Appendix B). Five items were designed to reflect *interpretive* control (e.g., "Whenever I have bad experience at university I try to see how I can turn it around and benefit from it"); six items were aimed at the assessment of *predictive* control (e.g. "I believe it is better to take it one day at a time rather than plan ahead); four items were designed to measure *vicarious* control (e.g. "I have found that talking to other students who have had the same experiences at university gives me a better sense that I can manage my life"); and three items were created to reflect *illusory* control (e.g. "I believe that much in life is determined by chance or fate"). All 18 secondary control items are accompanied by a 1-to-5 Likert-style response scale (1 = strongly disagree, 5 = strongly agree). The total 18 items formed the basis for the construction of two latent secondary control factors as outlined further in the results section.

Research involving this measure has identified the interpretive scale as the most reliable for example, Hall, Perry, Chipperfield, Clifton, & Haynes (in press) report

Cronbach's $\alpha = .74$. For the other secondary control subscales, Hladkyj et al. (2004) report variable levels of reliability: predictive secondary control $\alpha = .52 - .57$; vicarious, secondary control $\alpha = .48 - .52$; and illusory secondary control $\alpha = .55 - .60$. As such, one of the aims of the current project was to continue scale development with these specific secondary control items.

Academic Outcome Measures

Academic emotions. As part of BB Phase 3 students are asked "To what extent do the following emotions describe how you feel about your performance in your Introductory Psychology course to date?" This question is followed by a list of eight emotions including: guilty, helpless, angry, ashamed, regret, hopeful, proud, and happy. Students indicate their responses on a 10 point scale (1 = not at all, 10 = very much so). For the purposes of the current study, a principle components exploratory factor analysis with an oblimin rotation was conducted in order to assess the validity of grouping the above emotions according to valence (e.g., negative emotions vs. positive emotions). Indeed, the EFA suggested two factors: Factor 1 ($\lambda = 4.10$, 51.33% variance) was composed of the five negative emotions with factor loadings as follows: guilty (.78), helpless (.75), angry (.78), ashamed (.85), and regret (.80). All positive emotions had low negative loadings on Factor 1. Factor 2 ($\lambda = 1.30$, 16.17% variance) and consisted of the three positive emotions with factor loadings as follows: hopeful (.81), proud (.85), and happy (.84). All negative emotions had low negative loadings on Factor 2. As such, in order to examine Hypotheses 3 and 4 (concerning the association of primary/secondary control with emotion) the five negative emotions were used as indicators of a latent composite termed 'negative academic emotion' and the three positive emotions were used as indicators of a latent composite labeled 'positive academic emotion'.

Grade point average (GPA). Students' grade point average (GPA) is obtained directly from institutional records as is calculated by averaging the final grades for all courses in which the students were enrolled for that academic year. Each final course grade was determined by averaging test scores, assignment marks, final exam results, etc. Thus, yearly GPA represents an aggregate of students' academic achievement across all courses for the entire school year. The grade point scale is as follows: scale of measurement 4.5 = A+, 4.0 = A, 3.5 = B+, 3.0 = B, 2.5 = C+, 2.0 = C. For the Transition sample $M = 2.67$, $SD = .90$; Decision sample $M = 2.64$; $SD = .92$; Commitment sample $M = 2.70$, $SD = .94$. The combined sample (i.e., Transition, Decision, and Commitment) $M = 2.66$, $SD = .93$.

Results

Preliminary Analyses

In order to check the basic assumptions of data normality, the descriptive statistics of all indicators contributing to each of the latent variables (primary control, secondary control, positive emotions, negative emotions), and the observed dependent variable (GPA) were examined. That is, all indicators were inspected in terms of mean, standard deviation, variance, skewness, kurtosis, and minimum/maximum values with outlier analysis. Given the total number of indicators (35 indicators: 8 primary control, 18 secondary control, 8 emotions, and GPA), a descriptive table would be prohibitive. As such, only results of those items that violated the assumptions of normality will be reported here.

Date normality. As outlined in the Measures section, all primary control items were rated on a five-point scale with anchors 1 = *strongly disagree* and 5 = *strongly disagree*. An examination of the means, standard deviations, skewness, and kurtosis of all eight primary control items revealed two problematic items. Item pc2 ("The more effort I put into my courses, the better I do in them") was negatively skewed (-1.91) with positive kurtosis (4.02), a distribution which indicates that majority of participants answered '4' or '5', strongly agreeing with the item. Indeed, the average score for pc2 was high relative to the other primary control items, and the standard deviation of scores around that mean was relatively small, indicating restricted variance for pc2. The second problematic primary control item was pc6 ("There is little I can do about my performance in university") which was positively skewed (1.98) with positive kurtosis (4.82). The majority of participants answered '1' or '2', strongly disagreeing with item pc6. Again, the mean of item pc6 was substantially lower than the other perceived control items, and the standard deviation was small, again implying restricted variance. Due to these violations of normality, neither pc2 nor pc6 were retained for further analyses.

Outlier analysis. An assessment of outliers revealed a single outlying value in the GPA measure. As such, the extreme low GPA score of .12 was replaced with a system missing code. It is highly likely that this value of .12 represents faulty data possibly attributable to an error in data entry.

Correlations. See Table 4 for correlations among all study variables. All correlations were in the expected direction and were of reasonable magnitude. Due to the

Table 4

Correlations among all Study Variables

	1.	2.	3.	4.	5.	6.	7.
1. Primary Control	-						
2. Secondary Illusory	-.46*	-					
3. Secondary Interpret.	.13*	.02	-				
4. Negative Emotion	-.30*	.16*	-.03	-			
5. Positive Emotion	.26*	-.06	.15*	-.63*	-		
6. GPA	.24*	-.10*	-.08*	-.42*	.41*	-	

Note: * = $p < .001$

large total sample size, all but three of the correlations among the study variables reached statistical significance at the $p < .001$ level. As such, in order to assess the practical significance of all correlations Cohen's (1977) suggestions regarding the interpretation of correlation effect sizes were adopted as follows: small correlation effect size = .10; medium correlation effect size = .30; large correlation effect size = .50+.

Of particular note are five associations (or lack thereof): (1) The absence of a relationship between primary academic control and interpretive secondary academic control (r = .13, small effect size). This suggests that primary academic control and the interpretive form of secondary academic control are essentially orthogonal representing two distinct control processes. This finding replicates past research with these measures (see Hall, Perry, Ruthig et al., in press). (2) The large negative association between primary academic control and illusory secondary academic control (r = -.46) is peculiar given that primary and secondary control are typically observed to be orthogonal (see Hall, Perry, Ruthig et al., in press). In addition, this finding may suggest a maladaptive quality of illusory secondary academic control given its negative association with primary academic control. (3) The absence of a relationship between interpretive secondary academic control and negative emotion (r = -.03, *ns*) is somewhat unexpected as theory would predict a negative association between interpretive secondary control and negative affect. (4) The strong negative association (r = -.63) between positive emotions and negative emotions suggests strong discriminant validity, supporting the operationalization of positive emotions and negative emotions in terms of the construction of the specific latent variables. (5) The associations of positive emotions with GPA (r = .41), and negative emotions with GPA (r = -.42) provide further evidence for the validity of the emotion measures. In addition, it is notable that these correlation values fall in the medium effect size range, suggesting a relatively strong relationship between academic-related emotions and actual academic performance.

Rationale for Analyses

Hypothesis 1 and *2* concerning the factor structure of primary and secondary academic control for the Transition (17 – 18), Decision (19 – 20), and Commitment (21+) samples were assessed in three steps: First, Exploratory Factor Analyses (EFA) of both primary and secondary control were conducted using SPSS. EFA is a commonly used technique when the goal is to uncover the underlying structure of a set of indicators, and to identify those indicators that may be problematic (e.g., are not highly associated with any other indicators). In conducting an EFA, it is essential to set criteria for deciding on the number of factors to retain for further analysis. In this study two criteria guided this decision involving the Kaiser (1960) method and the scree plot (Catell, 1966). The Kaiser (1960) criterion is the most widely used method in which all factors with eigenvalues greater than 1.00 are retained for further investigation. The Kaiser criterion often results in the selection of the "correct" number of factors (Stevens, 2002), however, if used alone this method can be problematic. When communalities are low, the Kaiser criterion can result in the retention of factors that may not be practically significant in terms of the amount of variance explained (Stevens, 2002). As such, Cattell recommends an examination of the scree plot, paying specific attention to the point at which the plotted eignenvalues 'level off'. Cattell suggests retention of all factors with eigenvalues located in the sharp decent before this leveling-off point, ensuring that only those factors that account for large distinct amounts of variance are retained.

In addition to setting criteria for the number of factors to retain for further analysis, it is also advisable when conducting EFA to pre-select a critical item-to-factor loading value. Stevens (2002) recommends at least a 15% overlap in variance between item and factor. Thus, a value of |.40| was chosen as a minimum item-to-factor loading as it represents 16% overlap in variance between item and factor. Any item that did not meet this critical value of |.40| for the three samples was not retained for the next step in testing *Hypothesis 1* and *2* described below.

The second step used to address *Hypotheses 1* and *2* consisted of a Confirmatory Factor Analysis (CFA) of primary and secondary control using AMOS. While exploratory factor analysis seeks to uncover the underlying factor structure of the data, the aim of CFA is to determine if the number of factors and the item-to-factor loadings conform to expectations based on theory and/or past analyses. That is, items selected on the basis of theory or prior factor analysis comprise the hypothesized factor model, and CFA is used to examine whether or not the hypothesized items load as predicted on the expected number of factors. The assessment of the hypothesized CFA model is achieved by examining the overall data-to-model *fit indices*. A wide range of fit indices exist, and are available for use in the AMOS program. To facilitate interpretation of all results in the current study, the Comparison Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA) were chosen based on recommendations by Byrne (2002).

For the current analyses, the items that were retained following the exploratory factor analyses formed the hypothesized CFA models for primary and secondary control separately. The hypothesized primary control and secondary control CFA was conducted and models were carefully examined for model fit and possible misspecification. Once adequate fit was established for the measurement models of primary and secondary control, the third step in testing *Hypotheses 1* and *2* was conducted.

The third step in testing *Hypotheses 1* and *2* involved a multigroup test of factorial invariance across the age groups. As a prerequisite for all tests of multigroup invariance, the baseline measurement models must adequately fit for each separate group considered in the multigroup comparison. For example, the hypothesized model for primary control must fit each of the three age-based samples (Transition, Decision, and Commitment) adequately before an analysis of factorial invariance is conducted to compare the measurement of primary control across the three groups.

Once this criteria is satisfied, the test of multigroup invariance begins with a global or omnibus test conducted simultaneously including all groups (much like an omnibus F test in Analysis of Variance). First the *original model* is estimated, wherein all parameters are freely estimated for each group. Next, a *constrained model* is created, wherein all of the relevant parameters in the original model are held constant across all three groups. Thus, the test of factorial invariance is a comparison of the original, freely estimated model to the constrained model (parameters constrained as equal across all groups).

Statistically, this comparison is performed by subtracting the original model Chi Square (χ^2) and degrees of freedom (df) from the constrained model χ^2 and df resulting in values that represent a 'change in Chi Square' ($\Delta\chi^2$) and 'change in degrees of freedom' (Δdf). Rejection of the null hypothesis at the omnibus level signifies nonequivalence of the groups and prompts subsequent testing of more specific hypotheses designed to identify the source of nonequivalence. A non-significant finding implies that the latent variable (e.g., primary control) parameters of interest do not vary significantly across the groups considered in the multigroup comparison. That is, a non-significant finding implies that the original, freely estimated model is statistically equivalent to the constrained model, suggesting that all item-to-factor loadings are equal across all three groups. As such, this means that the variable under question (e.g., primary control) can be assessed identically across each of the samples tested in the multi-group comparison. This test of factorial invariance will conclude the investigation into *Hypothesis 1* and *2.*

Hypothesis 3 specified a direct relationship between primary control and academic performance (GPA), while *Hypothesis 4* specified an indirect relationship between secondary control and academic performance through academic emotion. Baseline structural equation models were created in order to examine the associations among primary control/secondary control, academic-related emotions and academic performance (GPA). Before directly addressing Hypothesis 3 and 4, neither of which directly specifed group differences across the age-based samples, a test of structural (causal) invariance across the three samples was conducted.

This test of structural (causal) invariance is conducted in the same way as the test of factorial invariance described above. An original freely estimated model is computed and then compared to a constrained model wherein all path coefficients are restrained equal across the three groups. If the statistical comparison of the two models (via Chi Square values) is significant, it would prompt further testing of more specific hypotheses designed to identify the source of statistical variance in the causal connections among the variables. In cases where the omnibus test is non-significant, the variables in the model are said to relate to each other in the *same way* across all groups. That is, the structure among the variables is invariant, or equivalent, across all groups. In the event of a non-significant omnibus test, it is appropriate to merge all data across groups for subsequent analyses (see Byrne, 2002). That is, when a set of variables have equivalent causal structure across groups, the groups may be considered homogeneous with regard to that specific set of variables, and data can be merged.

Factor Structure of Primary and Secondary Control

As outlined above, the factor structures of primary and secondary control were examined with Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and tests of factorial invariance across three age-based samples as follows: Transition students (aged 17 – 18), Decision students (aged 19 – 20), and Commitment students (aged 21+). For ease of interpretation, this section is organized as follows: the EFA, CFA, and test of factorial invariance for primary control (*Hypothesis 1*) are presented first, followed by the EFA, CFA, and test of factorial invariance for secondary control (*Hypothesis 2*).

Primary control EFA. As outlined in Hypothesis 1, it was expected that the factor structure of primary control would remain constant across the three samples, yielding one factor reflecting a general sense of direct control over one's academic performance. A principle components exploratory factor analysis with the six primary control items (pc1, pc3, pc4, pc5, pc7, and pc8; see Appendix A) confirmed this hypothesis (see Table 5 for factor loadings, eigenvalues, and percent variance by age-based group). That is, a single factor emerged for all three age-based samples with all six primary control items loading above the pre-selected cutoff value of .40 on *all* age-based samples. The single primary control factor explained roughly 40% of the variance for each of the age-based samples.

Primary control CFA and test of factorial invariance. Based on the EFA above, the hypothesized factor model of primary control for the confirmatory factor analysis contained all six primary control indicators (see Figure 4). Having specified the hypothesized factor model of primary control, the CFA was computed and fit indices were examined. The initial analysis conducted on the hypothesized baseline model revealed adequate fit overall (CFI = .94, RMSEA = .04). As such, no changes were made to the primary control model and the test of measurement invariance was conducted on the originally hypothesized six-item model.

As a prerequisite to testing for factorial invariance, the fit indices of the primary control model were assessed for each age group separately (see Table 6). Results indicated adequate fit for each group satisfying the requirement for the subsequent test of invariance. The procedure for the statistical test of factorial invariance can be found in the *Rationale for Analysis* section. Table 6 indicates the χ^2 and df for the original model and the constrained model. Comparison of the original model and the constrained model resulted in a Chi Square change of $\Delta\chi^2 = 25$, with an accompanying degrees of freedom change of $\Delta df = 21$. The critical χ^2 value at 21 degrees of freedom is equal to 32.70. As

Table 5

Eigenvalues and Percent Variance of Single Primary Control Factor by Age-group

Primary Control Items	Factor 1		
	17-18	19-20	21+
1. I have a great deal of control over my academic performance.	.62	.65	.66
3. No matter what I do, I can't seem to do well in my courses. R	.62	.64	.71
4. I see myself as largely responsible for my performance throughout my college career.	.64	.64	.60
5. How well I do in my courses is often the "luck of the draw". R	.64	.64	.63
7. When I do poorly in a course, it's usually because I haven't given it my best effort.	.50	.61	.53
8. My grades are basically determined by things beyond my control and there is little I can do to change that. R	.68	.69	.68
Eigenvalue	2.30	2.50	2.43
Percent Variance	38.35	41.53	40.41

Figure 4

Hypothesized Primary Control Factor Model

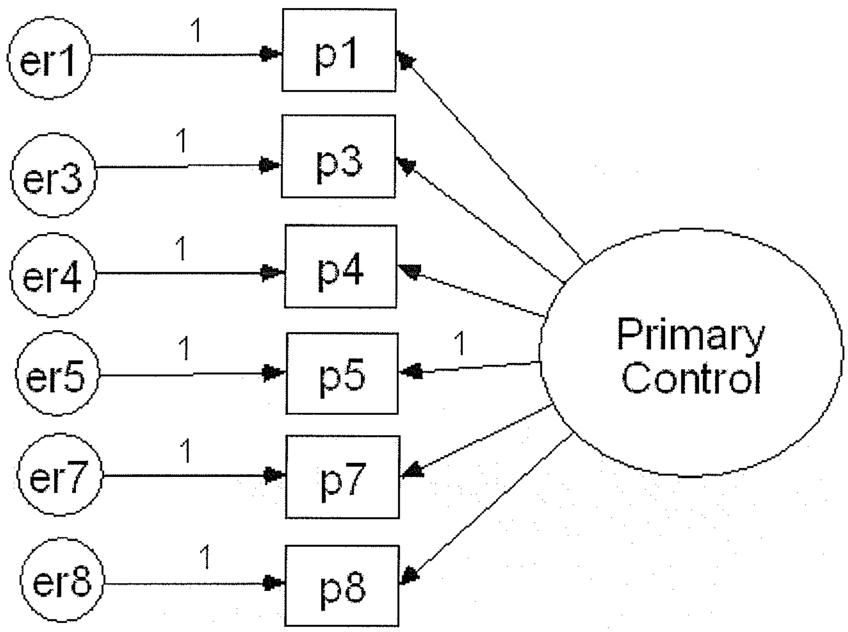


Table 6

Primary Control Measurement Model Comparisons

	Model	χ^2	df	Model Comparison	$\Delta\chi^2$	Δdf	CFI	RMSEA
1.	(17-18)	71	9	-	-	-	.95	.06
2.	(19-20)	56	9	-	-	-	.94	.08
3.	(21+)	30	9	-	-	-	.94	.07
4.	original	158	27	-	-	-	.94	.04
5.	constrained	183	48	5 vs 4	25	21	.94	.03

Note. Critical χ^2 value at 21 degrees of freedom = 32.70 ($p < .05$)

such, the omnibus test of the primary control measurement model suggests no significant differences in the factorial composition of primary control across the three age-based samples. That is, *Hypothesis 1* is tenable: there were no significant differences in the factor structure of primary control across the age groups.

Secondary control EFA. Hypothesis 2 specified that the structure of secondary control would vary across the age groups, with older students demonstrating a closer approximation to Rothbaum et al.'s (1982) theoretical four-factor structure than younger students. A principle components exploratory factor analysis with the 18 secondary control items revealed five factors with eigenvalues above 1.00 for all three age groups. Typically, in cases when an EFA produces multiple factors, a rotation method is selected in order to aid in the interpretation of the factors. An oblimin rotation was chosen in this case as the factors were expected to correlate. Inspection of the factor association matrix revealed that no factor pairs significantly correlated with one another. Comparison of the rotated solution to the initial principle components solution revealed little advantage to the rotated solution in terms of interpretability of the factors (i.e., reduction of cross-loading, clearer structure, etc.). As such, because the factors were essentially uncorrelated, and the rotated solution offered little advantage in interpretation, the initial unrotated principle components solution was selected for interpretation.

Although five factors with eigenvalues over 1.00 emerged, an examination of the scree plot (Cattell, 1966) indicated that only the first three factors were noteworthy (explaining large and distinct amounts of variance) for all three age-based samples (see Table 7 for eigenvalues and percent variance of Factors 1 – 5). However, a closer look at the third factor revealed a single secondary control item (s14) met the cutoff criteria of .40 for all three age-based samples. As such Factor 3 was not pursued for further analysis.

See Table 8 for *Factor 1* item-to-factor loadings, eigenvalues, and percent variance by age-based group. Based on the criteria outlined in the *Rationale for Analysis* section, the exploratory factor analysis suggests the retention of 5 items for the CFA: items s11, s12, s16, s17, and s18. See Table 8 for *Factor 2* item-to-factor loadings, eigenvalues, and percent variance by age-based group. The exploratory factor analysis resulted in five items loading above the .40 cutoff for all three samples: items s1, s2, s3, s5, and s13. Item s4 approached the cutoff for inclusion in both *Factor 1* and *Factor 2*, however, based on the content of item s4, it was interpreted as part of *Factor 2*.

Secondary control CFA and test of factorial invariance. The hypothesized factor model of secondary control (see Figure 5a) consisted of two factors: *Factor 1* included items sc11, s12, s16, s17, s18 and *Factor 2* included items s1, s2, s3, s4, s5, s13 (see Appendix B). Initial tests of the hypothesized baseline model revealed a poor data-to-model fit (CFI = .70, RMSEA = .05). These fit indices suggest that the model is seriously misspecified and that steps should be taken to modify the model in order to better fit the data. Modification of a hypothesized model is seen as post hoc model fitting (Byrne, 2002), and, as such, all further estimation represents exploratory analysis.

A review of the individual secondary control item parameter values and associated error variances suggested the removal of several items that were problematic across all three samples (s11, s12, s1, and s13). These items had relatively low parameter values combined with relatively large error variances. The problematic items were

Table 7

Eigenvalues and Percent Variance of five Secondary Control Factors by Age-group

	Transition (17 – 18)		Decision (19 – 20)		Commitment (21+)	
	eigenvalue	% variance	eigenvalue	% variance	eigenvalue	% variance
Factor 1	2.59	14.42	2.72	15.10	2.73	15.18
Factor 2	2.20	12.24	2.26	12.55	2.18	12.11
Factor 3	1.61	8.94	1.53	8.54	1.43	7.95
Factor 4	1.14	6.34	1.18	6.56	1.21	6.74
Factor 5	1.04	5.81	1.02	5.68	1.06	5.90

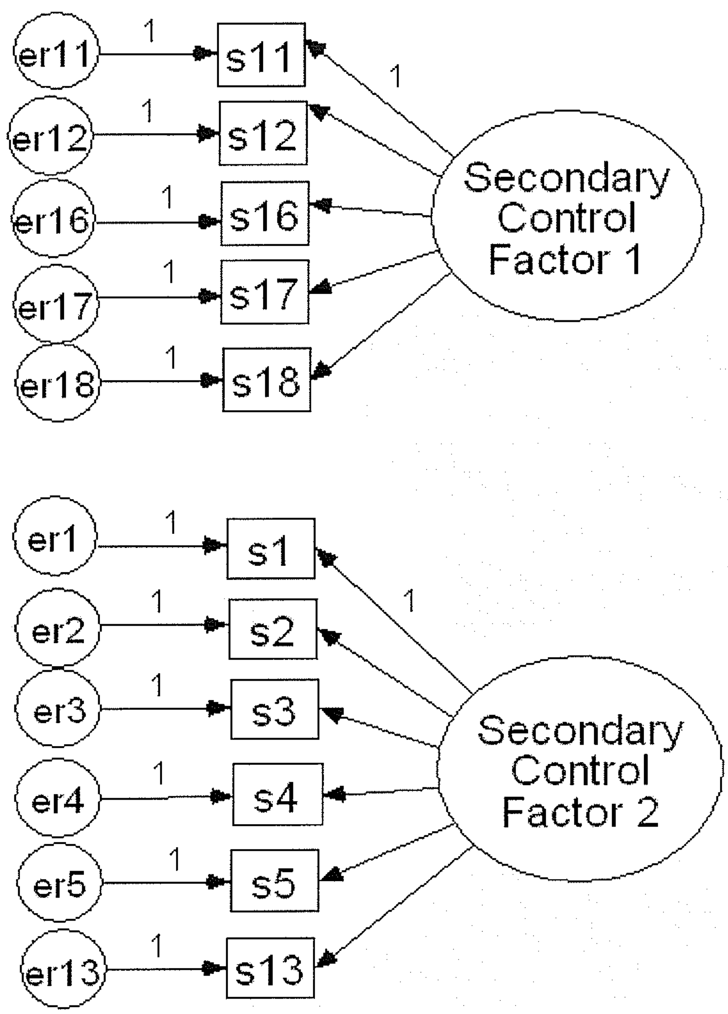
Table 8

Secondary Control: Factors 1 and 2

	Factor 1			Factor 2		
	17-18	19-20	21+	17-18	19-20	21+
1. On the whole, I feel that I am a better person because of my academic performance and experience.	-.03	-.04	.14	.52	.49	.51
2. My academic performance and experience has given me a deeper understanding of my life than could be achieved without this experience.	.08	.19	.16	.60	.62	.64
3. Regardless of what my grades are, I try to appreciate how my university experience can make me a stronger person overall.	.37	.39	.34	.52	.43	.55
4. No matter how well I do on a test or in a course, I try to "see beyond" my grades to how my experience at university helps me learn about myself.	.44	.51	.37	.42	.33	.54
5. Whenever I have a bad experience at university, I try to see how I can "turn it around" and benefit from it.	.15	.20	.09	.51	.53	.41
6. I believe it is better to take it "one day at a time" rather than plan ahead.	.45	.43	.36	-.20	-.24	-.21
7. When I got a low mark on a test I remind myself that it won't affect my graduating GPA because the good marks will balance out the bad.	.36	.46	.42	.04	.01	-.02
8. I seem to have been born lucky because I often do better by blindly guessing on multiple choice tests than by trying to figure out the answers.	.33	.37	.39	-.23	-.22	-.13
9. I'm reluctant to commit to a major because I want to keep my options open	.43	.39	.41	-.03	-.11	-.16
10. There is no point in thinking about what the future will bring.	.39	.42	.41	-.34	-.37	-.41
11. I try not to worry too much about my long-term academic career because things can always change unexpectedly.	.61	.58	.58	-.13	-.29	-.11
12. Knowing that other students have the same grades as I do gives me a comforting feeling of having something in common with others.	.46	.45	.47	.10	.05	-.04
13. I have found that talking to other students who have had the same experiences at university gives me a better sense that I can manage my life	.26	.20	.42	.46	.59	.52
14. When grades are posted I check how many students got the same mark as I did.	.15	.20	.22	.17	.11	-.02
15. I try to make friends with other students who are "in the same boat" as I am.	.33	.26	.22	.32	.43	.09
16. Much of what happens in our lives is a part of the way nature works.	.49	.55	.51	-.27	-.13	-.16
17. I believe that much in life is determined by chance or fate.	.48	.46	.51	-.32	-.21	-.32
18. I accept that some people are born to be A+ students while others have less natural ability, & there is little I can do to change what I was born with.	.44	.40	.52	-.28	-.28	-.24
Eigenvalue	2.59	2.72	2.73	2.20	2.25	2.20
Percent Variance	14.42	15.11	15.18	12.25	12.55	12.11

Figure 5a

Hypothesized Secondary Control Factor Model



removed and the reformulated secondary control factor model (see Figure 5b) was tested. The overall model fit of the reformulated secondary control model was acceptable (CFI = .94, RMSEA = .03).

A careful examination of the content of the three remaining items comprising *Factor 1* and the four items comprising *Factor 2* was conducted in order to provide more informative and theoretically relevant labels for the factors. All three items of *Factor 1* reflected causal ascriptions to chance, fate, nature, etc. Indeed, these three items were initially designed to reflect Rothbaum et al.'s (1982) illusory secondary control. As such, the label Illusory Secondary Control was adopted in reference to the first secondary control factor. The four items comprising Factor 2 appear to reflect an active re-interpretation of the perceived loss of primary control (i.e., re-interpretation of failure). These four items are part of the five-item scale designed to assess Rothbaum et al.'s interpretive secondary control. As such, the second factor was labeled Interpretive Secondary Control.

The prerequisite for multigroup invariance tests (i.e., ensuring model fit for each age group) was conducted. Fit indices were acceptable for each of the samples (see Table 9). It may be the argued that the fit is marginal in the case of the 19 – 20 years age group, however due to the exploratory nature of the analysis, this model was selected as the baseline for the factorial (measurement) invariance tests. A comparison of the original (reformulated) model to the constrained model (see Table 9) revealed a Chi Square change value of $\Delta\chi^2 = 21$ and a change in degrees of freedom of $\Delta df = 14$. The critical χ^2 value at 14 degrees of freedom is 23.70. As such, the omnibus test indicates no

Figure 5b

Reformulated Secondary Control Factor Model.

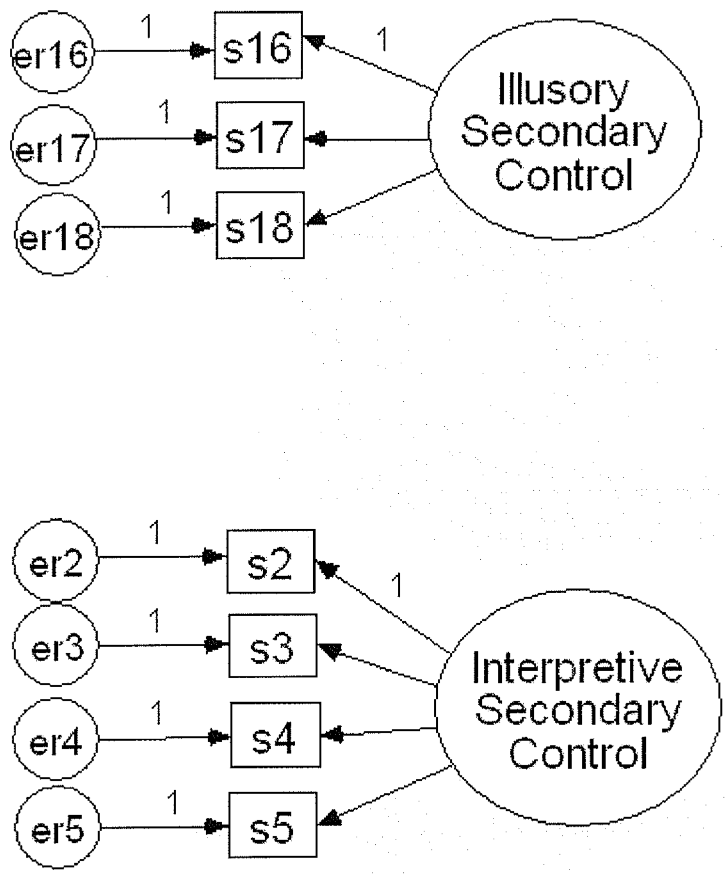


Table 9

Secondary Control Measurement Model Comparisons

	Model	χ^2	df	Model Comparison	$\Delta \chi^2$	Δdf	CFI	RMSEA
1.	(17-18)	63	14	-	-	-	.96	.04
2.	(19-20)	99	14	-	-	-	.86	.08
3.	(21+)	26	14	-	-	-	.96	.04
4.	original	190	42	-	-	-	.94	.03
5.	constrained	211	56	5 vs 4	21	14	.93	.03

Note. Critical χ^2 value at 14 degrees of freedom = 23.7 ($p < .05$)

significant differences in the measurement model of secondary control across the three age-based samples. Thus, *Hypothesis 2* was not tenable. The factor pattern of secondary control did not statistically differ for students at different developmental points (i.e., ages).

Academic Function of Primary and Secondary Control

The function of primary and secondary control was examined with separate baseline SEM models for primary control (see Figure 6) and secondary control (see Figure 7) as predictors of academic-related emotions and academic performance (GPA). As outlined in *Hypothesis 3,* it was expected that primary control would be directly related to academic performance (GPA). *Hypothesis 4* stated that secondary control would be indirectly related to academic performance (GPA) *through* emotion. Neither *Hypotheses 3* or *4* included specific predictions concerning differences in the function of primary/secondary control across the age groups. However, the structural (causal) invariance was tested across the three age groups, for exploratory purposes in keeping with the age-based focus of the study. The procedure for testing the structural invariance of a model across multiple groups is identical to the procedure outlined in the factorial test of multi-group invariance (see *Rationale for Analysis*).

The prerequisite fit of the primary control model to each age group was satisfied (see Table 10). Results of the test of structural invariance across the age groups for the primary control model revealed a $\Delta\chi^2$ value of 30 and a Δdf of 34. The critical χ^2 value at 34 degrees of freedom is 48.60. As such, the omnibus test indicated no significant differences in the causal pattern of the variables in the primary control model across the

Figure 6

Primary Control, Academic Emotions, and Academic Performance: Baseline Model

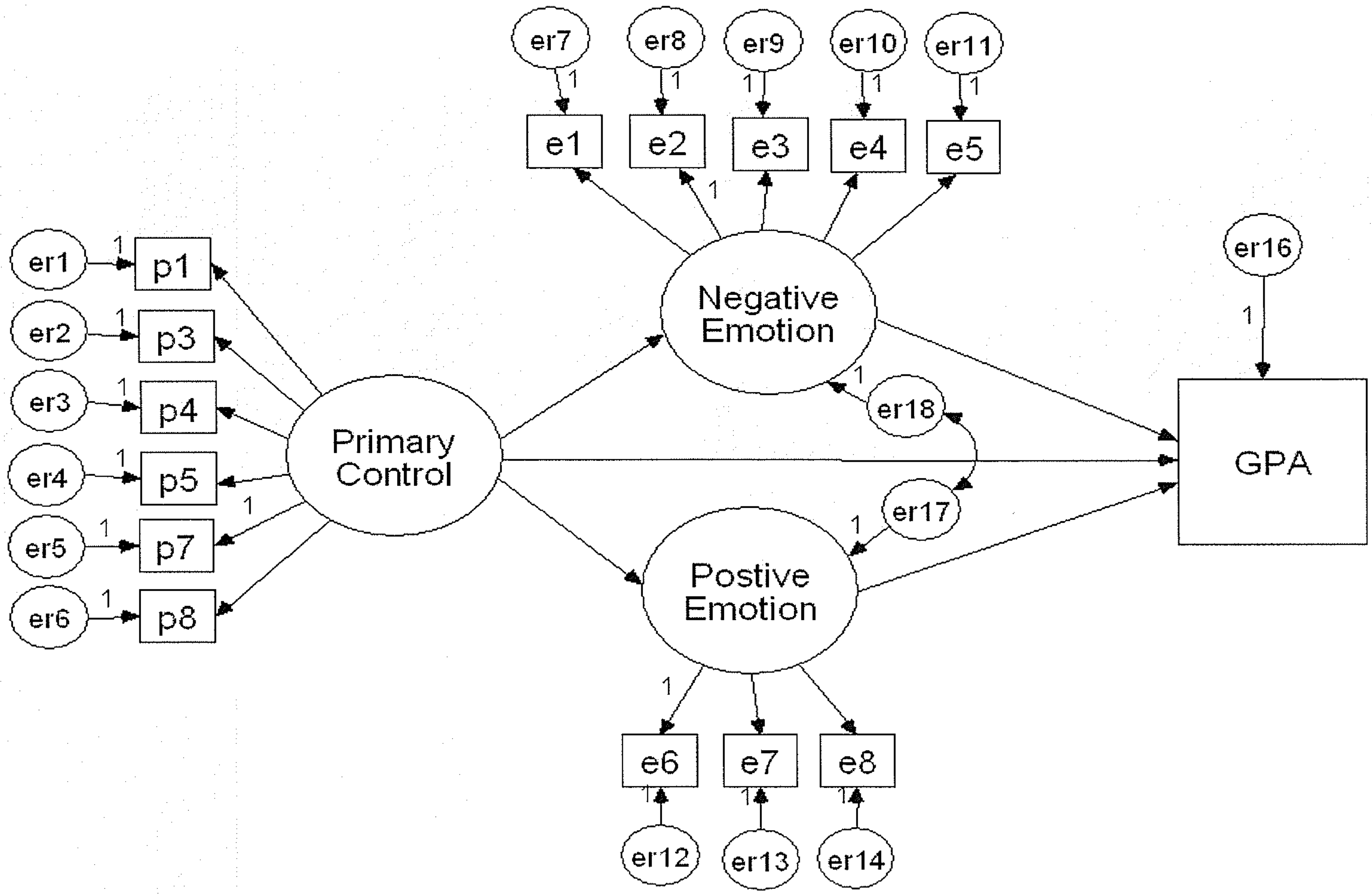


Figure 7

Secondary Control, Academic Emotions, and Academic Performance: Baseline Model

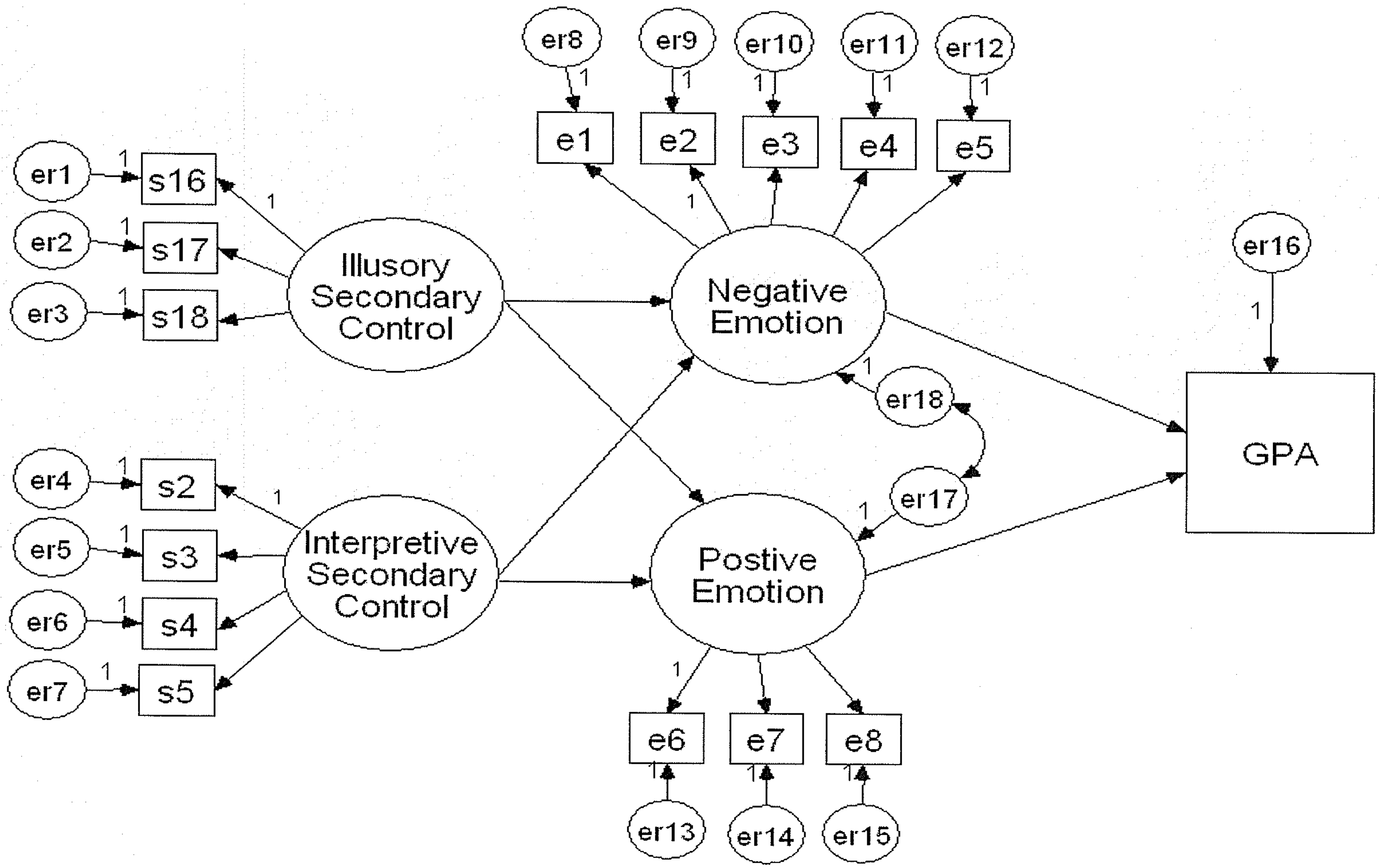


Table 10

Primary Control and Emotions Model Comparisons

	Model	χ^2	df	Model Comparison	$\Delta \chi^2$	Δdf	CFI	RMSEA
1.	(17-18)	805	85	-	-	-	.90	.07
2.	(19-20)	351	85	-	-	-	.92	.06
3.	(21+)	163	85	-	-	-	.95	.04
4.	original	1321	255	-	-	-	.91	.03
5.	constrained	1351	289	5 vs 4	30	34	.90	.03

Note. Critical χ^2 value at 34 degrees of freedom = 48.60 ($p < .05$)

three age-based samples. This suggests that primary control is associated with emotions and academic outcomes in a statistically identical fashion for all students, regardless of age-group.

The prerequisite fit of the secondary control model to each age group was satisfied (see Table 11). Results of the test of structural invariance across the age groups for the secondary control model revealed a $\Delta\chi^2$ value of 48 and a Δdf of 42. The critical χ^2 value at 42 degrees of freedom is 58.12. Again, the omnibus test indicated no differences in the associations of the two forms of secondary control with academic emotions and actual performance across the age groups.

In cases where groups are found to be equivalent in terms of structural variance, it is recommended to merge all data in order to examine further hypotheses. That is, because the groups can be considered homogeneous with regard to the connections among the specific set of variables under examination, it is valid to consider the three groups as one (Byrne, 2002). Because the age groups did not differ in the causal connections among variables in either the primary or secondary control models, this procedure was adopted and all group data were merged for the subsequent tests of *Hypothesis 3* and *4*.

Hypothesis 3 concerned the direct relationship between primary control and GPA and was tested with the baseline primary control model presented in Figure 6. The overall fit of the model was satisfactory CFI = .91, RMSEA = .06, see Figure 8 for the parameter values for all paths. Statistically, *Hypothesis 3* was confirmed with the beta weight from primary control to GPA ($\beta = .10$, $p < .001$) reaching statistical significance (see Figure 8).

Table 11

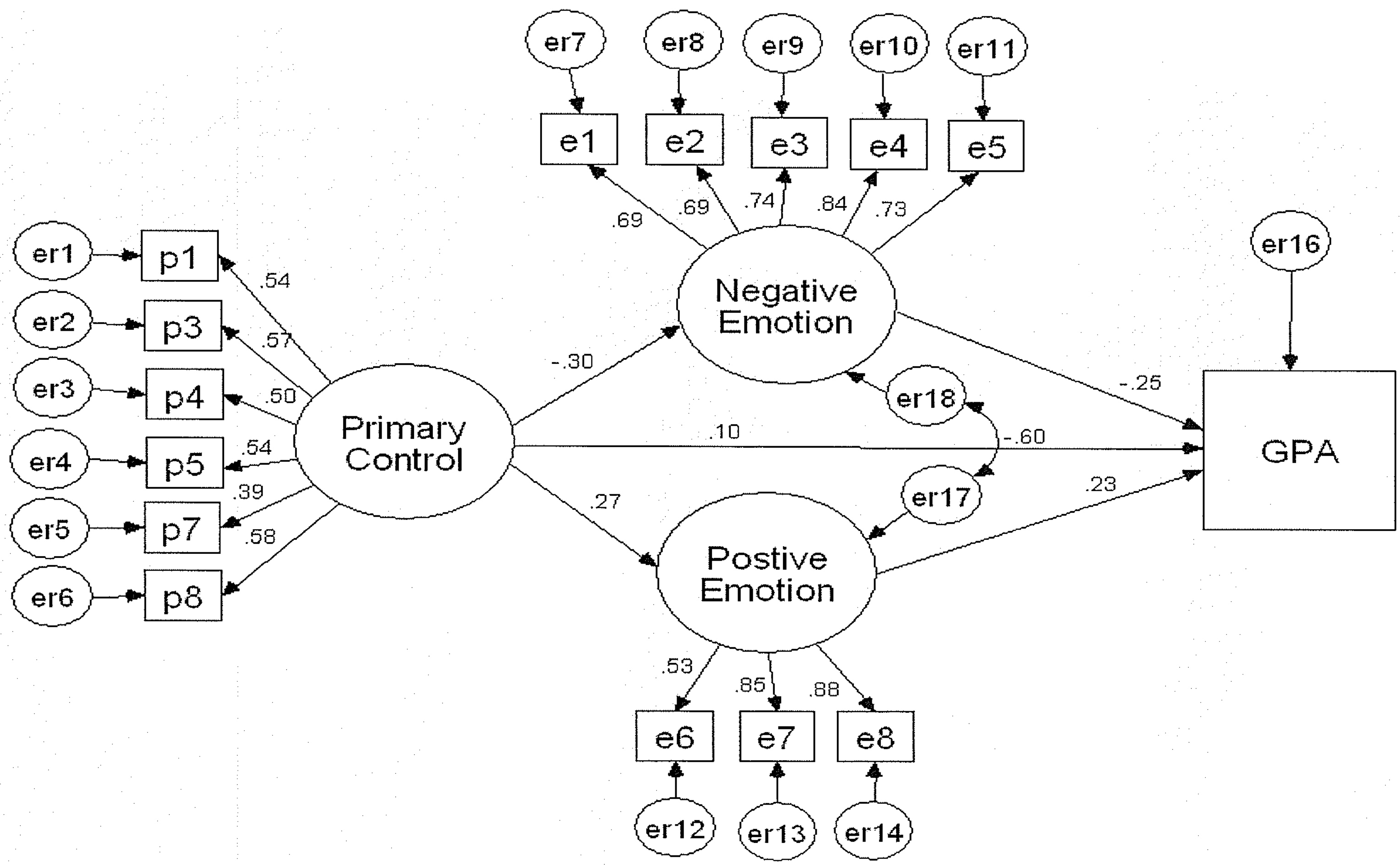
Secondary Control and Emotions Model Comparisons

Model	χ^2	df	Model Comparison	$\Delta \chi^2$	Δdf	CFI	RMSEA
1. (17-18)	612	97	-	-	-	.92	.05
2. (19-20)	321	97	-	-	-	.92	.05
3. (21+)	172	97	-	-	-	.94	.04
4. original	1105	291	-	-	-	.93	.03
5. constrained	1153	333	5 vs 4	48	42	.93	.03

Note. Critical χ^2 value at 42 degrees of freedom = 58.12 ($p < .05$)

Figure 8

Primary Control, Academic Emotions, and Academic Performance: Structural Model



Practically, this beta weight may be interpreted as follows: One standard deviation unit change in primary control produces .10 of a standard deviation unit change in GPA. The standard deviation of GPA typically ranges from .90 to 1.00 (see *Measures* section). As such, multiplying the standard deviation of GPA by the beta weight (e.g., 1.00 x .10) results in the following: One standard unit change in perceived control results in an increase in GPA of approximately .10, which translates into an entire point increase e.g., from 3.00 to 3.10.

In addition to the direct effect of primary control on GPA, two indirect paths from primary control to GPA were observed through both negative and positive emotion (see Figure 8). That is, primary control was negatively associated with negative emotion ($\beta = -.30, p < .001$) and positively associated with positive emotion ($\beta = .27, p < .001$). In turn, negative emotions negatively predicted GPA ($\beta = -.25, p < .001$) while positive emotions positively predicted GPA ($\beta = .23, p < .001$). The overall indirect effect of primary control on GPA (as mediated by negative and positive emotions) is approximately $\beta = .13$. This indirect effect may be interpreted as follows: one standard unit increase in primary control is associated with .13 of a standard unit increase in GPA. Computing the product of the indirect effect (.13) and the standard deviation of GPA (1.00) results in an increase of .13 in GPA for every unit increase in primary control. This indirect effect is in addition to the direct effect of primary control on GPA.

Hypothesis 4 specified an indirect relationship between secondary control and GPA, through academic-related emotions[1]. This relationship was tested with the baseline

1 Although not specifically hypothesized, the direct effects of both illusory and interpretive secondary control on GPA were examined. As expected, these direct effects were non-significant.

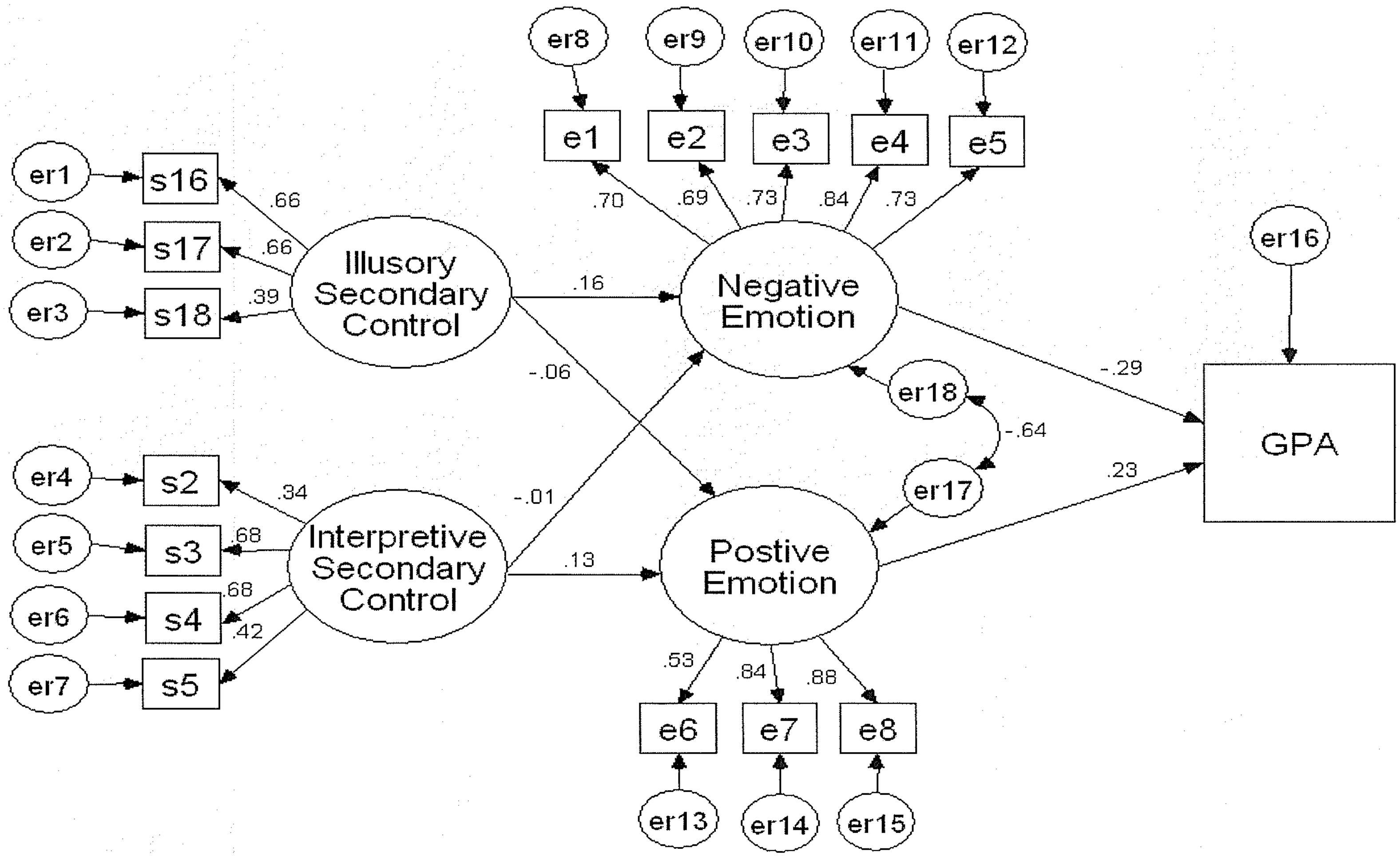
model presented in Figure 7. The data to model fit was acceptable CFI = .92, RMSEA = .05; see Figure 9 for all parameter values for all paths. Figure 9 reveals partial support for *Hypothesis 4*. The two forms of secondary control appear to be significantly related to emotion, but in highly disparate ways. The pattern of results for Illusory Secondary Control will be presented first, followed by those for Interpretive Secondary Control.

Contrary to theoretical expectations regarding the general function of secondary control in reducing negative affective states, the illusory form of secondary control was positively associated with negative emotion ($\beta = .16, p < .001$) and negatively related to positive emotion ($\beta = -.06, p < .05$). In turn, negative emotion was negatively associated with GPA ($\beta = -.29, p < .001$) and positive emotion was positively associated with GPA ($\beta = .23, p < .001$). As such, these results suggest a negative indirect effect of illusory secondary control on academic performance, as mediated by negative and positive emotions ($\beta = -.06$). Computing the product of the indirect effect (-.06) and the standard deviation of GPA (1.00) implies that when illusory control increases by one standard unit, GPA decreases by -.06. Based on Cohen's (1977) recommendations, this relationship would not qualify as particularly noteworthy due to its extremely small effect size. However, the overall pattern of associations among illusory secondary control and academic-related emotions may raise some serious questions about the adaptiveness of this type of secondary control in academic settings. The implications of these findings are further outlined in the discussion section.

In contrast to the pattern for illusory secondary control, the pattern for the interpretive form of secondary control appears to be adaptive in academic settings.

Figure 9

Secondary Control, Academic Emotions, and Academic Performance: Structural Model



Interpretive secondary control was positively associated with positive emotion ($\beta = .13$, $p < .001$), which in turn was positively associated with GPA ($\beta = .23$, $p < .001$). Thus, data show a small positive indirect effect of interpretive secondary control on GPA through positive emotions ($\beta = .03$), with one standard unit increase in interpretive secondary control resulting in a .03 increase in GPA (.03 x 1.00). Again, while this effect size is quite small (Cohen, 1977) the data do suggest an overall positive effect of interpretive secondary control in academic settings in terms of associations with two types of academic outcomes (positive emotions and GPA).

Notably, interpretive secondary control was unrelated to negative emotions ($\beta = -.01$, *ns*). This finding is somewhat unexpected given that secondary control is often theorized to result in a *reduction of the negative* affective consequences of losses in perceived primary control. Instead these data suggest that interpretive secondary control is bolstering positive emotion, thereby affecting academic performance. The implications of this finding are further discussed in the following section.

Discussion

Academic achievement settings serve as naturally occurring domain-specific environments in which individuals are faced with possible threats to perceived primary control, making the use of secondary control possible. This study aimed to examine two broad research questions concerning 1) the factor structure of primary and secondary control and 2) the way in which primary and secondary control function in academic achievement settings. Overall, findings generally suggest that primary control is less differentiated than secondary control, and that both primary and secondary control factor structures remain stable over the range of ages common to the university setting. Primary control had positive direct and positive indirect (i.e., emotion mediated) effects on academic performance. Alternatively, secondary control had no direct effects but instead had both positive and negative indirect (i.e., emotion mediated) effects on academic performance depending upon which secondary control orientation (illusory vs. interpretive) was manifest.

A summary of the specified hypotheses, empirical findings, and conceptual and practical implications of the *first* research question will be presented, followed by a similarly formatted summary for the *second* research question. This section concludes with a discussion of the strengths and limitations of the current study.

Structure of Primary and Secondary Control

The first research question concerned an investigation of the factor structure of primary and secondary control across three age-based college student samples: Transition students (aged 17 – 18), Decision students (aged 19 – 20), and Commitment students (aged 21+). Two hypotheses addressing this question were as follows: *Hypothesis 1* outlined a single-factor solution for primary control that would be consistent across the three age groups; *Hypothesis 2* specified a multi-factor solution for secondary control predicted to vary across the three age groups. *Hypotheses 1* and *2* were tested in three steps consisting of Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and a test of multi-group factorial invariance. Results confirmed *Hypothesis 1* in that a single primary control factor emerged from the EFA across all three age groups. CFA confirmed that the single-factor solution fit the data reasonably well, and the test of factorial invariance suggested measurement consistency across the three groups. Thus, as expected, primary control was best represented with a single factor which reflected the belief in direct influence over academic outcomes (e.g., through effortful behaviors). This conceptualization of primary control was consistent across students in all age groups suggesting few differences in the way in which students of disparate ages conceptualize primary control.

Hypothesis 2 confirmed Rothbaum et al.'s (1982) position in that secondary control had several substructures, two of which were consistent with the theory, namely illusory and interpretive secondary control. However *hypothesis 2* was largely disconfirmed regarding developmental age differences. It was expected that the factor structure of secondary control would vary according to age-group, however results suggested that this was not the case. A highly similar two-factor secondary control solution emerged for all three groups in the EFA. Initial CFA with the two secondary control factors revealed poor model to data fit. Re-specification of the two secondary control factors (see *Results* section) resulted in a greatly improved model fit. The two secondary control factors were examined for item content and the labels Illusory Secondary Control and Interpretive Secondary Control were adopted for Factor 1 and Factor 2 respectively. The test of factorial invariance across the three groups was non-significant, disconfirming the expectation that the structure of secondary control would vary across the age groups. That is, the structure of secondary control was consistent across the age groups suggesting little differences in the measurement of these two types of secondary control across students of different ages.

What are the conceptual and practical implications of the empirical findings regarding *Hypotheses 1* and *2*? From a conceptual point of view, findings for *Hypothesis 1* are reasonably straightforward. The consistent single-factor structure of primary control implies a relatively robust conceptualization of primary control across the range of ages examined. This single primary control factor is focused on the individual capacity to directly influence academic performance. That is, it appears that primary control among students (regardless of age) can be reliably assessed with items reflecting beliefs and actions aimed at effortful behaviors such as attending class, studying for exams, etc.

Findings for *Hypothesis 2* present several conceptual points of interest. Two of Rothbaum et al.'s (1982) four factors emerged in the data, suggesting partial support for Rothbaum et al's original typology of secondary control as it relates to academic achievement. The two forms of secondary control that emerged represent highly disparate cognitive reactions to loss of perceived primary control. The process of interpretive secondary control entails the substitution of an original desired outcome (assumed to be successful academic performance) for more readily realized outcome (e.g., knowledge acquisition, becoming a more 'well-rounded' student, etc.). In so doing, students reinstate a perception of environmental contingency and are able to maintain a personally valid perception of control. Alternatively, the process of illusory secondary control entails the substitution of the original agent of control (assumed to be the 'self') for another agent such as luck, fate, chance, nature, etc. In this process the student may maintain a valid perception of being in control concerning academic outcomes, though not necessarily a perception of being able to influence academic outcomes.

It seems feasible that illusory secondary control serves a direct protective function among students in that the responsibility for academic failure is removed from the self and placed on an external agent such as fate or luck, allowing for the reduction of doubts concerning the self's competency. The protection of self-worth in terms of perceived ability and personal capacity is theorized to be the single strongest motive in achievement settings (Covington, 1994). However, it is also thought that the protection of self-worth may come at a cost in terms of reduced motivation and subsequent reduced goal-striving (Heckhausen and Schulz, 1998). This conceptual issue will be further discussed in the section pertaining to the function of secondary control in academic settings (*Hypothesis 4* below).

Another point of interest, from a conceptual standpoint, is the statistical invariance of the two factor structure of secondary control across the three age groups involving Transition (17 – 18 years), Decision (19 – 20 years) and Commitment (21+ years). That is, there was no evidence to suggest a differential conceptualization of secondary control based on student's age. This finding was somewhat unexpected given Heckhausen and Schulz's (1995) theoretical position concerning the increased focus of secondary control among older, more experienced individuals, and the empirical research backing this theoretical position (e.g., Chipperfield et al., 1999). This null finding may be due in part to the relatively small range of ages examined in this study. In addition, reconsideration of Heckhausen and Schulz's theory suggests that age may not have been the appropriate independent variable for capturing developmental differences among university students, and that 'year in academic program' may have been a better alternative. It is possible that differences may exist among students at different points of their academic training, a question that could not be adequately assessed with the current data given sampling limitations.

Moving on from the conceptual implications, from a practical point of view findings for *Hypotheses 1* and *2* suggest that both primary and secondary (illusory and interpretive) can be assessed equivalently across a range of typical university student age groups. That is, primary and secondary control can be reliably assessed in each age population with the identical instrument (i.e., measurement scale). This finding serves as an important prerequisite for a multitude of possible subsequent analyses such as the testing of actual mean levels of primary and secondary control across age groups.

Function of Primary and Secondary Control

Upon the discovery that primary and secondary control can be reliably assessed across a range of student age-groups, the investigation turned to the second research question concerning the function of primary and secondary control in academic settings. Two hypotheses were outlined: *Hypothesis 3* specified a direct link between primary control and academic achievement (GPA), and *Hypothesis 4* specified an indirect link between secondary control and GPA through academic-related emotions. Although no specific age group differences were outlined in *Hypotheses 3* and *4*, a test of structural invariance was conducted. This test of structural invariance examined the possibility of variance in the causal connections between primary/ secondary control, academic emotions, and academic performance (GPA) across the age groups. For both the primary control and secondary control models this test was non-significant, implying that the structure of the causal connections among the variables was statistically identical across the age groups. As such, the data were merged (see *Rationale for Analysis*) and *Hypotheses 3* and *4* were tested with the total sample.

Hypothesis 3 was largely confirmed, that is, higher levels of primary control directly predicted actual academic performance (GPA). This finding is not surprising given the large body of empirical research suggesting the direct positive impact of perceived primary control in achievement settings (see Stipek & Weisz, 1981; Perry, 2003). However, in addition to the direct link between primary control and GPA, the current study demonstrated a moderate indirect effect of primary control on GPA through both positive and negative emotions. That is, primary control was associated with higher levels of positive academic-related emotion (e.g., pride) and lower levels of negative academic-related emotion (e.g., anger) which, in turn, predicted GPA. This finding suggests that primary control functions in two ways in academic settings: (1) by directly influencing actual academic performance and, (2) by indirectly influencing performance through psychological adjustment outcomes (i.e., positive and negative emotions).

Findings for *Hypothesis 4* offer partial confirmation in that both forms of secondary control had indirect effects on GPA through academic-related emotions. However, the patterns of results for the two forms of secondary control were somewhat unexpected in terms of the nature and direction of associations between secondary control and emotions. In particular, contrary to the initial prediction, the interpretive form of secondary academic control was unrelated to negative emotions. That is, higher levels of interpretive secondary control did not result in lower levels of negative affect. Instead, interpretive secondary control was related to positive emotion, indicating that higher levels of interpretive secondary control predicted greater positive affect. As such, the effect of interpretive secondary control on GPA did not occur via a reduction in negative emotion (e.g., shame) as expected, but instead through the bolstering of positive emotion (e.g., happiness).

An alternative pattern of findings emerged for the illusory form of secondary academic control. Results suggest that illusory secondary control was positively associated with *negative* emotions. Specifically, higher levels of illusory secondary control predicted greater negative emotion, which in turn predicted lower GPAs. As such, illusory secondary control had a negative indirect effect on GPA. This finding helps to clarify the previous research literature relating to *Hypothesis 4* in that secondary control was generally found to be both beneficial as well as detrimental, having both positive and negative indirect effects on academic performance.

What are the conceptual implications for the findings pertaining to *Hypotheses 3* and *4*? In terms of primary control (*Hypothesis 3*), it appears that primary academic control functions in two ways: First, primary control serves to directly impact actual academic performance as evident in the direct connection between primary control and GPA. This suggests that students who believe they have direct control over their academic outcomes may perform better than students who do not hold such beliefs. It is possible that endorsement of these primary control beliefs may translate into actual primary control strategies (e.g., attending class, taking notes, studying for exams, etc.) that are essential for academic success. Additionally, primary control functions in a second way by serving to enhance psychological well-being through increases in positive emotions and decreases in negative emotion, thereby indirectly affecting academic performance. As such, it appears that the maintenance of perceived control through primary control processes is adaptive in academic settings both in terms of academic performance and psychological well-being.

In addition, it appears that interpretive secondary control is also highly adaptive in academic settings. However, interpretive secondary academic control did not function in the theoretically expected fashion. That is, rather than resulting in a reduction of negative affect, findings suggest that interpretive secondary academic control resulted in a bolstering of positive emotion. While this finding was not entirely expected, it is not necessarily counterintuitive. Specifically, the effects of interpretive secondary control are in the hypothesized direction – that is, the overall effect of interpretive secondary academic control is *beneficial* not detrimental for students. This finding suggests that the adaptiveness of the interpretive form of secondary control in academic settings may be manifest in increases in positive outcomes such as motivation and emotions, rather than reductions in negative outcomes such as stress and negative emotion.

Alternatively, illusory secondary control does not appear to be adaptive in academic settings. Illusory secondary control's association with negative emotion raises serious questions as to the consequences of this type of secondary control in achievement settings. While it is possible that illusory secondary control protects student's self-worth, it appears to be somewhat detrimental in terms of motivation and actual goal-striving. In some cases when students experience failure, they may use illusory secondary control in a defensive way to maintain a perception of control via luck, fate, chance, etc. and to avoid taking responsibility for their academic failure. This defensive use of illusory secondary control may explain the association of illusory secondary academic control with negative emotions and the subsequent negative indirect effect of illusory secondary control on GPA.

Turning from conceptual issues to a more practical point of view, the implications of the findings for *Hypothesis 3* extend from both the direct and indirect effects of primary control on students' actual academic performance. Specifically, a standard unit increase in primary control results in a .10 increase in GPA (direct effect) and/or a 1.30 increase in GPA (indirect effect). A difference in GPA of this magnitude (e.g., from 3.40 to 3.50) may translate into academic consequences such as: inclusion on the Dean's list, acceptance into special academic programs (e.g., B.A. Honors program), or even securing a fellowship or scholarship. In addition to the direct and indirect effects of primary control on GPA, the observed direct effects of primary control on *negative and positive emotions* may have practical implications in terms of students' overall psychological well-being. That is, as primary control increases, negative academic emotions (i.e., guilt, anger, regret, helplessness, and shame) decrease while positive emotions (i.e., happiness, pride, and hope) increase.

The practical implications of *Hypothesis 4* concern both the negative indirect effect of illusory secondary control on GPA and the positive indirect effect of interpretive secondary control on GPA. While the indirect effects of secondary control on GPA may be small, they both may still be of some practical significance. In particular, any decrease in overall GPA is likely to be considered important among most university students. That is, because the highly competitive environment of university ensures only the survival of the "fittest GPA" (as evident in terms of initial university admission, awarding of scholarships, etc.), most students are concerned with maintaining relatively high GPAs. As such, the negative impact of illusory secondary control on GPA (mediated by negative affect) is small but arguably important. Likewise, anything that can be done to *raise* one's GPA would be of interest to most university students. The indirect effect of interpretive secondary control on GPA (as mediated by positive affect) suggests that by simply re-interpreting one's academic failures one may raise his/her GPA e.g., from 3.07 to 3.10, which may have implications for academic-related outcomes similar to those suggested above.

In addition, the findings pertaining to both *Hypotheses 3* and *4* reinforce the practical importance of interventions aimed at enhancing perceptions of control. Specifically, interventions such as Attributional Retraining (AR), briefly described in the *Procedure* section, are designed to enhance students' perceptions of primary control through the modification of causal attributions for academic failure/success. AR has been associated with increases in students' perceived primary control (Haynes, Ruthig, Perry, Stupnisky, & Hall, in press), and consistently results in beneficial academic outcomes in terms of final exam performance (i.e., Van Overwalle & De Metsenaere, 1990; Van Overwalle, Segebarth, & Goldchstein, 1989), final course grades in introductory psychology (e.g., Hall, Hladkyj, Perry, & Ruthig, 2004; Struthers & Perry, 1996), and overall grade point averages (Ruthig, Perry, Hall, & Hladkyj, 2004; Wilson & Linville, 1982). Recent research suggests that a specific form of writing-based AR may actually increase students' level of perceived interpretive secondary control as well (Hall, Perry, & Chipperfield et al., in press). Findings also suggest the possible utility of an intervention aimed specifically at secondary control whereby the interpretive form of secondary control is emphasized and the illusory form of secondary control is discouraged.

Strengths and Limitations

The current study has several notable strengths. In particular, the design of the present study was both cross-sectional (examining differences across age groups) and longitudinal (spanning an entire academic year). This particular design allowed for the comparison of primary and secondary control across the range of ages typical in an academic setting, as well as the investigation of the long-term effects on primary and secondary control levels in terms of end-of-year achievement. In addition to a strong design, the current study employed an ecologically valid and objective dependent measure, i.e., actual grade point averages. This measure provides a reliable assessment of students' academic performance, and as such, inspires confidence concerning the validity of the findings, as opposed to a study using less objective dependent measures.

An additional strength of the current study pertains to the scale development of primary and secondary academic control. Specifically using CFA this study confirms that our primary and secondary control (interpretive and illusory) measures adequately fit our data. Results validate the factor structure of primary academic control and secondary academic control across the range of ages that is common in academic settings. That is, this study confirms that primary and secondary control can be reliably assessed among students ranging in age from17 to 21+ with our particular scales. In addition, because primary and secondary control appear to function in the same way for students of all ages (in terms of associations with emotions and achievement), it is reasonable to expect that interventions designed to enhance primary and/or secondary control should work in the *same way* for all students.

While the present study has several strengths, the findings should nonetheless be interpreted with the following limitation in mind: The present analyses compared the structure and function of primary and secondary control across a range of student age-groups in the interests of determining whether or not primary and secondary control processes develop and change as students mature. However, it is possible that the development of primary and secondary control processes may depend less on students' age, and more on students' stage in their undergraduate training, i.e., year in academic program. As such, the most appropriate variable to assess the development of primary and secondary control among university students may be 'year in academic program' as opposed to 'age-group'. Unfortunately, due to sample size limitations the present data did not allow for this 'year in program' comparison across students groups.

Despite this limitation, the findings for both research questions are nevertheless conceptually and practically intriguing. In particular, findings for the first research question, concerning the factor structure of primary and secondary control, provide partial support for Rothbaum et al.'s (1982) theoretical position in terms of the distinction between primary and secondary control in academic settings, and the differentiation of two theoretically proposed secondary control factor structures (i.e., illusory and interpretive). In addition, results suggest that both primary and secondary control can be reliably measured across the range of ages typical to a university setting. These findings confirm that primary and secondary control can be assessed equivalently across students of different ages thereby serving as a *measurement* foundation for further analyses that may investigate the possibility of control-related differences across student groupings based on variables other than age (e.g., year in program).

Findings for the second research question, regarding the function of primary and secondary control in terms of associations with academic-related emotions and actual achievement, imply that primary control positively effects academic achievement both directly and indirectly (through academic-related emotion). Conversely, secondary control does not directly impact achievement, but instead has both positive and negative indirect effects (through academic-related emotion) on achievement depending upon the type of secondary control that is used. These findings serve to confirm the importance of primary academic control, in addition to clarifying the role of secondary academic control in that it can be both beneficial and detrimental depending upon which secondary control belief orientation is manifest.

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Appendices

A. Primary Control

B. Secondary Control

APPENDIX A

Primary Academic Control

Strongly Disagree 1	2	3	4	Strongly Agree 5

p1 I have a great deal of control over my academic performance.

p2 The more effort I put into my courses, the better I do in them.

p3 No matter what I do, I can't seem to do well in my courses.

p4 I see myself as largely responsible for my performance throughout my college career.

p5 How well I do in my courses is often the "luck of the draw".

p6 There is little I can do about my performance in university.

p7 When I do poorly in a course, it's usually because I haven't given it my best effort.

p8 My grades are basically determined by things beyond my control and there is little I can do to change that.

APPENDIX B

Secondary Academic Control

Strongly Disagree 1	2	3	4	Strongly Agree 5

Interpretive Secondary Control

s1 On the whole, I feel that I am a better person because of my academic performance and experience.

s2 My academic performance and experience has given me a deeper understanding of my life than could be achieved without this experience.

s3 Regardless of what my grades are, I try to appreciate how mu university experience can make me a stronger person overall.

s4 No matter how well I do on a test or in a course, I try to "see beyond" my grades to how my experience at university helps me learn about myself.

s5 Whenever I have a bad experience at university, I try to see how I can "turn it around" and benefit from it.

Predictive Secondary Control

s6 I believe it is better to take it "one day at a time" rather than plan ahead.

s7 When I get a low mark on a test I remind myself that it won't affect my graduating GPA because the good marks will balance out the bad.

s8 I seem to have been born lucky because I often do better by blindly guessing on multiple choice tests than I do by trying to figure out the answers.

s9 I'm reluctant to commit to a program major because I want to keep my options open for as long as I can.

s10 There is no point in thinking about what the future will bring.

s11 I try not to worry too much about my long-term academic career because things can always change unexpectedly.

Vicarious Secondary Control

s12 Knowing that other students have the same grades as I do gives me a comforting feeling of having something in common with others.

s13 I have found that talking to other students who have had the same experiences at university gives me a better sense that I can manage my life.

s14 When test grades are posted, I make a point of seeing how many other students got the same mark as I did.

s15 I try to make friends with other students who are "in the same boat" as I am.

Illusory Secondary Control

s16 Much of what happens in our lives is a part of the way nature works.

s17 I believe that much in life is determined by chance or fate.

s18 I accept that some people are born to be A+ students, while others have less natural ability, and that there is little I can do to change what I was born with.