School Contextual Effects on the Adolescent Academic Performance-Substance Use Relationship

by

Fernando Humberto Andrade Adaniya

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Education)
in The University of Michigan
2012

Doctoral Committee:

Assistant Professor Lori D. Hill, Co-chair
Professor Jorge Delva, Co-chair
Associate Professor Kai S. Cortina
Assistant Professor Leticia J. Marteleto

To all adolescents who, at some point, struggle in finding their place in society.

ACKNOWLEDGEMENTS

When I think about education, especially my education, I usually recall one of my great grand mothers. She was a small woman from the central parts of the Andes in Peru. Her native language was Quechua and she spoke Spanish with the typical accent that Quechua speakers have. She did not complete any formal education, nor did she know how to read well and her hand writing resemble those of children; however, what she lacked in formal education was compensated by hard work, love, caring, and wisdom. As the caring woman she was, she showed remarkable excitement when I was about to start elementary education, her words still resonate in my mind: "Soon you will start school and you will learn the abc..." At that time, 'the abc' sounded so intriguing because I could not understand what it meant. I was also very curious about this abc that I was supposed to learn in school, it also sounded exciting because she said it with her shiny eyes and happy smile. She transmitted curiosity to me, curiosity that has driven me to pursue this long road in my education; from her I got the excitement that constantly has fed energy to endure all the hard work behind this dissertation and grad school.

During all my years of education and specially during graduate school, I have found faculty and peers that have also transmitted curiosity and excitement, and most important, support and guidance that have been key for completing my last years of 'formal' education.

I would like to extend my appreciation to all the people from whom I have found a constant guidance, support, perseverance, and mentorship. I would like to express

my gratitude to Lori Hill for taking me under her advice during my last years at the School of Education; she has helped me conceptualize and frame this dissertation, and has forced me to think in ways that I thought I was not able. Thank you Lori for your continued support and guidance.

Equally important, I would like to express my gratitude to Jorge Delva, who has also taken me under his guidance, specially in my first steps in learning about substance use research. I also want to express my appreciation to Jorge for letting me actively and productively participate in his research team and research agenda. No doubts that it has been pivotal for my last years in grad school to work with Jorge and his research team. Jorge has also provide financial support for logistic related expenses in conducting this dissertation.

I would like to thank Kai Cortina for his valuable feedback, definitively his comments helped to improve this dissertation. I also would like to thank Leticia Marteleto, who has been also present since my preliminary exams up to the last steps of my dissertation, sharing with me her comments and opinions about my work.

I also would like to thank Christine Feak and John Swales for all their very useful help with my academic writing learning process. Other people has also shared with me ideas and advice that made this dissertation better. Thank you to James Lepkowski for providing me with advice related to specific sampling issues with the dataset used in this dissertation. Also, I want to thank Robert Henson for sharing ideas on how to deal with some psychometric issues in this dissertation. Thanks to Victor Chan who helped me with some LaTeX technical issues, and also many thanks to Juan León, who has listened to my ideas during all the dissertation work.

I would like also to specially mention Addison Stone and Pamela Moss, who helped me in the most difficult moments of my schooling at Michigan. Thank you for providing me with support and the necessary tools to remain focused and on track. I would also like to thank Steve Raudenbush, who gave me valuable advice about how

to conduct research. Much of my appreciation goes to Valerie Lee who looked after me during the my first two years in Michigan. It was possible to come to Ann Arbor thanks to her.

This dissertation uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill. Add Health was funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (http://www.cpc.unc.edu/addhealth). No direct support was received from grant P01-HD31921 for this dissertation. My gratitude goes to the adolescents who participated in the Add Health study, as this dissertation would not have been possible without their valuable contribution.

I also would like to thank the University of Michigan Vivian A. and James L. Curtis School of Social Work Research and Training Center for providing me a research space to conduct my dissertation work.

Finally, I would like to express my gratitude to Anna, my wife, who has been most supportive and an excellent source of companionship and love during all this time in Ann Arbor. Many, many! thanks to Andreas, my son, for bringing all that good energy and love reminding me how precious life can be. My gratitude to my parents who literally have sacrificed their lives in giving us the best they could do. *Mis padres, hermana y hermanos, en mi corazón y en mi mente siempre están y estarán presentes a pesar de la distancia y el largo tiempo sin verlos.*

TABLE OF CONTENTS

DEDICATION ii

ACKNOWLEDGEMENTS iii

LIST OF FIGURES ix

LIST OF TABLES x

LIST OF ABBREVIATIONS xiii

ABSTRACT xiv

CHAPTER

I. Theoretical Framework 1

1.1 Introduction 1
1.1.1 Academic performance - substance use relationship . 4
1.1.2 School context influences 6
1.1.3 Setting boundaries for the school context 7
1.2 The school effects literature 10
1.2.1 The school conceptualizations 10
1.2.2 School effects in academic performance 14
1.2.3 School effects on substance use 18
1.2.4 School effects on education and substance use . . . 22
1.3 Theoretical framework 23
1.3.1 Definitions and conceptualization 23
1.3.2 Guiding conceptualizations 30
1.3.3 Summary 39
1.4 Research questions 39
1.4.1 Question and general hypothesis related to the academic performance and substance use dynamic . . . 40
1.4.2 Questions and general hypotheses related to school context effects 40

II. Methods 43

2.1 Population and sample 43
2.1.1 Population 43
2.1.2 Sample 45
2.2 Measurements and operationalization 50
2.2.1 Indicators for academic performance and substance use factors 50
2.2.2 Indicators for school levels of academic performance and school rates of substance use 54
2.2.3 School context measurements 55
2.2.4 Individual level covariates 65
2.3 Analytic methods 67
2.3.1 Missing data 67
2.3.2 Statistical analysis 69

III. Academic Performance and Substance Use Dynamic 73

3.1 Academic performance - substance use dynamic 73
3.1.1 Building the student and school level factors for academic performance and substance use: multilevel measurement model 74
3.1.2 Results for the multilevel factor structures for academic performance and substance use 87
3.2 Academic performance and substance use dynamic 92
3.2.1 Goodness of fit 93
3.2.2 Variance and correlations 95
3.2.3 Unconditional multilevel bivariate cross-lagged model between academic performance and substance use . 97
3.2.4 Student level conditional multilevel bivariate crossed-lagged model between academic performance and substance use 100
3.2.5 Summary 102

IV. School Context Effects Results 104

4.1 School level models: goodness of fit, variances and correlations 105
4.2 Student body composition: risk factor 109
4.3 School institutional features: school problem factors 111
4.4 School practices and policies factors 113
4.5 School academic pressure factor 114
4.6 School context model 120

V. Discussion and Conclusions 124

5.1 Recapitulation 124
5.2 Dynamic between academic performance and substance use . 125
5.2.1 The importance of defining the school context . . . 125
5.2.2 The dynamic between academic performance and substance use 127
5.2.3 School level relationship between academic performance and substance use 129
5.3 Concentric school context effects 131
5.4 Empirical results 131
5.5 I-C space: functional-systemic explanation 137
5.6 Policy and practical implication 139
5.7 Final remarks and conclusions 141

APPENDICES 144
A.1 School context Factors 145
A.1.1 Student body composition: student level factors . . 145
A.1.2 School institutional features factors and school policies factors indicators 153

BIBLIOGRAPHY 158

LIST OF FIGURES

Figure

3.1 Measurement model for substance use and academic performance: multilevel CFA (Wave 1) 90

3.2 Measurement model for substance use and academic performance: multilevel CFA (Wave 2) 91

3.3 Multilevel unconditional crossed-lagged model between substance use and academic performance 98

4.1 Multilevel bivariate crossed-lagged model: effect of school factors on substance use and academic performance 121

LIST OF TABLES

Table

2.1 Estimated proportions for student level covariates 48

2.2 Estimated proportions for school characteristics 49

2.3 Estimated proportions for academic performance indicators 52

2.4 Factor structure for student body composition: school risk factor . . 57

2.5 Factor structure for school institutional feature: school institutional problems, and drugs and pregnancy 60

2.6 Factor structure for school social and academic problems 61

2.7 Factor structure for school practices and policies: policies against delinquent behavior and policies against drugs use and possession . 63

2.8 Factor structure for school academic pressure 66

3.1 Academic performance and substance use indicators 77

3.2 Two-level CFA: model fit and variance decomposition for substance use and academic performance (Wave 1) 79

3.3 Two-level CFA: model fit and variance decomposition for substance use and academic performance (Wave 2) 80

3.4 Within level correlations among substance use and academic performance indicators at Wave 1 82

3.5 Within level correlations among substance use and academic performance indicators at Wave 2 83

3.6 Between level correlations among substance use and academic performance indicators at Wave 1 84

3.7 Between level correlations among substance use and academic performance indicators at Wave 2 85

3.8 Observed and estimated intraclass correlations for indicators of substance use and academic performance 86

3.9 Multilevel crossed-lagged model: goodness of fit 95

3.10 Multilevel bivariate cross-lagged model: variance decomposition and correlations between SU and AP 96

3.11 Multilevel bivariate crossed-lagged model: student level model . . . 101

4.1 Multilevel bivariate crossed-lagged model: model fit for school factor effects 106

4.2 Multilevel bivariate crossed-lagged model: variance decomposition and correlations between SU and AP 108

4.3 Multilevel bivariate crossed-lagged model: effect of school risk factor on SU and AP 110

4.4 Multilevel bivariate cross-lagged model: effect of school social and academic problems 112

4.5 Multilevel bivariate crossed-lagged model: effect of school delinquent behavior policies on SU and AP 115

4.6 Multilevel bivariate crossed-lagged model: effect of school selective academic pressure on SU and AP 117

4.7 Multilevel bivariate crossed-lagged model: effect of school generalized academic pressure on AP and SU 119

4.8 Multilevel bivariate cross-lagged model: effect of school factors on substance use and academic performance 122

A.1 List of indicators used in building the student body composition latent factors 148

A.2 List of indicators used in building the student body composition latent factors (cont.) 149

A.3 Factor structure for emotional problems (anxiety/depress) and somatic factors 150

A.4 Factor structure for drug use and risk behavior factors 151

A.5 Model fit for sense of belonging, physical well being and self-esteem factor structure 153

A.6 Factor structure for sense of belonging, physical well being and self-esteem 154

A.7 Factor structure for health status factor 155

A.8 School institutional problems, and drugs and pregnancy indicators . 156

A.9 School policies factors indicators 157

LIST OF ABBREVIATIONS

AP Academic performance

CFA Confirmatory Factor Analysis

CFI Comparative Fit Index

DIF Differential Item Functioning

DPP Drug and Pregnancy Problems

EFA Exploratory Factor Analysis

GAP Generalized Academic Pressure

ICC Intra Class Correlation

I-C Interactional-Conceptual

IRT Item Response Theory

MLR Maximum Likelihood with Robust standard Errors

RMSEA Root Mean Square Error Approximation

SAP Selective Academic Pressure

SAP School Academic Pressure

SIP School Institutional Problems

SES Socioeconomic Status

SEM Structural Equating Modeling

SU Substance use

TLI Tucker-Lewis Index

WLSMV Weighted Least Square Parameter Estimates

ABSTRACT

School Contextual Effects on the Adolescent Academic Performance-Substance Use Relationship

by

Fernando Humberto Andrade Adaniya

Co-chairs: Lori D. Hill and Jorge Delva

Children and adolescents are exposed to multiple contextual influences along their development towards adulthood. Before they transition to adulthood, adolescents acquire skills and knowledge usually in schools, which are one of the most influential contexts during adolescence. During school years performing well academically can generate better opportunities to become successful in the transition to adulthood.

As part of their development, adolescents might face several challenging situations and eventually engage in non-conventional behaviors such as substance use. Research has shown that, during adolescence, academic performance and substance use are inversely related where it is difficult to distinguish between cause and effect. Thus, in this dissertation both outcomes are conceptualized as an inter-connected complex relationship. The literature has documented how several individual factors explain this relationship. However, how the school context influences this dynamic relationship has been scarcely investigated, leaving a research gap to be filled. To fill this gap, this dissertation uses a new conceptual model to explain the empirical findings related to school context effects on the dynamic between academic performance and

substance use.

The effects of these school factors were estimated, in a national representative sample of adolescents (ADD Health), using longitudinal and multilevel techniques – multilevel confirmatory factor analysis, multilevel conditional cross-lagged modeling.

Two important findings: (a) the academic performance-substance use relationship is different depending on whether it is modeled at the student level (negative relationship) or school level (positive relationship); (b) three school context factors: a general risk factor, social and academic problems, and generalized academic pressure, had statistically significant effects on the relationship between academic performance and substance use.

Theoretical implications rely on the importance to use more specific definitions of the school context. Policy and practical implications pivot around the idea that substance use and academic performance need to be understood as co-occurring outcomes. The findings provide empirical evidence suggesting that (i) educational and drug preventing programs need to integrate academic and social goals, aiming to prevent substance use while promote academic performance; and (ii) social and academic aspects of the school context need to be considered in framing intervention programs.

CHAPTER I

Theoretical Framework

1.1 Introduction

Children and adolescents are exposed to multiple contextual influences that affect their development and well being. These contextual influence can broadly be classified into two types: macro social influences, such as culture and large communities; and micro social influences such as family, peers and friends, neighborhoods, and schools.

Among all these micro contextual influences, the school stands out as one of the most important context besides the family. Schools provide the context where children and adolescents spend great part of their lives preparing for future roles in adulthood. Because of the pivotal importance of schools in the development and well being of children, schools have been the focus of research in education and other social sciences (Barr, 1975; Anderson, 1982; Bryk et al., 1993; Eccles and Roeser, 2011).

Schools, indeed, can affect the development of children and adolescents in several domains, such as academic and social development. Moreover, schools can also affect the intersection of these two domains, for example, it can be explored how the school context influences the relationship between academic performance and adolescent drug consumption. How school contexts can affect dynamic relationships such as the co-occurrences of academic performance and substance use is a research area that has been under explored capturing scarce attention in the educational and substance use

literatures.

Thus, in this dissertation, I explore the effect of the school context on the relationship between one important aspect in the academic development and one specific behavior in the social domain: academic performance and substance use. In other words, the focus of this dissertation is to examine how the school context can influence the relationship between academic performance and substance use.

Focusing on school context effects on this relationship provides at least two major contributions: (i) Theoretically, it represents an opportunity to conceptualize what is understood as school context. As discussed later in this chapter, school context is mostly used as a "fuzzy" term that has been understood in several ways lacking clear definitions and conceptualizations. For instance, Sörensen and Morgan (2000) highlight that the ways by which schools and students interact in the learning process has not been clearly conceptualized; the same argument can be made in the case of the relationship between academic performance and substance use where there is a need for theoretical explanations of how the school context can modify this relationship.

(ii) Empirically, this dissertation tests the existence of school context effects on the relationship between academic performance and substance use, thus expanding our understanding of what is known about school effects separately on academic performance or substance use. In more general terms, this dissertations attempts to open a dialog that aims to explore school effects on the dynamics between educational outcomes and other type of non academic outcomes such as the co-occurrences between academic performance and substance use.

The relevance to study school context effects on the relationship between academic performance and substance use emerged from two research areas in education –school effects on educational outcomes and the well-establish idea of the "hidden curriculum"– and the growing interest on school effects on a general range of adolescent development and behaviors.

Schools are important for academic performance because they are one of the social contexts where most adolescents formally learn and develop skills and knowledge that can be pivotal after they finish high school. Performing well at school can provide better opportunities to pursue higher levels of education, and join the labor market as adolescents transition to adulthood roles.

In addition to the growing body of empirical school-effect research on a wide range of adolescent behaviors, non-academic goals, and achievements (Eccles and Roeser, 2011); the relevance to study school context effects on behaviors such as substance use has theoretical support on one well established idea in the sociology of education, the hidden curriculum. This idea has been widely studied as early as in the work of Dewey (1916), later in the work of Freire (1972); and recently, Haralambos et al. (2008) defined the hidden curriculum as those "things" that students learn by attending schools that are not intended or stated as educational objectives of such institutions. Thus, the idea of the hidden curriculum provides a very general overall rationale to justify conceptually the possibility that the school context can increase the probabilities or chances for students to engage in substance use among other non academic behaviors. In addition, from the substance use perspective, schools are generally considered as ideal places for drug prevention programs (Allott et al., 1999; Evans-Whipp et al., 2004).

As part of the exploration of this contextual effect, this dissertation uses a new conceptual model that aims to explain structural and mechanical aspect of school contextual effects on the academic performance and substance use relationship. This new conceptual framework has three key components: (i) a detailed definition of the school context, (ii) a division of the school context into peripheral and concentric, and (iii) four guiding conceptualizations to interpret the empirical results. This dissertation also assumes that the effects of the school context can transcend school boundaries; thus, having effects on behaviors such as substance use consumption

outside the school.

Before explaining in more detail the rationale of school context effects on the academic performance - substance use relationship, as well as the new theoretical framework; let us concentrate on one key aspect of the academic performance and substance use relationship.

1.1.1 Academic performance - substance use relationship

Within the academic development of adolescents, it is normative and socially expected that students would perform well academically. In addition, successful performance in academic areas can have important consequences after high school, especially, when the adolescent decides to continue with tertiary education or to join the labor market. Thus, one relevant academic goal to understand is academic performance. For the purposes of this dissertation, academic performance is defined as how successful a student is in accomplishing the particular demands, requirements, and goals set in his and her learning environment (high school, for example) during a period of time, usually the school year. One common way to reflect academic performance is using the teacher evaluations (grades) in several school subjects.

Along the adolescent social development, adolescents can engage in several normative, pro-social, anti-social, and risk behaviors. Among these risk behaviors can be found bullying, gang involvement, aggressive and delinquent behaviors, unprotected sex, and substance use (consumption of legal and illegal drugs). Substance use can be detrimental for the adolescent development and well being; for instance, see Bradizza et al. (2006) for a documentation on negative impacts of substance use on adolescents physical and mental health; and see D′Amico et al. (2008), who provide evidence supporting correlates between substance use and higher levels of violent and delinquent behaviors.

Substance use is understood as the consumption of legal and illegal drugs; given

that the focus of this dissertation is on adolescents, substance use is restricted to the three most common substances consumed during this period of development: alcohol, cigarettes and marijuana (Johnston et al., 2011a,b). Because chronic abuse and addiction are not common during adolescence, this definition of substance use excludes addiction and chronic abuse.

A comprehensive work by Bachman et al. (2008) shows the complexity of the relationship between educational outcomes and substance use. This complexity depends on several factors such as the different conceptualizations and measurements of substance use and educational outcomes (for example, dropout rates can be related to alcohol consumption in one way and to illicit drugs in a different way); the type of substance use trajectory (e.g. academic outcomes can be related differently depending on whether the adolescent only has initiated consumption, has engaged in some level of consumption, or is beginning to experience abuse and addiction); and the educational level (for example, during secondary education academic achievement is inversely related to substance use, but in college this may not necessarily be the case).

More specific research focused on adolescents who attend middle and high schools has been documenting how substance use and academic performance have been related (Owens et al., 2008; Crosnoe, 2006; Weng et al., 1988; Newcomb and Bentler, 1986). This literature indicates that substance use and academic performance/achievement, on average, are inversely related (negatively related in the statistical sense). In simpler words, as adolescents engage in more substance use, they might be less likely to attain higher levels of academic achievement/performance (Brook et al., 2008; Bergen et al., 2005; Jeynes, 2002).

Interestingly, it has also been shown that educational outcomes can be protective against substance use. For example, researchers found that adolescents with higher levels of academic performance/achievement were less likely to consume alco-

hol (Crum, 2006; Hoffmann, 2006; Ellickson and Hays, 1991).

The effect of academic performance/achievement on cigarette use has also been documented, the relationship is not as clear as in the case of alcohol. For example, a paper by Bryant et al. (2000) reported a significant effect, where adolescents with lower levels of academic achievement were found to be more likely to engage in cigarette consumption. Similarly, effects for marijuana were reported by Henry et al. (2007), who found that lower levels of academic performance increased the adolescent likelihood of initiating marijuana use. Moreover, common individual factors (such as gender, ethnicity, SES and personality traits) have been identified as common determinants of the relationship between academic performance/achievement and substance use (Crosnoe, 2006; Darling, 2005).

All these results strongly suggest that by the time students attend high schools; Substance use (SU) and Academic performance (AP) co-exist in an inter-related or co-occurring relationship, where it is difficult to distinguish cause and effect. Thus, in this dissertation, academic performance and substance use are conceptualized as two events that occur simultaneously. In other words, academic performance and substance use can be seen as a phenomenon where both can simultaneously develop and affect each other. This phenomenon is referred as the dynamic between substance use and academic performance.[1] Thus, in this dissertation, school context effects are explored on this dynamic relationship between AP and SU.

1.1.2 School context influences

It is necessary to highlight that the new conceptualization of school effects presented in this dissertation emerged from the need to provide a theoretical framework that: (a) can explain this complex dynamic between AP and SU, and (b) identify

[1]the term relationship is replaced by dynamic because relationship captures a more general understanding of how substance use and academic performance are related. For example, relationship can imply effects of substance use on academic performance or vice verse. However, dynamic reflects more accurately the co-occurrence, which is central in this dissertation.

school characteristics as well as school mechanisms, at the organizational level, that provide explanations for the school context effects.

Literature on school effects on the relationship between academic performance and substance use is extremely scarce, especially if substance use and academic performance are understood as the dynamic described above. All this imposes challenges in selecting specific aspects of the school that can affect the AP-SU dynamic. In addition, relying only on the education literature or only the substance use literature might introduce bias to the conceptualization of school effects on the AP-SU dynamic because what applies to educational outcomes might not apply to substance use and vice-verse. Furthermore, only one perspective (either educational or substance use) might not provide sufficient understanding of how schools can affect AP and SU. Another challenge is that academic performance can be seen as an expected outcome that students achieve in schools; however adolescents do not attend schools with the expectations to consume substances. In fact, it is more likely that substance use occurs mostly outside the school boundaries.

There might be several ways to proceed in order to overcome these challenges, one way is to use a deductive approach to set a theoretical framework with boundaries, structure and mechanisms to empirically test school effects on the AP-SU dynamic. The first step of this deductive approach is to set boundaries to what is understood as school context.

1.1.3 Setting boundaries for the school context

The school can be understood as a complex social environment where several interactions take place among school actors. Schools can be characterized by a large set of characteristics and factors, which can be related to a wide range of behaviors and achievements. One way to deal with this complexity is to precisely define what aspects of the school are actually researched, for instance one of these aspects is the

school context. Given the focus on the context, then it is necessary to define it in order to organize what can be understood as school context effects. A precise definition of the school context provides a conceptual advantage setting a theoretical framework to understand and interpret school effects.

In the theoretical framework section, a detailed definition of the school context is provided. School context is defined as a set of school "traits" that are not directly observed with specific structural and functional characteristics, which can be useful to explain and guide the exploration of school context effects on the AP-SU dynamic.

In addition, conceptualizing and defining the school context can be useful for more pragmatic applications such as educational policies, substance use prevention programs, and for any intervention that needs to deal with the school complexity. Conceptualizations and definitions can provide a framework to set expectations, goals, and means of evaluation for more practical and political decisions. Conceptualizations and definitions can also be useful for a common understanding of how a particular policy or a program has been developed, implemented, and evaluated (more details about these ideas are discussed in the final chapter).

Following the idea of the need to organize the school context, one way to distinguish school context influences is based on the proximity of the context influences dividing it in three main parts: "peripheral", "concentric", and "intrinsic". This division can be useful and efficient when exploring school context effects on the dynamic between academic performance and substance use; and in general, when exploring school context effects on any type of outcomes.

The peripheral context is the component of the school context that surrounds the school or has a temporal presence in the school. For example, the ethnic composition and levels of poverty of the neighborhood where the school is located can be part of the peripheral context. Another example would be the presence of temporal school programs for a semester or a year, or sporadic participation of parents such as vol-

unteer work. Other characteristics, such as school district policies or broad school features (public and private), can also be part of the peripheral context.

The concentric context is constituted by permanent school characteristics that are active components of what constitutes the school and are concentrated mainly within the school boundaries. For example, the student body composition (e.g. ethnicity composition, school rates of substance use, school poverty composition, and rates of mental health problems), school institutional features (e.g. educational resources, permanent school problems and challenges such as gangs, higher rates of violence and drug use, and rates of dropouts), school policies (e.g. policies against violent behavior, bullying and drug consumption and possession), and levels of academic pressure (e.g. academic expectations, the level of generalization of academic demands, amount of homework) can be part of the concentric context.

The intrinsic context is constituted by more specific school characteristics circumscribed within school spaces; the intrinsic context has permanent and more immediate influences on adolescents behaviors and achievements. The intrinsic context can be found within such spaces as classrooms, cafeteria, the playground, and administrative offices. In the intrinsic context, for example, students interact creating cliques, teachers deliver knowledge using instructional practices, and students engage in learning or leisure activities. This is the most dynamic part of the school context where school actors, mainly students and teachers, interact.

This dissertation is focused on the concentric context exploring how this component of the school context can influence the dynamic between academic performance and substance use. Focusing on the concentric context is centered on the perspective that it is more parsimonious to explore school context effects on the relationship between academic performance and substance use. The peripheral context brings a level of complication in the definition of what can be understood as "the school's neighborhood". Can it be defined as the census tract or does it requires a more

specific definition? Also distinguishing what is temporal brings another level of complication. On the other hand, the intrinsic context demands the conceptualization of additional sub level of analysis, for example the classroom, requiring additional conceptualizations, such as classroom mechanisms. In addition, focusing only on one intrinsic context, such as the classroom, might not be enough to understand how the school context can affect the relationship between academic performance and substance use. Other intrinsic contexts might be needed in addition to the classroom such as cliques and spaces that are created during leisure time. Thus, as mentioned before it can be more parsimonious to focus only on the concentric context. A more formal introduction of the division of the school context is presented in the theoretical framework (section 1.3).

Before presenting the theoretical framework, the following section provides a summary of the principal ways by which the school has been conceptualized; this followed by a review of the school effects literature.

1.2 The school effects literature

1.2.1 The school conceptualizations

The literature on school effects on a broad range of adolescent academic and non-academic goals has conceptualized the school context in several ways. The purpose of this brief review in search of school context definitions is to identify key components that could provide support for a specific school context definition to be used in this dissertation.

The simplest definition is a universal definition where the school context is assumed to be understood and it is usually defined empirically in terms of the school characteristics involved in the analysis. For example, Simmons and Blyth (2010) definition of the school context is provided in their description of the nature of the

school setting. This is composed by a brief description of "main characteristics of the school", such as size and grade structure (Simmons and Blyth, 2010, 30). Another recent example can be found in the paper written by Bellmore and Nishina (2012) who define the school context based on the ethnicity composition of the student body. Similarly, Green et al. (2012) describe the school context literally as "high school".

In fact, according to Teddlie and Reynolds (2000), during the 80's the school context was mainly confined to one variable: the Socioeconomic Status (SES) of the school's student composition. Later, Wimpelberg et al. (1989) included in the school context definition other features, such as socio-political facets as the student SES, governance structures that circumscribe fiscal and operational decision process, grade structure, curriculum programs, and others. This definition was expanded by Reynolds and Teddlie (2000), who (for the case of school effectiveness research) define the context based on student SES, community type, grade phase of schooling, and governance structure. The authors restrict the school context to this set of variables as an "...attempt to avoid further 'Balkanization' of the field..., (which) would make it increasingly difficult to discuss the generalizability of results beyond the immediate context of the study being conducted" (Reynolds and Teddlie, 2000, 163).

In other interesting approaches such as the developmental perspective, the school context is understood as one of the social settings where adolescents are embedded and develop. In this perspective, the school context is a micro system with hierarchical structures (for example, students within classrooms, classrooms within school, schools within school districts). One of the latest developmental conceptualizations of the school context was elaborated by Eccles and Roeser (2011), who conceptualize the context of schooling as a 'bridge' between the social and cultural macro-levels and the middle and micro levels. At the microlevel schools are conceptualized as organizations –with a hierarchical structure "...whose people, through daily acts of leadership, teaching, and social interaction, affect adolescents learning and develop-

ment in immediate ways" (Eccles and Roeser, 2011, 255). The authors' definition is complemented with a hierarchal structure to organize school characteristics and factors. This definition is very comprehensive and inclusive of clustering school characteristics such as teachers, curricula, academic tasks, and classroom environments (level 1); a broader range of "school-wide" characteristics (level 2) and school district policies (level 3) (Eccles and Roeser, 2011).

Organizational and bureaucratic perspectives are more focused on how schools are organized rather than providing definitions of the school context. The idea is that the school reflects business and bureaucracies with structures and characteristics that arguably do not capture the nature of schools. It has been argued that schools have similar structures to bureaucratic organizations and businesses; for instance, Dornbusch and Lin (1996) stated that schools have clear hierarchies of authority, specific job descriptions, specific roles with expectations of professionalism among school personnel, and positions that are supposed to be filled in the basis of merit. But the same authors highlight that the organizational models might not capture the nature of schools because schools "... have most of the disadvantages and few of the advantages of both bureaucracies and professions" (Dornbusch and Lin, 1996, 410).

Among the principal differences, Bidwell and Quiroz (1991) pointed that classroom instruction, which can be considered as the most essential activity at schools, is detached from most of the administrative process at school. Other noted differences are that principals have few means of control over school personnel; for instance, unions play a more active role with relative more power, payment is not based on merit and teachers cannot perform in the same professional way as members of bureaucracies or businesses (Bidwell and Quiroz, 1991). Furthermore, in the US, the teaching profession does not enjoy further mentorship (Stigler and Hiebert, 1999) that other professions offer.

In addition, the nature of schools might not be accurately captured by organiza-

tional and bureaucratic models is that these models pay little attention to the fact that the schools are constituted mainly by children and adolescents, not adults, as in the case of most organizations. Therefore, what applies to adults in organizations might not apply to children and adolescents in schools. Moreover, students are at the same time "clients" to whom education is delivered and "actors" who constitute major parts of the school context. This is not the case in organizations and bureaucracies. Although, these models do not directly define school context, it can be inferred that the school context can resemble organizational or bureaucratic contexts. Thus the school context can be understood as a broad set of organizational characteristics such as school hierarchies, roles among school actors, policies and sets of rules, expectations for each role and systems of reward and punishment.

From another different perspective, the school context is conceptualized in one of the most comprehensive ways: the community model, which is widely accepted in educational research because it has a rich long-standing history. For instance, early ideas of the community model can be found in the works of Bidwell (1965); Dewey (1943); Weber (1968). More recently consolidation of this model is presented in the works of Lee and Smith (1999), Shouse (1996), and Bryk et al. (1993). This model conceptualizes the school as community with three major components that represent the degree to which school actors share (i) values and understandings, (ii) an ethic of caring and (iii) a common agenda of activities (Bryk and Driseoll, 1988).

This community perspective distinguishes school research into two dimensions: an organizational level where schools are defined as communities in their organizational features, and a micro level focused on social interactions (Lee and Smith, 1999). The community model is very broad and seems to be more suitable for qualitative or mix methods research. For instance, the work of Bryk et al. (1993) provides deep qualitative insights of catholic schools' history and organization among other interesting details that can be only reveled by qualitative studies. This model provides

a very broad definition of the school as a community, and it is not clear how the school context can be defined. However, at least three ways are possible: (a) using a complementing theory, such as activity theory (Engeström et al., 1999), (b) based on qualitative observations of the schools, and (c) restricting the context to a set of school factors.

From this discussion about school contexts definitions, three major ideas can be drawn with important implications for the school context definition used in this dissertation: (i) there is no consensus of what is the school context; (ii) the definition of the school context seems to be intimately related to the particular objectives of the study; specifically, the outcomes of interest; (iii) the school context definition can be broad or very specific, reflecting the overwhelming complexity of the school. It seems that more than consensual and universal definitions of the school context, it is more important to provide clear definitions and a logical rationale to frame school contextual effects. Based on these three general ideas, a specific school context definition is presented in section 1.3. The following subsections present a review of school effects on academic performance and substance use.

1.2.2 School effects in academic performance

Research in education has generated an extensive body of literature in the area of school effects. This body ranges from philosophical and theoretical conceptualizations, such as discussions on the purpose of schools (for example, see the work of Dewey (1916), one of the most influential thinkers on American education) to more applied studies such as school policies and program evaluations. With regard to the latter, for instance, Bryk et al. (1998) provide detail descriptions of the Chicago School Reform.

In between the philosophical and more applied studies, a large body of literature has been conceptualizing and documenting school effects on educational outcomes.

For example, see the pioneer work of Barr (1975) who offered a conceptualization of how ability grouping, as a characteristic of the school context, can affect academic achievement/performance. Another example is the detailed and exhaustive work on the role of catholic schools on education documented by Bryk et al. (1993).

Importantly, within this diverse range of scholarship, a research tradition has emerged mainly centered on academic achievement and initiated in response to the early work of Coleman et al. (1966), who controversially claimed that the school had little impact on students' academic achievement. Currently, a great amount of empirical evidence has supported the effects of the school context on academic outcomes.

This literature can be broadly classified in four main groups that account for a wide range of school effects on educational outcomes. These groups are: effects of the student body composition, effects of school institutional features, effects of teacher quality and instructional practices, and effects of school academics (academic press, opportunities to learn, academic expectations, attitudes towards academics). Across these categories, topics such as causality, school effectiveness and inequalities in education have attempted to articulate definitions and explanation for school effects.

The literature on the effects of the **student body composition** has focused mainly on effects of school SES and ethnicity composition. For example, Caldas and Bankston (1997) found that students from disadvantaged socioeconomic backgrounds can benefit from the resources that those with the most advantaged socioeconomic backgrounds bring to school. The same authors also suggest that students who belong to minority groups could benefit more from ethnically diverse school contexts than from segregated schools. Similar results are presented by Hanushek et al. (1997) where racial segregation in schools can explain a small amount of the racial gaps in achievement.

The effects of the **school institutional features** have been documented on sev-

eral school characteristics such as sector (public, charters, magnet, private secular and private religious), school size, school location, and school grade structure (for example k-12 versus only high schools). For example, public schools have been compared to other types of schools. The most consistent pattern points to the fact that catholic schools offer school environments that can promote academic outcomes better than public schools (Bryk et al., 1993; Coleman et al., 1982; Willms, 1985).

A consistent pattern emerges in relation to school size, research in this area has provided empirical evidence supporting the idea that small and large schools compared to middle size schools provide environments that are less likely to promote academic achievement (Ready et al., 2004). The effect of school size was also examined in the context of school reforms as documented in detail by Lee and Smith (2001). A more recent and comprehensive work on school size was published by Leithwood and Jantzi (2009), who summarized empirical evidence suggesting similar results as Ready et al. (2004) and Lee and Smith (2001).

Another school feature that has been researched is grade structure; for instance Rockoff and Lockwood (2010) reported that students who change from k-6 schools to middle schools tend to experience a drop in their academic performance compared to students who remain in k-8 schools. A broader research domain that is focused on studying the effects of the transition from one environment, such as elementary schools, to a new environment, such as middle school, emerged with the work of Eccles and Midgley (1989), who developed the concept of "stage-environment fit". The idea is simple but powerful in capturing context effects, especially from a developmental perspective. The authors argue that what is important is the fit between the adolescents' developmental needs and their educational environments. When a transition occurs, it might be possible that there are "developmental inappropriate changes" in the organization, instruction, and climate of the classrooms. Changes in several aspects in the classroom (such as classroom's activities, instructional prac-

tices, difficulty of tasks, quality of relationships, motivational strategies, and locus of responsibility in learning activities) can be in synchrony with the developmental needs or can be inappropriate for the adolescent, thus contributing to negative changes in the student motivations and achievements (Eccles et al., 1993).

The research on **teacher quality and instructional practices** is not consistent in identifying one specific aspect of teacher quality (teaching experience, preparation, and qualification), however the literature points to the existence of a complex 'teacher' effect on students' academic performance/achievement (Hanushek et al., 2005; Wayne and Youngs, 2003). One key aspect of this body of research is that both teacher quality and instructional practices can be conceptualized in a different dimension of schools, the classroom. This implies that modeling these factors at the school level might present the same methodological and conceptual problems when ignoring the nested structure of students within schools as described by Raudenbush and Bryk (2002). Thus, regardless of the conceptual importance of these sets of factors, they cannot strictly represent school effects, rather classroom or teacher effects.[2]

The effects of **school academics** have been extensively explored in several areas such as grouping and tracking, opportunities to learn, instructional time, teacher's expectations for students performance, and academic press. For example, within instructional time research, Carroll (1989) proposed a learning model based on five factors, two of them expressed in terms of achievement and the other three expressed in terms of time. Academic press, sometimes also expressed as academic climate, has been also extensively examined, having its origins in the concept of organizational press and implemented in educational research by McDill et al. (1986). The authors highlight three key assumptions: (a) US standards in schools are low, (b) the implementation of higher standards can demand more effort on students, and (c) thus leading to higher levels of academic performance or achievement. Research

[2]Modeling them at the school level might introduce bias, which need to be empirically explored.

on this topic found positive effects on academic achievement (Lee and Smith, 1999), especially in students with low academic performance (Shouse, 1996).

For other interesting and more comprehensive examples of school effects see Fuller and Clarke (1994), who provide an extensive review of school effects in ethnically diverse context and developing countries. Konstantopoulos (2006) presents a more general national approach exploring school effects on trends in academic achievement; the author used three national representative surveys and found that major school characteristics that predict academic achievement come from the school composition of the student body. Teddlie and Reynolds (2000) provide an excellent introduction to several issues of school effectiveness raging from theoretical and historical overviews, methodological issues, and including an international perspective.

All these documentations strongly argue for the existence of complex effects of the school on educational outcomes. Compelling evidence strongly suggests effects of both the student body composition and school academic measures on academic performance.

1.2.3 School effects on substance use

Returning to the case of adolescent substance use, there is no extensive documentation relating the school context to adolescent substance use. Please note that in the case of substance use, there is some literature that uses 'school' factors at the individual level (Darling, 2005; McNeely and Falci, 2004; Ellickson et al., 1999). For example, students' report of school bonding is used as an indicator of the individual bonding between the student and his/her school; however school bonding does not represent a school level characteristic accounting for rates of school bonding in the school. These types of studies, in this dissertation, were excluded from the literature accounting for school effects on substance use because they reflect an individual characteristic related to the school or individual perceptions of school characteristics.

These studies are not school effects studies; however, they are very common and are considered as studies measuring "individual-level school-related exposure" (Fletcher et al., 2008).

The concern of how school can affect adolescent substance use is relatively new in research on substance use. This emerging literature is based on intervention programs guided by the experimental tradition in social sciences; but with fewer documentation based on observational and national representative studies. For example, Fletcher et al. (2008), summarized evidence from experimental studies suggesting that increasing student participation, improving relationships, and promoting a positive school ethos might reduce drug use. In one of few observational studies, Fletcher et al. (2008) consistently found evidence suggesting school effects on substance use.

The most notorious school characteristic explored can be grouped under the student body composition. Research in this area has focused mainly on ethnic composition; for example, Botticello (2009) found that schools that are more ethnically diverse had students that were less likely to engage in the consumption of alcohol. Similar to this result, Eitle and Eitle (2004) found that as the percentage of white students increases, schools become environments where adolescents are more likely to consume alcohol and tobacco. Related to the student body composition, Ennett et al. (1997) showed that schools with higher rates of acceptability to try alcohol, cigarettes, and marijuana were more likely to promote the use of these three substances among their students. The authors' findings seem to reflect that the student body composition can generate risk environments where adolescents can be more likely to engage in substance use consumption.

Another area of research has focused on school climate; notoriously, there is no consensus in the literature that explores school effects on substance use, on what constitutes school climate. For example, Botticello (2009) defined school climate as school rates of cohesion, safety, and frequency of drunkenness. Interestingly, the

authors found that as the school rates of frequency of drunkenness increase, students are more likely to engage in alcohol use as well as in heavy drinking.

Mayberry et al. (2009) presented another way to understand climate, the authors defined climate based on how much students feel that they are getting a good education and how much respect they feel from adults; higher levels of the score represented more "positive climates" and schools with more positive climates were environments that were more likely to protect against substance use. Eitle and Eitle (2004) defined climate as a comprehensive multidimensional composite of three sets of school factors: school culture (rates of absenteeism, school levels of academic achievement, and dropout rates); school organizational structure (school size, school average class size, and per-pupil expenditure); and school social "milieu" (ethnicity composition and teacher experience and qualification). The authors found that schools –with weaker commitment to academic mission, whose students are mainly white, with fewer resources, and with relative inexperienced and less qualified teachers– were environments that could promote substance use among their students.

Using a more comprehensive approach to capture school characteristics, West et al. (2004) explored high-school effects among several health indicators including use of illicit drugs, drinking, and smoking. The authors suggested that several school characteristics were associated with drug use. For example, higher levels of poor teacher-student relationships were associated with higher rates of substance use. Poorer overall social environments contributed to higher rates of consumption as well as poorer school ethos. On the contrary, higher levels of involvement in the schools as well as stronger school denomination were protective factors against substance use. More interestingly, this study found that the number of students who drank, smoked and consumed illicit drugs was significantly higher in some schools even after adjusting for a large set of factors (such as demographics, student's health behaviors prior high school, parental behaviors income, and religion) (West et al., 2004).

A third area of research can be grouped under general school characteristics. Among these school characteristics are grade structure, school sector (private versus public), and school size. Accounting for the effect of school size, West et al. (2004) suggested that larger schools were more likely to have higher rates of substance use. These results were consistent with a paper about school effects on alcohol use by Botticello (2009); the authors also found that small schools compared to large schools were less likely to have adolescents engaging in alcohol use and heavy drinking. In relation to school sector, Guilamo-Ramos et al. (2005) found that public schools were found to have slightly higher rates of binge-drinking. In the case of grade structure Botticello (2009) and Eitle and Eitle (2004) found that high schools are environments where substance use can be more likely among students.

A common trait among manuscripts accounting for school effects on substance use is the lack of conceptualization of school context. In general, it seems that schools are assumed to be an influential context with no major need to provide theoretical explanations as to why schools can affect substance use. Despite this lack of conceptualization, it seems that the emerging literature accounting for school effects on substance use is finding its way towards the accumulation of empirical evidence that schools can indeed affect substance use among adolescents.

As summary, compelling evidence demonstrates that schools characteristics, indeed, affect academic performance, which adds to the growing evidence suggesting that schools have an influence on substance use. Thus, it is logical to expect, from an empirical perspective, that the school context can influence the relationship between educational outcomes and substance use. As logical as this reasoning might sound, more than logic is needed to justify and understand the contribution of this dissertation in exploring the relative importance of the school context on the academic performance - substance use relationship.

1.2.4 School effects on education and substance use

The literature accounting for school effects on academic performance - substance use relationship is very scarce; only a handful of papers account for school effects. As in the case of the literature of school effects on substance use, there is also research that approaches school effects using the "individual-level school-related exposure" measurements described by Fletcher et al. (2008). For example, Bryant et al. (2003) investigated how academic achievement, attitudes, and behaviors related to the course of substance use. The authors explored how individual-level school-related exposure factors such as school misbehavior, feeling left out, school interest and school enjoyment were associated to drug use controlling for academic achievement. In a study by Bryant and Zimmerman (2002), using growth curve analyses, revealed that adolescents who perceive negative school attitudes among peers were more likely to increase their cigarette and marijuana use. This kind of publications were excluded from this section because they do not represent school effects.

However, there is research that explored school characteristics on the relationship between academic performance and substance use. For example, Crosnoe (2006) studied how schools can affect simultaneously both academic failure and alcohol use. Interestingly, Crosnoe found school effects for both outcomes. Adolescents attending schools with higher rates of academic failure were more likely to drink more and fail in grades. It is worth noting that these findings suggest effects for both drinking and academic failure. Two other school effects on drinking and academic failure were reported; the effects of teacher-bonding and school attachment acting as protective factors against both outcomes (Crosnoe, 2006).

In another paper, Hoffmann (2006) found in addition to school effects, two interesting cross level interactions. (i) The author found that the positive relationship between athletic participation and alcohol use is stronger for female adolescents who attended lower-SES schools and for males who attended higher-SES schools. (ii) He

also found that participation in nonathletic activities can be protective against alcohol use, especially for boys attending low-minority-population schools (Hoffmann, 2006).

These two papers clearly opened the possibility to explore school effects on the relationship between academic outcomes and substance use. As mentioned before, the research topic of this dissertation directly relates to finding empirical evidence supporting effects of the school context on the academic performance-substance use dynamic. This is reflected in a general research question, that later in this chapter will be laid out as a set of empirical questions. Broadly, however, the question is whether the school context influences the dynamic between academic performance and substance use. To address this general research question a theoretical framework is presented in the next section, which is followed by the proposition of research questions and general hypothesis.

1.3 Theoretical framework

1.3.1 Definitions and conceptualization

Keeping in mind what has been discussed so far, this section is organized in two parts: (i) definitions of the school context, and (ii) four guiding conceptualizations of school context effects on the academic performance-substance use dynamic.

1.3.1.1 School context definition

In order to organize and guide my ideas related to how the school context can be defined, I rely on one idea based on substantial research about the dynamic nature of relationship in school settings and four key definitions that shape my conceptualization of the school context. These four definitions are: (1) the school context is socially constituted, (2) the school context can be divided in three parts: peripheral,

concentric, and intrinsic; (3) the school context is constituted by several layers of interactional-conceptual spaces; (4) the school context has a hierarchical structure.

1.3.1.2 Definition 1: The school context is socially constituted

The school context is constituted by members (school actors) with broadly-defined specific roles assigned to students, teachers, principal, and school staff.[3] These school members are active subjects that interact with each other and can simultaneously influence each other's behaviors. For example, a student attending school with a good attitude towards learning could motivate a teacher, causing the teacher to pay more attention to this particular student. At almost the same time this student can be reinforced by the teacher's positive disposition, thus feeling more motivated to learn. This student's motivation could be transmitted to other classmates who can feel more motivated to study; in turn this motivation can bounce back to the teacher. As a result, a cycle of positive general classroom attitude towards learning can facilitate a positive climate towards learning.

This nature of being active members can also generate less propitious environments for learning, for example, active disruptions by a group of students during class or gang type behaviors at school can generate more favorable environment for less desired behaviors and outcomes such as violent acts or substance use.

1.3.1.3 Definition 2: Peripheral, concentric, and intrinsic contexts

As mentioned before, the school context can be divided in three main parts: the peripheral, concentric, and intrinsic contexts. The peripheral context is the component of the school context that is assumed to have more distal effects on students' behaviors and achievements. This part of the context is constituted by characteristics

[3]Parents could also be considered as part of the school, especially when parents actively participate in school meetings, volunteer to help with students or as members of any parental organization in the school. However, traditionally the research literature does not directly consider parents as part of the school context.

of the school surrounding such as the school's neighborhood social composition (e.g. ethnic and levels of education), levels of poverty, rates of drug use, rates of violence, availability of drugs, drugs advertisements among other characteristics. The peripheral context is constituted also by temporal presence of other actors in the school such as temporal prevention programs, temporal academic programs, sporadic events and sporadic participation of parents in learning and leisure activities.

The concentric context is constituted by school characteristics that are directly related to the school environments, thus having more influences on students' behaviors and achievements than the peripheral context. The concentric context can include characteristics such as the student body composition (e.g. school ethnicity composition, school levels of risk based on students' risk factors, and aggregated levels of students' SES); school institutional features (institutionalized problems, relationships among school actors, proportion of qualified teachers, and school size); school policies and practices (e.g. policies against use and possession of drugs, policies against delinquent behaviors, and policies against truancy); school academics (e.g. academic press, academic practices, school year calendar, and academic expectations). This dissertation, as argued earlier in this chapter, is focused on school effects of the concentric context. The concentric context represents school level outcomes directly linked to the academic performance and substance use at the student level. For the purpose of this dissertation, this concentric context is conformed by the school characteristics presented in section 1.3.2. From now on, because of simplicity, when the term school context is used, it will refer to the school concentric context.

The intrinsic context represents the school spaces where learning activities take place, as well as the school spaces where social interactions occur. These spaces are mainly the classroom and places such as the playground or school hallways. The intrinsic context includes characteristics such as management of time, classroom management, the classroom teacher characteristics, instructional practices and amount

homeworks. It is in the intrinsic context where most of the learning and leisure activities are performed and more direct and proximal influences are expected such as peer influences and the effects of teacher instruction. It is in the intrinsic context where concepts such as the "zone of proximal development" developed by Vygotsky (1978) can be anchored.

1.3.1.4 Definition 3: The school interactional-conceptual space

The school context has a physical space and an Interactional-Conceptual (I-C) space. The physical space is composed of educational and non-educational materials, the classrooms and the school buildings. Embedded in this physical space, the I-C spaces are constructed by the interaction among school members. Indeed, the I-C space is similar to the internal plane of action in activity theories. (See Engeström et al. (1999), who provides one of the most used versions of activity theory in the West). The internal plane of action as well as the I-C space provide a concept that is useful to address 'soft' factors which are not well captured and represented in the literature of school effects.

Students at schools engage in various activities, such as learning activities during math class or leisure activities during playtime. Within these activities I-C spaces are continuously created and modified. To be more concrete, during math class, a teacher is about to introduce addition of two digits; let us assume that once the students pay attention an I-C space is created among the teacher and students. He or she starts the introduction and students are silent listening to what the teacher has to say. This I-C space is referred to as interactional because it emerges from the interaction among school members within a physical space. In this example, the interactions are between students and the teacher within the classroom or parts of the classroom.

The I-C is conceptual because it exists in the mind of students, teachers, principal and school personnel. In the example, in the teacher's mind and in the students'

minds there is a common and shared understanding of what is being created. The I-C space is the "conceptual container" where ideas and minds interact during a learning process or a leisure activity (for example when cliques get together to talk about what they did over the weekend). Returning to the example, the teacher and the students are engaged in sharing knowledge about addition. Once the teacher explained that they are going to learn how to add two-digit numbers, their minds interact around ideas related to the addition of two-digit numbers, within this space they share questions and answers related to addition of two digits. Once this space is created, it has some properties explained below. We will return to the example after a brief explanation of the each property.

First, it is relative to the actors and to time. The I-C spaces depend on who are interacting and when they are interacting. Returning to the example, the teacher and students can create a different I-C space if one or more students are missing, or if a substitute teacher would deliver the introduction to the addition of two-digit numbers. Even though the I-C space is a shared space, each student and the teacher has a unique mental representation of the I-C space; this reflects a subjective component in all activities at schools. In this example, the teacher could be thinking of addition with two-digit numbers without carrying digits; however, some students could be creating mental representation of addition with two-digit numbers carrying a digit from the units to the tens. At the same time, each student and the teacher will have a mental representation of the space, for example, the teacher would see the students and the back of the classrooms while the students would mainly see the blackboard and the teachers. However, a student could be more concentrated on his or her notebook and the blackboard if he or she is worried about taking notes.[4]

Second, the I-C space depends on the physical space. The same students and teachers would generate two different virtual spaces depending on the arrangement of

[4]The time component is more complex and refers mainly to seasonal changes in I-C spaces. For now, it is not necessary to pay more attention to time.

the furniture in the classroom, the availability of educational resources, or the overall physical condition of the classroom. In this example, the I-C space would be different if students were sitting around the teacher or in a more traditional way in individual seats organized in rows by columns, or if the students were sitting on bricks and the teacher was using the floor to explain how to add tow-digit numbers.

Third, the school I-C space is dynamic, which means that once the space is created it can be changed. For example, while the teacher is giving an example of how to add $32+45$, some students can get distracted by an interruption of the school psychologist asking to have one of the students come to her/his office. The I-C space could be more disrupted by poor class management or the presence of students with low levels of motivation to learn how to add two-digit numbers.

Fourth, this interactional-conceptual space can affect children's and adolescents' behaviors and outcomes transcending the school boundaries. For example, the I-C space created during this mathematics class might motivate students to learn more about addition in such a way that learning how to add two-digit numbers can continue during recess time, doing exercises at home with the parents and siblings or in a friendly conversation with friends discussing different algorithms of how to add.[5]

Fifth, the I-C space can be related to academic and non-academic matters. The I-C space is academic when it is centered on academic or learning activities about a specific topic in a particular subject. However, the same I-C space could become less academic when the teacher and students spend time organizing and preparing the classroom for a transition between math class to art class. The I-C could be completely non-academic when it is about leisure activities during recess.

Sixth, The I-C space mirrors the school hierarchical structure, which is the third premise described below. For example, I-C spaces can be created during class but also larges I-C spaces can be created in the cafeteria or during school activities that

[5]Note that this dynamic characteristic of the I-C implies that the school context is also dynamic; thus the school context can be influenced and changed.

involve all students and teachers. Some schools for example might have a specific time before beginning of the week where students are addressed by the principal who can communicate general announcements about the school schedule for the week.

The I-C space is a key concept that builds a bridge between what individuals, such as teachers and students, bring to school and the school context. It is through changes in the I-C space that school characteristics can affect individual behaviors and outcomes. The I-C space is a conceptualization that mainly attempts to explain the link between the concentric, and intrinsic school contexts and student behaviors and achievements. To be more specific, fluctuations in the school contexts can generate changes in any I-C space that in turns can influence academic performance and substance use.

1.3.1.5 Definition 4: The school hierarchical structure

The school is organized in a hierarchical structure; this hierarchy ranges from a simple structure where students are embedded in schools; for example, this structure has been commonly modeled as a two-level hierarchical model as specified by Raudenbush and Bryk (2002). The acceptance and utilization of this hierarchical structure has become the norm in educational research and is increasingly being used in all other social studies that involve school context, children and adolescents' development, organizations, and neighborhoods (Eccles and Roeser, 2010; Sampson et al., 2002; Raudenbush and Bryk, 1986).

Given the importance of the hierarchical structure as a conceptualization of the school context, it is mandatory and logical not to ignore this structure in the analysis of school context effects in the academic performance - substance use dynamic. Avoiding this structure would represent methodological drawbacks in the empirical estimations of the school peripheral context effects and most importantly would ignore a well-established aspect of how schools have been conceptualized. In other words,

this hierarchical structure is intrinsic to the concept of school context regardless of additional definitions.

1.3.2 Guiding conceptualizations

This section provides a rationale to explain how the four groups of factors in the peripheral context can be translated to academic performance and substance use, thus affecting the dynamic between these two outcomes.

1.3.2.1 Guiding conceptualization 1: The role of the school's student body composition

As mentioned in the first definition of the school context (the school context is socially constituted); students are not isolated at school; on the contrary, they are embedded in a complex network of connections among school actors, mainly consisting of other students -peers and friends- and teachers. In addition, the literature on school effects has documented the existence of effects of the student body composition on academic performance and substance use as described in section 1.2.2.

The composition of the student body can be understood as one representation of the concentric context; the characteristics of the students body composition can affect the school context constitution such as I-C spaces, thus affecting the school latent factors related to academic performance and substance use.

In the particular case of this dissertation, the student body composition can provide a set of school characteristics related to two main sets of school factors. The first set is composed by school demographic characteristics such as ethnic composition, socioeconomic composition, school poverty levels and age and gender distribution.

The second set of factors, more relevant to the work in this dissertation, reflects on a set of school risk factors based on the students' traits and problems that they bring to school. Among these traits and problems can be found delinquent behaviors,

student mental health status, students self-esteem, student-school bonding or sense of belonging, as well as other risk factors and personality traits.[6]

The idea behind this set of factors at the student level is that this set can have a counterpart at the school level. This counterpart can be expressed as an overall school factor that reflects on characteristics of the school composed by a set of factors accounting for students characteristics (for a detailed description of this factor and other school factors see the Methods section related to school measurements).

For example, a school risk factor can range from lower levels of risk, where schools can be perceived as safer environments that can protect against adolescent substance use and provide safer environments where learning activities can take place mainly in I-C spaces generating settings that can promote learning; thus adolescents might be more likely to increase their academic performance. On the other hand, schools with higher levels of risk can become contexts with higher levels of risk that might increase substance use among their students, at the same time this environment can be more disruptive, especially for learning activities; thus decreasing the likelihood of attaining higher levels of academic performance.

More precisely, this risk factor can act as a social mold that shapes the school I-C space at different levels of the school hierarchies. For example, imagine a new student who has two options of where to start high school. One of the schools is composed mainly of students with higher levels of mental health problems, higher levels of violence, delinquency, and higher levels of drug use (among other risk behaviors). Overall, it can be conceptualized that this school has higher levels of risk, with more disrupted I-C spaces focused on learning and with more I-C spaces centered in informal unstructured leisure or overly restrictive and punitive activities. In turn, all this can promote more risk behaviors and detriment learning activities. Students

[6]Please note that the students are not the only school actors that bring characteristics, teachers also bring their characteristics to the schools, but including the teacher level brings conceptual and methodological concerns that go beyond the scope of this dissertation, therefore are not considered, which does not mean that are not important.

in this kind of school would experience more personal challenges as a result of being part of a school with higher levels of risk.

The other school, on the contrary, is a school with lower levels of overall risk. This school can create I-C spaces that are safer spaces that can center more on academic tasks and learning activities; thus becoming environments that promote academic performance and protect against substance use.

If the student were to attend the first school, holding all other factors constant, would he or she have an environment where the school would have a less protective effect against behaviors such as substance use? Would this environment detriment his or her academic endeavors? If the student were to attend the second school, keeping all other aspects constant, would then the school provide a more protective environment against risk behaviors? Could this other environment encourage the attainment of academic goals?

In summary, the effect of the composition of the student body can be reflected as an overall school risk factor that might unequally shape the school. The effect of the student body composition, *ceteris paribus*, can change I-C spaces generating school contexts that might increase or decrease the school levels of academic performance and the rates of alcohol consumption; in turn, affecting the students' academic performance and substance use.

1.3.2.2 Guiding conceptualization 2: effects of school institutional features

Similar to the composition of the student body, the school's Institutional features derived from the first definition related to the school context, (the school is constituted by school actors). These features reflect structural traits that after several occurrences become an institutionalized component of the school. These traits can be conceptualized as latent school factors that are not directly observed, but reflect on

indicators such as the presence or absence of violence among teachers and students, the presence or absence of academic problems in the school, communication problems among all school actors, especially between teacher and students and political problems among principal and teachers.

There are two conceptual differences between this set of features and the set of characteristics that students bring from home (student body composition). The first difference resides in the fact that the school institutional traits result from the interaction between school actors (for example conflicts between teachers and students). This set of traits can also result from structural characteristics, such as school resources -educational and economic; these structural traits go beyond the scope of characteristics of the students.

The second difference occurs when a school feature becomes an institutionalized characteristic of the school. In other words, the student body composition can be a temporal characteristic determined by cohorts (a cohort can be characterized by higher levels of drug use or a students with more economic resources). However, when the feature is systematically observed at the school it becomes an institutionalized trait that characterizes the school. For example, after several years of teen pregnancy occurrences in the school, this trait becomes an institutionalized characteristic partially defining the school context as an environment with higher rates of teen pregnancy. This is not the case if only for one year the school observes higher rates of pregnancy which reflects a temporal and particular characteristic of the composition of the student body.

Similarly, we can extend this idea to violence, drug use and possession, and gang membership becoming characteristic features of the school such that they do not depend on the cohort, but are recreated at the school as part of institutional features. The assumption is that these features are noticeable by school actors, such as the principal, once the problems become institutionalized. Therefore, it could be assumed

that the principal would be more likely to report these problems in a questionnaire.

There are "typological" school characteristics such as school sector (private, magnet, public), school religious membership, school grade structure (k-12, middle schools, high schools), location (urban rural). These characteristics are not considered components of the school context. They are more stable and less dynamic characteristics, which usually do not change and some of them cannot be changed; for example, it is possible that a private school could become public or vice versa, but usually private schools tend to remain private and public schools public.

That said, the second set of factors, school institutional problems, can be understood as non-observed school traits. Higher levels of these traits are assumed to underly the school context; which can disrupt the I-C space. Lower levels of these traits can result in safer and more academically centered I-C spaces; thus reducing the school rates of substance use and generating environments where students are more likely to achieve higher levels of academic performance.

As in the case of student body composition, institutional school problems can provide different school environments as well as opportunities for adolescent development. Could it thus be expected, after holding all factors constant, that the institutional problems would affect the relationship between academic performance and substance use? For example, we can hypothetically compare two schools; the first school has higher levels of an underlying trait of school institutional problems, which is reflected in higher levels of teen pregnancy, drug use, violence, and lack of or mis communication among school actors. This school is compared to another with lower levels of school institutional problems.

Now, in consideration of the topic of this dissertation, if a student were to attend the first school, would he or she be embedded in a social environment that might protect from substance use consumption and promote the achievement of better grades? Would the risk of engaging in more substance use and achieve lower grades be higher

in the second school?

As mentioned before, a plausible explanation that addresses the questions above implies that the institutional problems can be the reflection of a "cocktail" of school problems affecting the school environment and therefore affecting the I-C space. The I-C spaces can be disrupted interfering with academic activities creating an overall environment that unintentionally and ultimately are translated into more substance use and decrements on academic success.

1.3.2.3 Guiding conceptualization 3: the systematic and institutional effect of school policies and practices

School policies and practices might, in some contexts, mainly be determined by the principal and teacher management of the school, while in other contexts, school policies and practices might be determined by other stakeholders of the educational system such as the Department of Education or the school district's board. Policies and practices also usually reflect the organizational aspects that determine sets of rules for students. However, is it possible that policies and practices have no discernible influence on the behaviors, habits, and ultimately on student achievements?

The existence of practices and policies is a necessary but not sufficient condition to exert intended influences on school actors. For example, anecdotally, I remember that in my high school smoking and drinking were prohibited. However, it was well known among some senior students that it was possible to bring cigarettes to the discipline office and smoke with the school officer in charge of discipline. Clearly, for some students the non-smoking policy was not enforced, not only once, but repeatedly. This might imply that the mere existence of policies against smoking is not a sufficient condition to prevent cigarette use among students.

In light of the above example, should practices and policies be recognized and respected by all members of the school? Typically, it would be expected that practices

and policies are institutionalized in order to increase the chances to obtain the desired influences. For the purpose of this dissertation, this concept of institutionalized policies and practices relies on three assumed conditions: systematicity, universality, and constancy.[7]

The underlying idea of the effect of policies and practices can be understood making a parallel with parenting styles at home, management of business, and leadership in political institutions. Indeed, the school can be conceptualized as a unique social institution that shares features of family, business, and politics. In this unique institution, policies and practices play more than a regulatory role that have to adapt to the several demands from all school actors. However, the adaptation to the demands of the school actors might imply that practices and policies can be the results of external forces deriving from explicit directions of what is socially valued, expected, and approved within and outside the school settings. All these external and internal social forces might shape policies and practices reflecting influences of the school context.

As in the case of the first two conceptualizations, practices and policies can be classified into two sets: one set is related to general policies that affect all students, which are usually created, transmitted, and enforced by the principal and school committees. The second set is created, transmitted and enforced by the teacher and mainly affects the classroom, and is closely related to instructional practices, class time administration, and classroom management. This second set is omitted for the purposes of this dissertation. Conceptually it might be more than interesting to consider them; however, to the best of my knowledge, there are no studies that report this set of policies and practices in detail and with sufficient statistical power to conduct reliable analyses. In addition, the inclusion of class policies and practices implies one more layer of complexity, the inclusion of the classroom level; which immediately will complicate all aspects of the work in this dissertation.

[7]Testing and relaxing these assumptions go beyond the scope of this dissertation.

Based on what was described above, we can expect that these school policies and practices provide students with general and specific guidelines, such as policies against smoking, drinking, delinquency, policies related to truancy, and general norms of behavior and dress codes. These guidelines might also specify how school actors interact. If the main purpose of these policies and practices is to generate an appropriate school climate that organizes and supports the school activities; then is it possible that these policies and practices impact specific aspects of the adolescent development, such as the relationship between academic performance and substance use? Indeed, it might be possible, as suggested by some previous research, that school practices and policies explain academic performance and academic achievement (Gaddy, 1988).

For this dissertation let us focus only on policies because the operationalization of practices is problematic; practices imply reports on students behaviors that should mirror the school policies, to the best of my knowledge there is no study that captures the structure between policies and practices (please see the methods section for a detailed operationalization of school policies).

Specifically, institutionalized policies, such as policies against delinquent behaviors, against drug use and possession, and school attendance policies, might promote safer and more structured school environments, reflecting on safer and more structured I-C spaces where adolescents have more opportunities to channel what they bring from home. Could then, after holding all other influences constant, these students be less vulnerable to engage in substance use and be more likely to get good grades in school subjects? Although, we might intuitively expect a positive answer to this question; it is necessary to empirically test this conceptualization.

1.3.2.4 Guiding conceptualization 4: effects of school academic pressure: academic practices, goals, and expectations

Similar to the case of policies and practices, school academic pressure (usually set in the school context by teachers and principals and -outside the school context- mainly by parents) can be influential on students. To illustrate this idea, the assumption is that schools where academic expectations are higher can generate I-C spaces that engage teachers, students, and parents in hard work to meet the schools' expectations. On the other hand, schools with lower academic expectations could promote unstructured or neglectful I-C spaces, whereby teachers, students, and parents might not feel the need to work harder on the students' academic endeavors.

Academic pressure could, potentially, provide more structure to the roles that schools expect from their students. Imagine a school with high levels of academic pressure; in such a school, teachers and principal would orient the school environment towards academics, and students would attend school knowing that their main purpose is to be successful in the academic domain. Would it then be expected, holding all other factors constant, that the same students attending this kind of school could achieve better grades compared to the hypothetical case when attending another school with lower levels of academic pressure?

As mentioned before, the intuitive idea linked to this conceptualization is that academic pressure (academic demands and expectations) potentially would generate I-C spaces; thus, forcing students to spend more time on academic tasks and other extra curricular activities, in and outside the school, taking away unstructured leisure time that could promote substance use; therefore, affecting the relationship between academic performance and substance use.[8]

[8]The operationalization of academic pressure is clearly described in the methods section.

1.3.3 Summary

In conclusion, all four of the working conceptualizations described above rely on the school context definition outlined before. Students usually bring to schools attributes, habits, behaviors, skills, knowledge, energy, attitudes, expectations, and ideas. In other words, adolescents bring their existence; and the school receives them providing a social context, which in turn can establish certain conditions for their academic performance and substance use. It is worthwhile to explore whether under these conditions students either achieve good grades and/or become more likely to engage in drug consumption.

Framing school contextual effects under these four conceptualizations can provide an initial understanding and interpretation as to how the school context can affect the typical inverse AP-SU relationship. This point brings us back to the empirical question that guides this dissertation. Would the school context –understood as the set of factors related to the four conceptualizations– influence the dynamic between academic performance and substance use? The remaining work in this dissertation is to empirically address this general research question. In the following section, I expand this research question and generate interpretations that might explain school effects on the AP-SU relationship.

1.4 Research questions

Based on what has been discussed so far, I propose five general research questions along with general hypotheses that guide my intellectual curiosity about why and how the school context could affect the AP-SU dynamic. Assuming all other factors constant, five general research questions are outlined next.

1.4.1 Question and general hypothesis related to the academic performance and substance use dynamic

Question 1: *How are academic performance and substance use related across time during adolescence?*

General hypothesis 1: Based on previous research it is expected that AP and SU are inversely related at the individual level. At the school level, it can be expected that school contexts that promote higher levels of academic performance are also contexts where substance use is more likely to happen because students are allocated to schools representing clusters of the student population; thus academic performance and substance use are likely to be observed simultaneously at schools. Based on previous research on academic performance and substance use, it is expected that AP and SP share multiple influences reflected across time; at the student level, it is expected that there are cross effects (AP/SU in time 1 affects SU/AP in time 2) and lagged effects (AP/SU in time 1 affects AP/SU in time 2). However, at the school level only lagged effects are expected because school do not systematically attempt to reduce substance use while improve academic performance.

1.4.2 Questions and general hypotheses related to school context effects

Question 2: *Does the composition of the student body influence the relationship between school levels of academic performance and school rates of substance use, thus affecting academic performance and substance use?*

General hypothesis 2: Based on what was discussed in guiding conceptualization 1 and under the theoretical assumption that characteristics of the student body composition can affect I-C spaces, it is expected that factors representing the student body composition can have effects on school levels of academic performance and school rates of substance use, thus affecting the dynamic between AP and SU.

Question 3: *Do school institutional features influence the relationship between*

school levels of academic performance and school rates of substance use, thus affecting AP and SU?

General hypothesis 3: Based on guiding conceptualization 2 and assuming that school institutional features can affect I-C spaces; it can be expected that measurements representing these institutional features will affect the relationship between academic performance and substance use. In general, it is expected that school institutionalized problems will generate school contexts that can promote substance use among students and represent more challenges to achieve higher levels of academic performance.

Question 4: *Do school policies affect the relationship between the school levels of academic performance and the school rates of substance use, thus affecting the AP-SU relationship?*

General hypothesis 4: Based on what was discussed in guiding conceptualization 3, it can be hypothesized that school policies will have a preventive effect on the school rates of substance use and could contribute to generating school environments that are safer for learning activities, thus affecting the school levels of academic performance; in turn, affecting the relationship between academic performance and substance use.

Question 5: *Does the school academic pressure influence the relationship between school levels of academic performance and school rates of substance use, thus affecting the relationship between AP and SU?*

General hypothesis 5: Based on what was discussed in guiding conceptualization 4, it can be anticipated that factors representing school academic pressure will have positive effects on the school environment promoting higher levels of academic performance and reducing rates of substance use, thus affecting the dynamic between AP and SU. A more detailed interpretation will be provided in the results sections in Chapter IV and also expanded in the discussion section.

To address these research questions and reflect the dynamic between substance use and academic performance, and to estimate contextual effects on the school levels of academic performance and the rates of substance use; it is mandatory to use longitudinal data that could overcome the limitation of cross-sectional designs. Thus, this dissertation relies on data collected by The National Longitudinal Study of Adolescent Health (Add Health). This data allow for two time points of measurement and contain several measurements related to substance use, academic performance, and student and school level factors. More details on these data, the population and sample, the measurements and operationalizations used, together with the analytic approach, are presented in the following chapter.

Chapter III presents results related to research question 1, describing how substance use and academic performance are related at the individual and school levels. Chapter IV presents results related to questions 2 to 5 accounting for school context effects on the academic performance-substance use dynamic. Finally, Chapter V contains a discussion of the results presented in this dissertation; this final chapter also outlines general policy recommendations for educational programs and drug use prevention problems.

CHAPTER II

Methods

2.1 Population and sample

2.1.1 Population

Given that the primary focus of this dissertation is to investigate the effect of the school context on the relationship between academic performance and substance use, the population targeted is composed of US adolescents attending high schools. Adolescents who attended special education schools and were home schooled are excluded. Traditionally, special education in educational research has its own domain of specialization and the focus of this dissertation is out of this domain. Home schooled students are excluded for one obvious reason: home schooled students do not attend schools.

From all the available educational and substance use datasets, there is one special study that brings a unique opportunity to address the research questions that guide this dissertation. This study is The National Longitudinal Study of Adolescent Health (Add Health). Add Health's longitudinal component consists of a nationally representative sample of about 15,000 US adolescents who attended grades 7-12 during the 1994-1995 school year. This study currently has four waves of data collection. Data for the first wave were collected in the 1994-1995 school year, data for the second

wave were collected in 1996, data for the third wave were collected in 2001-2002, and the last wave was carried out in 2007-2008.

Add Health is probably the largest and most comprehensive longitudinal survey of adolescents ever undertaken in the US combining longitudinal survey data on adolescents' social, economic, psychological, educational and physical well-being with contextual data on the family, neighborhood, community, school, friendships, peer groups, and romantic relationships. Some of the adolescent topics measured are the social and demographic characteristics of respondents, the education and occupation of parents, household structure, risk behaviors, expectations for the future, self-esteem, health status, networks and friendships, school academic indicators (transcripts and self-reports of GPA, high school graduation, academic failure and curriculum), and school-year extracurricular activities (Harris, 2011).

Some of the contextual topics covered are neighborhood characteristics, school characteristics such as student body composition, school sector (private or public), religious affiliation, school size, student-teacher ratio, school's programs, academic demands and expectations, and census data on school district characteristics. Add Health provides a rich source of data to study how social environments and behaviors in adolescence are linked to health and achievement outcomes in particular during adolescence and young adulthood.

In the context of this dissertation, Add Health offers an opportunity to explore the effects of the school context on the academic performance-substance use relationship, for the following reasons: First, Add Health consists of a national representative sampling design of adolescents allowing the sample's results to be extrapolated to the population targeted in this dissertation. Second, Add Health is a longitudinal study and thus provides a way of overcoming most of the limitations of cross-sectional designs, such as not being able to adjust the results by previous levels of academic performance and substance use. Third, Add Health sampling has a cohort structure

composed of grades 7 to 12 (all grades of high school) and follows them through all grades in high school. This cohort structure is important because it incorporates into the longitudinal design cross-sectional differences among students attending high schools. Fourth, Add Health collected data on several domains of the adolescents health and development, including educational components such as academic performance and school contextual characteristics. Fifth, the Add Health study covers adolescent behaviors in the first two waves of data collection, thus providing a contemporary psychological and sociological picture of adolescent and early adulthood behaviors.

2.1.2 Sample

2.1.2.1 Add Health sample design

The Add Health study selected a representative sample using a school-based design, where the primary sampling unit was the school. The sampling frame was constructed based on school information from the Quality Education Database (QED). From this frame eighty high schools - defined as any school with 11th grade and more than 30 students- in different communities were selected with probability proportionate to the school size. The schools were stratified by region, urbanicity (urban, suburban, and rural), school type (private, public, and parochial), ethnic mix and size. For each school selected, a feeder school was randomly selected with probability proportionate to the number of students attending the high school. In addition, replacement schools were selected within each stratum until an eligible school or pair of schools was found. The total number of schools selected was 132 because some schools had all grades from 7 to 12, as there was no reason to select a feeder school in these cases (Harris, 2011).

In the 1994-1995 school year, in-school questionnaires were administered to students in all these schools during one single day, taking about 45 to 60 minutes. The

purpose of the questionnaire was to collect information about the school context, friendship networks, and school activities, among others. It was also the purpose to identify special supplementary samples of students within theoretically important social groups such as half and full siblings, twins, and African American adolescents with highly educated family backgrounds. Then, from a list of students from each school roster and students who completed the in-school questionnaire, a sample of students was selected for a 90-minutes in-home questionnaire. This in-home sample of students was selected based on stratification by gender and grade, where about 17 students were selected per strata resulting in approximately 200 students for each high school and its respective feeder school. The total number of students selected for the in-home questionnaire comprise the core sample, which is representative of American adolescents attending grades 7 to 12. From these students about 85% had parents who completed a 30-minute interview with questions about inheritable health conditions, marriage, demographics (ethnicity, age, education, income), parent adolescent relationships and parental awareness of their children's friends and their respective parents.

In addition to this core sample, eleven supplemental samples with special characteristics were oversampled, resulting in a total of 20,745 adolescents interviewed in Wave 1. The core sample is the base for the follow ups in the Add Health longitudinal component. In 1996, Add Health collected the second wave of data interviewing 14,738 students attending grades 8 to 12. Details of data collection are available in a technical report by Harris (2011). The sample designed used school as the primary stage unit (PSU), stratified by region and the final weights were adjusted by unequal probability of selection, non response, and post stratification (Tourangeau and Shin, 1999).

2.1.2.2 Analytical sample

The analytical sample was determined by the measurements of AP and SU in Wave 2. This analytical sample consisted of 13,568 adolescents including grades 7th to 12th nested in 132 schools. From the original 20,745 adolescents sampled in Wave 1 only 14,738 were sampled in Wave 2; and from them only 13,568 had longitudinal multilevel weights available. Adolescents with no weights were removed from the analysis because the lack of weights does not allow analysis to be performed taking into consideration the Add Health sample design. The analytical sample also excludes adolescents attending 7th, 8th, and 12th grades in Wave 1 reducing the number of students to 7,984 adolescents. In addition, 141 adolescents were also excluded because they were not attending schools in Wave 1 or 2. However, as recommended by survey experts, the analysis were performed using the complete sample of 13,568 students in order to allow for the incorporation of the sample design and guaranteeing the correct estimation of parameters and standard errors (Heeringa et al., 2010). To manage this situation, a dummy indicator was created where 1 indicates analytical sample and 0 non-analytical sample. The distribution of this dummy is 7,843 coded as 1 representing 58% of the 13,568; the rest of the participants were assigned 0. To be more specific, all statistical analysis and results were focused on the 7,843 students nested in 114 schools using the sample design for the 13,568 students and 132 schools. No statistical results were generated for students that were not part of this analytical sample.

Table 2.1 presents proportions and means estimated that describe characteristics of students attending grades nine to eleven. These estimates represent an extrapolation to the targeted US adolescent population used in this dissertation. For example, about 50% of the adolescents were female while almost 2/3 were white, about 15% were African American and a little more than 10% were Hispanic. The average age was 15 years old.

	Estimate	C.I.	
		Lower	Upper
Student gender			
Male	0.497	0.479	0.515
Female	0.503	0.485	0.521
Student ethnicity			
Hispanic	0.117	0.072	0.163
White	0.652	0.578	0.727
African American	0.149	0.097	0.200
Asian	0.040	0.020	0.059
Other/Amer. Ind./mixed	0.042	0.034	0.050
Grade repetition			
Never repeated	0.809	0.785	0.833
Repeated at least once	0.191	0.167	0.215
Grade attended			
Ninth	0.366	0.341	0.391
Tenth	0.341	0.325	0.358
Eleventh	0.293	0.278	0.308
Family SES	0.078	-0.024	0.179
Student age	15.661	15.564	15.757

Table 2.1: Estimated proportions for student level covariates: National estimates for adolescents characteristics who were attending grades 9-11; C.I.: 95% Confidence Interval in the estimated parameter distribution ($n = 7843$).

	Estimate	C.I.	
		Lower	Upper
School sector: Proportions			
Public comprehensive	0.452	0.314	0.591
Public Magnet/other	0.105	0.026	0.185
Public Choice	0.251	0.145	0.357
Private	0.191	0.049	0.334
Percent repeated	0.221	0.191	0.252
Ethnicity composition: Proportions			
90% white	0.378	0.238	0.517
90% white and $\leq$ 5% minority	0.267	0.156	0.378
76%-89% white and $\leq$ 20% minority	0.179	0.048	0.310
50%-75% white and $\leq$ 20% minority	0.160	0.072	0.248
$\leq$ 50% white and $\leq$ 100% minority	0.016	-0.003	0.035
School Average age	14.50	14.15	14.85
School Average SES	-0.05	-0.167	0.067

Table 2.2: Estimated proportions for school characteristics: National estimates for school characteristics with grades 9-11; C.I.: 95% Confidence Interval in the estimated parameter distribution ($k = 114$).

Table 2.2 shows national estimates describing some school characteristics; for instance about 45% were comprehensive public schools, about 35% were magnet or choice public schools and about 20% were private schools. The average age composition was 14 year and a half, about 83% of the schools were mainly composed of white students, and the remaining of them had a mixed composition with less than 75% white with presence of minority –African American and Hispanic– and other groups.

2.2 Measurements and operationalization

2.2.1 Indicators for academic performance and substance use factors

Both Substance use and academic performance were measured in Waves 1 and 2. This means that there was one measurement of SU per wave, as well as one measurements of AP per wave. A total of four factor scores were estimated to operationalize the two outcomes. These operationalizations were constructed based on the adolescents reports about SU and school grades in the In-home questionnaires at Waves 1 and 2. The measurements of academic performance were based on the questions asking for grades in mathematics, English, history or social studies, and science. The measurements of substance use were constructed base of the questions related to the consumption of alcohol, cigarettes and marijuana. The following paragraphs describe how these indicators were constructed. A detailed description of how these factors were operationalized and constructed are presented in the next chapter.

Academic Performance, as mentioned in Chapter I, is conceptualized as the students' performance during the school year in several subjects. This performance is reflected in the grades that students are assigned by their teachers during the school year in all the courses taken. The operationalization of AP was based on the student self-report of grades at the most recent grading period in four subjects: English or language arts, mathematics, history or social studies, and science.[1] Students reported these grades at Waves 1 and 2. For example, in Wave 2, students were asked to report the last grades in the four subjects mentioned above. Students reported this grades in the in-home questionnaire section 6: academics and education, questions 7 to 10, for more details see (Harris and Udry, 1998, 1999). These grades were coded in an ordinal scale: D or lower, C, B and A. The AP outcome variables in both waves were

[1] student's average GPA (in mathematics, English, foreign language, social studies, Science and physical education) were available from the transcripts records; however, there were more than fifty percent missing in each GPA making impossible the use of the transcript information.

conceptualized as a latent factors assuming the existence of a general latent academic performance. These latent factors used as indicators the grades in the four subjects reported in each wave. These latent factors were estimated using Confirmatory Factor Analysis (CFA), where greater values of the factor indicate greater levels of AP. The measurement properties and more details are described in section 3.1.

Table 2.3 presents estimated proportions for each one of the indicators described above. For example, it is estimated that the proportion of students achieving the highest grade (A) in English and social studies was about 10%, in mathematics about 15%, and in science 11%.

Substance Use was conceptualized as the adolescents' consumption of three drugs: alcohol, cigarettes and marijuana. The operationalization of SU assumed the existence of a general latent trait of consumption that clustered together these three substances. As in the case of AP, two latent factors, using CFA, were estimated to account for adolescent SU at Waves 1 and 2. These latent factors used nine indicators based on the student's self-report, in the in-home questionnaires, on his or her consumption of alcohol, cigarettes, and marijuana. For example, in Wave 2, the questions used to construct the SU factors were in section 27: Tobacco, Alcohol, Drugs–Audio CASI. A similar section can be found in the In-home questionnaire for Wave 1 (Harris and Udry, 1998, 1999). The latent factors used three indicators of smoking, four of alcohol and two of marijuana.

The smoking indicators, in Wave 2, were constructed based on questions 1,3, 5 and 7. The first smoking indicator used the dichotomous response (1=yes, 0=no) for questions 1 and 3. Question 1 asked if the adolescent ever smoked at least 1 or 2 puffs since Wave 1 and question 3 asked if the adolescent regularly smoked (by regularly meaning at least one cigarette per day for 30 days). The responses were combined in a single ordinal variable with three categories where 0 means never smoked, 1 accounts for ever smoked at least 1 or 2 puffs, and 2 accounts for smoked regularly.

	Wave 1			Wave 2		
	Estimate	**C.I.**		**Estimate**	**C.I.**	
		Lower	**Upper**		**Lower**	**Upper**
English						
A	0.111	0.098	0.125	0.101	0.087	0.115
B	0.235	0.216	0.255	0.212	0.193	0.231
C	0.369	0.344	0.393	0.396	0.374	0.418
D	0.285	0.258	0.311	0.291	0.26	0.322
Mathematics						
A	0.176	0.157	0.195	0.154	0.138	0.17
B	0.253	0.235	0.272	0.269	0.251	0.288
C	0.313	0.297	0.33	0.314	0.297	0.332
D	0.257	0.234	0.281	0.262	0.242	0.283
Social studies						
A	0.109	0.093	0.125	0.098	0.079	0.117
B	0.208	0.19	0.226	0.216	0.194	0.238
C	0.335	0.316	0.355	0.325	0.307	0.344
D	0.348	0.318	0.377	0.36	0.329	0.392
Science						
A	0.127	0.11	0.144	0.113	0.097	0.129
B	0.228	0.212	0.244	0.236	0.217	0.256
C	0.340	0.323	0.357	0.34	0.321	0.359
D	0.304	0.281	0.327	0.311	0.284	0.337

Table 2.3: Estimated proportions for academic performance Indicators: National estimates for adolescents attending grades 9-11; C.I.: 95% Confidence Interval in the estimated parameter distribution ($n = 7843$).

The second indicator, in Wave 2, was based on the responses to question 5 which asked the number of days that the student smoked during the past 30 days. These responses were grouped in an ordinal variable with four categories (0: never smoked, 1: smoked less than 7 days, 2: smoked 8 to 25 days, and 3: smoked more than 26 days up to the 30 days). The third indicator uses the responses for question 7; which asked for the number of cigarettes smoked each day on the days the adolescent smoked in the past 30 days. The number of cigarettes smoked were categorized into an ordinal variable with four categories (0: none, 1: 1 to 2 per day, 2: 3 to 9 cigarettes per day, and 3: ten or more per day).

The indicators for alcohol consumption, at Wave 2, were constructed based on questions 19 to 22 in the same section 27 used for the smoking indicators. The first alcohol indicator used responses from question 19 that asked for the number of days that adolescent drank alcohol in the past 12 months. The responses to this question were recoded into an ordinal variable with five categories (0: none, 1: 1 or 2 days, 2: 1 in a month or 3-12 times a year, 3: 2 or 3 days per month, and 4: 1 to 7 days a week).

The second indicator was based on question 20 that asked how many drinks the adolescent had each time that he/she drank in the past 12 months. The responses were collapsed into four categories in an ordinal variable (0: none, 1:1 drink, 2: 2 to 3 drinks, 3:4 to 6 drinks, and 4: 7 or more drinks).

The third indicator used responses from question 21 (how many days drank five or more drinks over the past twelve months), these responses were recoded into an ordinal variable with four categories (0: none, 1:1 or 2 days, 2: 1 to 3 days in a month or 3 to 12 days in a year, 3: 1 or more days per week).

The fourth indicator used responses to question 22 that asked for the number of days that the adolescent had gotten drunk or very, very high on alcohol. As the third indicator, the responses to this question were recoded into four identical categories

(0: none, 1:1 or 2 days, 2: 1 to 3 days in a month or 3 to 12 days in a year, 3: 1 or more days per week).

The two marijuana indicators, at Wave 2, were based on questions 45 (number of times tried marijuana since the last interview) and 46 (in the past 30 days how many times used marijuana) in the already mentioned section 27. The responses to these two questions were recoded in two ordinal variables. The first, has three alternatives (0: none, 1: 1 to 9 times, and 2: 10 or more times). The second variable had also three alternatives (0: none, 1: 1 to 6 times, and 2: 7 or more times). The indicators of the three substances are categorical ordinal variable where higher values indicate more consumption; therefore, higher values in the latent score indicate higher levels of consumption.

Similar to Wave 2, the Wave 1 indicators for SU and AP were based on the same items asked in the In-home interview at Wave 1. The latent factors for SU and AP at Wave 1 were constructed using the same indicators and following the same process utilized to build the factor scores at Wave 2. The measurement properties and more details about these four factors are presented in the first part of Chapter III.

2.2.2 Indicators for school levels of academic performance and school rates of substance use

The measurement for the school levels of academic performance and school rates of substance use were estimated as part of the measurement model that decomposes academic performance and substance use in two levels: student and schools. These school levels indicators are latent factors automatically estimated by the statistical software based on the student level indicators described for substance use and academic performance. More details about how these factors were constructed are presented as part of the results in Chapter III.

2.2.3 School context measurements

The school measurements related to the school context were constructed using two main sources of information: In-School questionnaire and the school administrator questionnaire. All these measurements were conceptually derived from the four guiding conceptualizations. In addition, the school measurements were constructed under the assumption that the school context cannot be directly observed; thus all the school measurements are represented by latent factors that reflect on school level indicators.

All the factor structures were estimated using two procedures. The first procedure used only Confirmatory Factor Analysis (CFA). This procedure was used when the wording of the indicators clearly suggested a factor structure. The second procedure used Exploratory Factor Analysis (EFA) with a random sub-sample using half or one third of the total sample, and then CFA was used to confirm the factor structure suggested by the EFA. The CFA used a sub-sample containing the students who were excluded from the EFA analysis. In this final step, the factors scores were estimated for the whole sample using CFA. (Note that this procedure was used when the wording of the indicators did not suggest a clear structure). In all cases, the correlations of errors are based on conceptual decisions always accounting for a second conceptualization that accounts for another source of variation, which was not accounted for the main factor or compensated the existence of two factors suggested by the EFA but estimated only as one factor.

The following subsections describe each of the school factors that were used in the estimation of school context effects; please see appendix A for specific details about each factor.

2.2.3.1 Student body composition risk factor

The student body composition measurements come from the Add Health In-School questionnaire administered in Wave 1. This self-administrated questionnaire contains questions related to social and demographic characteristics, such as gender, ethnicity, religion; education and occupation of parents; household structure; risk behaviors; health status; expectations for the future; self-esteem; friendship and school-year extracurricular activities. This questionnaire was administered to more than 90,000 students from grades seven to twelve in a 45-60 minutes class period. Student who missed school the day of administration and students who did not have signed parent consent forms did not participate.

The Student Body Composition measurements were generated in two steps. The first step, performed at the student level, estimated a set of factors related to adolescents characteristics that can be part of the student body composition. All these factors were aggregated at the school level and then used as indicators for the construction of school level factors in the second step, for details of these factors please see appendix A.[2]

The second step was performed at the school level and estimated one measurement representing an overall aspect of risk status of the school. This school risk factor used as indicators the aggregated factor scores of the following constructs: Emotional Problems (Anxiety/Depress), Somatic Symptoms, Risk Behaviors, Drug Use, Self-Esteem, Sense of Belonging, and Health and Physical Problems. (see appendix A for

[2]Factor analysis makes a distinction between observed measurements and non-observed measurements. Usually, the observed measurements are referred as items or indicators and the none-observed are called latent factors (sometimes referred only as factors), which scores are estimated in a continuous scale (under the assumption of normality and the specifications of the factor model such as error structure and scaling). The items, also named indicators, are the observed measurements that are used as indicators of the existence of the latent factor. For example, intelligence cannot be directly measured, however, intelligence tests assume that the individual's level of intelligence determine what items the individual is more successful to correctly answer or endorse. Thus, the assumption is that only intelligence determine the response to the items or indicators (local independence). This conceptualization is similar for other latent structures such as IRT test scores, attitude scales, and, in this dissertation, the school factors.

	Fit indicators ($n = 128$)	
Chi-square	4.77	
RMSEA	0.068	
RMSEA 90% CI	0.000-0.117	
CFI	0.998	
TLI	0.992	
Indicator	*Loadings*	*Residual variances*
Emotional problems	1.000	0.387
Somatic symptoms	0.892	0.47
Risk behaviors	1.139	0.201
Drug use	1.106	0.227
Self -esteem	-0.978	0.51

Table 2.4: Factor structure for student body composition: school risk factor. Mental health problems construct was accounted using correlated errors between somatic symptoms and emotional (anxiety/depression); similarly risk behaviors and drug use errors were also correlated to account for a strong correlation between risk behaviors and substance use. All loadings are significant at $p \leq 0.001$, $k = 128$.

details of how these factors were constructed).

Using these aggregated school level factor scores, an EFA with half of the sample was carried out to explore the factor structure. The EFA suggested the presence of one clear factor with eigenvalue greater than one composed by the following five factors: Emotional Problems, Somatic Symptoms, Risk Behaviors, Drug Use, and Self-Esteem. Based on these results, a CFA was used to confirm the factor structure and estimate the factor scores.

The results of this CFA are shown in table 2.4. The goodness of fit seems good except for the Root Mean Square Error Approximation (RMSEA) indicator (it is above .05 with a CI with an upper bound greater than .1), which might be indicating some miss-fit of the model; however, Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) are above 0.99 indicating a very good fit (see Chapter 3, section 3.2.1,

for a more detail of the goodness of fit in CFA. Usually RMSEA below 0.05 and TLI and CFI above 0.90 or .095 are expected as indicators of good fit).

This school factor is driven by the Risk Behavior scores, (higher scores indicate more risk behaviors) followed by drug use and Emotional Problems (Anxiety/Depression). Self-Esteem had a negative loading indicating that greater levels of the Student Body Composition School Risk Factor score reflect on lower levels of Self-Esteem. Based on the loadings the interpretation of this factor is a 'general' School Risk Factor. This school risk factor was standardized (mean: 0 and Std. Dev.: 1). Higher scores represent higher levels of risk at the school while lower scores represent absence or low risk levels (i.e. a more protective environment).

2.2.3.2 School institutional features factors

School institutional problems, drugs and pregnancy: Two factors were estimated using questions 24a-24j answered by the principal in Wave 2 interview, see Appendix A, section A.1.2 for a detailed description of these items (see Harris and Udry (2002b) for a reference of the questionnaire). The principal reported how much of a problem each of the indicators represented for the school using a three-level ordinal scale (no problem, small problem, and big problem). These factors were constructed in three steps: an exploratory factor analysis, a confirmatory factor analysis and the estimation of the factor scores for all the school sample.

The first step fitted an EFA, in 66 schools, to estimate the factor structure among the problems reported by the principal. The EFA suggested the presence of two factors with eigenvalues greater than 1. In one of these factors loaded smoking, drug use, alcohol, and teen pregnancy; the second factor included responses to questions 24d to 24j (gang violence, sexual harassment, teen pregnancy, vandalism, eating disorders and racial conflicts).

Based on the EFA results, the second step subsequently estimated a CFA to

confirm the two factor structure. This CFA used 62 schools, not included in the EFA step. The model fit is good for the factor structure with two factors. Finally the third step used another CFA to estimate the factor scores in the 128 schools. Table 2.5 presents the results of these two CFA. The structure of the EFA was confirmed for all the items except for teen pregnancy that had a statistically non- significant loading in the second factor. This item was not considered in the CFA that estimated the final factor scores. The interpretation of these factors was clear, the first factor was driven by drug use and teen pregnancy; this factor was labeled as Drug and Pregnancy Problems (DPP). Teen pregnancy is probably capturing risk sex behaviors, given that risk sexual behavior was not an alternative in questions 24. This factor could also be interpreted as a risk behavior factor involving drug use and sex behaviors, however, I think it is better to outline it as drug use and pregnancy.

The second factor was interpreted as a general School Institutional Problems (SIP) factor driven by sexual harassment, eating disorders and gang violence, followed by stress and pressure, vandalism and racial conflicts.[3] These two factors scores were standardized to have mean 0 and standard deviation 1, where higher values in the score imply greater levels of drug and pregnancy and more school institutionalized problems. Lower levels of the factor indicate absence or little drug and pregnancy problems as well as absence of lower levels of institutionalized problems.

School institutional feature: school social and academic problems: this factor was constructed at the student level using CFA and then the factor scores were aggregated at the school level. Using four items from the In-School questionnaire, students were asked how often they have problems: in getting along with your teachers, in paying attention in school, in getting your homework done, and in getting along

[3]Note that I am making the distinction between the factor scores reported by the students body composition and the factor scores reported by the principal about problems in his or her school related to the students. In doing so, I am assuming that the principal will report any of the items in question 24 as a problematic school situation because he has noticed a trend in the school. In other words, I am assuming that a problem is only noticed once it becomes institutionalized. This is a main conceptual distinction also highlighted in Chapter I.

Fit indicators	*Model 1* ($n = 62$)		*Model 2* ($n = 128$)	
Chi-square	28.5		37.9	
RMSEA	0.000		0.030	
RMSEA 90% CI	0.000-0.070		0.000-0.073	
CFI	1.000		0.998	
TLI	1.000		0.997	
Indicator	*Factor loadings*			
	DP	*SIT*	*DP*	*SIT*
24.*School problems as reported by principal*				
a.Smoking or tobacco use	1.369		1.295	
b.Drug use	1.566		1.461	
c.Alcohol use	1.516		1.411	
d.Gang violence		1.000		1.000
e.Sexual harassment		1.122		1.125
f.Teenage pregnancy	1.000		1.000	
g.Vandalism/thieving		0.894		0.892
h.Eating disorders		1.198		1.149
i.Racial conflict		0.906		0.808
j.Stress or pressure		1.036		0.991

Table 2.5: Factor structure for school snstitutional feature: school institutional problems, and drugs and pregnancy problems. All factor loadings are significant at $p \leq 0.001$. Indicators had as response alternatives a three level ordinal scale (no problem, small problem, and big problem).

Indicators	*loadings*
46.*How often have you had trouble:*	
a. getting along with your teachers?	0.771
b. paying attention in school?	0.784
c. getting your homework done?	0.733
d. getting along with other students?	0.766

Table 2.6: Factor structure for school social and academic problems. Loadings are standardized and significant at $p \leq 0.001$. Indicators had as response alternatives a five level ordinal scale (0:never to 4: everyday). RMSEA 0.077, RMSEA 90% CI = (0.071,0.083), CFI = .999, TLI=0.992. Errors between the academic indicators were correlated 46b with 46c, $n = 85413$.

with other students (questions 46a to 46d, see Appendix A, table A.8). This measurement is not considered as part of the Student Body Composition because these items gathered information about the students interactions with teachers and other students, and school activities (such as homework and being able to pay attention during classes).

The results for the CFA are displayed in table 2.6. The goodness of fit is good, the RMSEA is a little above 0.05 indicating some miss-fit of the data; however, CFI and TLI are above 0.99 indicating a very good fit of the data. This factor is evenly driven by the four items (their loadings are very close to each other). The interpretation of the factors was conceptualized as a general indicator of school troubles between teachers and students as well as troubles with academic activities, such as paying attention and doing homework. The estimated factor score was aggregated to the school level and standardized with mean zero and standard deviation one. Higher values in the score indicate more presence of social and academic problems in the school.

2.2.3.3 School practices and policies factors

Based on the third guiding conceptualization (see 1.3.2.3), two factors were estimated to represent policies at the school. The estimation of these two factors relied on the assumption that part of the school context is constituted by a latent trait that reflects on school policies. Schools with with stronger policies would have higher levels of this latent trait, while schools with no need or less stronger policies would have lower levels or scores in the estimation of the factor score.

These two factor scores were estimated based on EFA and CFA among a group of selected items from questions 31a-31x -questions from the School Administrator questionnaire (Harris and Udry, 2002a). From these questions, only the items about policies against first occurrence were selected, the responses to the items ranged from 1 no policy to 7 expulsion (see Appendix A, table A.9 for a list of the items used in the construction of these factors). First, an EFA was carried out to estimate the factors structure resulting in two meaningful factors with eigenvalues greater than 1.

Based on the factor structure suggested by the EFA, a CFA was estimated to test the factor structure and estimate the factor scores. The results of the CFA are shown in table 2.7. The factor structure showed one factor mainly driven by the following indicators: fighting with students, injuring another student, verbally abusing a teacher, and stealing school property.[4] The second factor is driven by possession and use of alcohol and illegal drugs. These two factors were interpreted as a factor of Policies Against Delinquent Behaviors (PADL) and a factor of Policies Against Drug Use and Possession (PADR). These two factors were standardized (mean:0 standard

[4]It is interesting to note that smoking loaded in this factor. It seems that the policies against smoking correlated with the policies against delinquent behavior. In addition, this item did not loaded in the drug use and possession factor, suggesting that policies against smoking do not fit in the same category as policies against alcohol and illegal drugs. On the other hand, the possession of a weapon loaded with the drug use and possession factor but not in the delinquent behaviors factor. This suggests that principals might see alcohol and illegal drugs as misbehaviors with similar levels of punishment to weapon possession while smoking might have similar levels of punishment to delinquent behaviors.

Indicators	*PADL*	*PADR*
31.*In your school, what happens to a student who is caught:*		
c. Fighting with another student	1.000	
e. Injuring another student	0.866	
g. Possessing alcohol		1.000
i. Possessing an illegal drug		0.802
k. Possessing a weapon		0.579
m. Drinking alcohol at school		0.864
o. Using an illegal drug at school		0.728
q. Smoking at school	0.555	
s. Verbally abusing a teacher	0.710	
u. Physically injuring a teacher		0.701
w. Stealing school property	0.738	

Table 2.7: Factor structure for School Practices and Policies: Policies against delinquent behavior and Policies against drugs use and possession. All loadings are significant at $p \leq 0.001$. Indicators had as response alternatives a six level ordinal scale (1:no policy to 6:Out of school suspension). RMSEA = 0.048, RMSEA 90% CI = (0.000,0.081), CFI = .995, TLI=0.994. Errors between the possession (31i) and use of illegal drugs (31o) indicators were correlated, $k = 128$.

deviation: 1) and higher scores indicate the more need or presence of stricter policies. Lower levels indicate the absence of policies or less stricter policies.

2.2.3.4 School academic pressure factor

The fourth conceptualization assumes the existence of a school context latent trait that exerts academic pressure on students; this trait was operationalized by two factors. To build these factors, eight indicators were constructed using the reports of the principal and students in the In-school questionnaire. Principals reported the percentage of dropout in each grade (questions 18a-18f, for example response to question 18a gathered the percentage of dropout in grade 7; similarly, the responses to the subsequent items gathered the percentage of dropouts for grades 8, 9, 10, 11 and

12); the percentage of retention in each grade (questions 19a-19f, similar to question 18, responses to 19a are the percentages of retention in grade 7 and items 19b to 19f account for retention rates for grades 8 to 12); and the presence of tracking and ability groups in the school, question 23a for grade 7, 23b for grade 8 until item 23f for twelfth grade (Harris and Udry, 2002a).

The presence of tracking and ability groups was collapsed into one single indicator where 1 accounts for tracking or ability groups in at least one grade from 7 to 12, and 0 when there was no tracking at all in the school. The percentage of retention and the percentage of dropout were categorized into two indicators with three ordinal categories (0: No retention across all grades, 1: mostly 1% or more retention/dropout in 3 grades, and 2: 1% or more retention/dropout in 4 grades or 5% or more retention in 2 grades). The last indicator used from the principals' report is the percentage of 12th graders in academic or college preparatory instructional programs (question 22a).

From the In-school questionnaire, three questions were used asking about: the level of effort put in academic activities (question 48 alternative b); student expectations to attend college (question 45e); the student participation in academic clubs –Debate team (44a7), History club (44a10), math club (44a11), Science club (44a12) and participation in Honor society (44a31). These In-school questions were aggregated to the school level reflecting the following: question 48 accounted for the percentage of students that tried to do their best but not as much as they can. The aggregation of responses to question 45e represented the percentage of students expecting to attend college; and the aggregation of responses to question 44 represented the average participation in academic clubs.

All eight indicators were used in the estimation of an EFA which suggested the presence of two factors. Based on this factor structure a CFA was carried out in order to confirm the two factor structure. The results of the CFA are shown in table 2.8;

the results confirmed one factor driven by the percentage of students in academic and college preparatory, followed by expectations to attend college and the presence of tracking at the school. The second factor was driven by lower levels of retention and dropout, followed by expectations to attend college. (Note that the indicator related to the amount of effort students put on school work did not load in any of the two factors in the CFA, therefore it was excluded from the final estimations).

The interpretation of these two factor clearly relate to academic pressure, however, I made an arbitrary differentiation. I named the first factor School Academic Pressure (SAP) based on the indicators that loaded in this factor. Higher scores of this factor made the school be more likely to have students attending academic and college preparatory, place their students in tracking or ability groups and have students with expectations to attend college. These indicators, specially the presence of tracking can give the impression that there might be higher levels of academic pressure to some students and not others.

On the contrary the higher scores of the second factor made the school more likely to have very low rates of dropout and retention, more participation of students in academic clubs within the school and higher levels of students expectations to attend college. These indicators can give the impression that the factor accounts for generalized levels of academic pressure that might be evenly applied to all students. This factor was named Generalized Academic Pressure (GAP). In addition, it was interesting to learn that the correlation between this two factors was -.23 ($p \leq 0.05$); meaning that schools scoring higher in generalized academic pressure score lower in selective academic pressure.

2.2.4 Individual level covariates

The set of individual covariates came from the In-Home questionnaire administered in Wave 1. The interview was carried out mainly in the adolescent's home. Some

Indicators	*Selective*	*Generalized*
Percent of 12th graders in academic/college prep	1.000	
Expectations go to college	0.553	1.966
Tracking /ability groups	0.437	
More part in academic groups		1.000
Retention		-2.381
Dropout		-2.422

Table 2.8: Factor structure for school academic pressure: selective academic pressure and generalized academic pressure. All loadings are significant at $p \leq 0.001$. RMSEA = 0.017, RMSEA 90% CI = (0.000,0.091), CFI = .995, TLI=0.992, $k = 132$.

of the most important topics covered in this one/two-hour interview were related to health status, nutrition, peer networks, family composition and dynamics, educational aspirations and expectations, employment, romantic relationships, substance use, and criminal activities (Harris and Udry, 1998). In addition to the In-home questionnaire, a parent, mostly the mother was interviewed in Wave 1. Among all questions, this interviewed asked questions related to inheritable health conditions, marriage and demographics, education and employment, household income, and parent-adolescent interactions. The set of covariates used as individual controls in the analyses were constructed based on the information collected in the parent and adolescent interviews at Wave 1. The following paragraphs describe in some detail the construction of these covariates.

Demographics characteristics were included as control variables. These characteristics were gender represented by a dummy measurement (1: female and 0: male); students age (standardized to mean 0 and Std. Dev. 1), age square was also computed to account for possible quadratic effects of age; student family SES, a composite score based on the mother's report on her education, her partner education and her family income. Mother and father education were measured in years of education. Principal component analysis (PCA) was used to construct the SES score.

This measurement was standardized (mean=0, Std. Dev.= 1). Student ethnicity, four dummies accounted for Hispanic, African American, Asian (Japanese, South Korean, and Chinese), and other groups (Indian American, other Asian groups and mixed ethnicities). The reference category was White.

Academic covariates include grade with two dummies representing grade 9 and grade 10 at Wave1 (Grade 11 is the reference category) and retention, where 1 accounts for the students being retained in one or more grades before Wave 1.[5] The following section explains the analytic procedures.

2.3 Analytic methods

2.3.1 Missing data

For most of the variables used in the statistical analysis missing data were not a problem. Ten out of the fifteen measurements included in the final models had no missing data at all. Three of them had less than 0.1% missing, three of them had 3% missing and only one had 12% missing. Most of the analysis, specially CFA analysis treated the indicators as outcomes and therefore missing data theory was applied to deal with missing data in all the estimation of the factor structures and scores including the outcomes (SU and AP). The covariates with 3% or less missing were retention, age and three of the school factor scores: policies against delinquent behavior, school trouble factor and student body composition school risk factor. These variables that constitute of 3% or less missing can reasonably be assumed as ignorable and random missing, letting the statistical software deal with the missing problem.

However, SES had 12% missing data and hardly can be assumed as missing completely at random. Three procedures were tested to deal with missing data. First,

[5]In previous exploratory analyses, other covariates were used but were systematically non-significant. Some of them were family structure, opportunities to consume alcohol, marijuana and cigarettes, peer pressure and friends drug use.

analysis were performed doing nothing including SES with 12% missing. Second multiple imputation was performed only for SES, and third multiple imputation using a very large pool or variables was performed.[6] The first, procedure was used a reference model against the other two procedures.

The second approach was imputing missing data only for the most problematic variable (SES) with 12% missing data. Five datasets were generated using a large pool of variables in the imputation model including the outcomes and all the covariates present in the models as well as auxiliary variables. Once the multiple imputation was performed the five imputed scores of SES were compared to the none imputed scores. The correlation among these scores and the non imputed score was 1, meaning that, essentially, the six measurements of SES are the same. These five SES imputed scores were combined into one score using the average among the five imputed measurements of SES. This combined score was used in the estimation of the final models instead of the SES score with 12% missing. (Given that SES was used as a covariate the imputation purpose was mainly to avoid loosing cases in the analyses because Mplus does not treat covariates using missing data theory. Another option is to estimate the covariances and run all the analyses using the covariance matrix).

[6]The third procedure was carried out to deal with missing data in a large pool of data; multiple imputation was performed in order to have complete information for all cases in the 13568 students and 132 schools. Given that missing data was less than three percent in most of the variables; five complete datasets were generated using two steps in the imputation. These two steps were necessary because of the multilevel nature of the data. The first step, included the imputation of only the school level variables generating five complete datasets. Then each dataset was merged with the student level data set with missing data comprising five datasets with student level data to be imputed. Each data set was imputed once, generating the final five sets with complete data. MI was carried out using SRCware (IVEware stand alone version). The SIR algorithm was used in the imputation (Raghunathan et al., 2001, 2011).

The results of the multiple imputation seemed to work well for most variables except for the SU and AP indicators. Three attempts were done performing this multiple imputation with more or less variables in the imputation model. All of the attempts systematically reduced the covariance and variances among all the indicators of SU and AP and also underestimated all the ICCs. This was troublesome. More detail inspection is needed to determine if this systematic reduction is correct or something went wrong with the multiple imputation.

2.3.2 Statistical analysis

In order to estimate the school context factors, the statistical analyses were carried out under the Structural Equating Modeling (SEM) framework. This framework was chosen for the following reasons: First, SEM can treat missing data under missing data theory and the use of algorithms that are based on the Full Information matrix. Second, it allows for the conceptualization of latent factor scores using sound and well-established statistical techniques to analyze, cross-sectional, longitudinal, and multilevel data. Third, it allowed for estimating the effects of the conceptualized school factors using a multilevel multivariate longitudinal approach. And forth, it allowed for the exploration of measurements structures in the operationalization of the outcome as well as school latent factors.

Unfortunately the measurement parts could not be incorporated in the final models given the relative small number of schools 114, in the target sample (grades 9, 10 and 11) compared to the greater amount of factors indicators at the school level that a full two level SEM would have. More details about the factor indicators were described in the previous section and details for the operationalization of academic performance and substance use factors are described in the Chapter III.

The statistical analysis were carried in two main sets. The first set is related to the conceptualization of the student outcomes (AP and SU) and school level factors related to academic performance and substance use. To estimate this set of factors multilevel CFA was used constructing latent factors for academic performance and substance use at both school and student levels. In order to account for the dynamic between substance use and academic performance, which reflects a longitudinal co-occurring relationship; an unadjusted multilevel cross-lagged model was estimated.

The second set of analyses had as main objective to estimate school context effects on the school level factors related to substance use and academic performance. The modeling of these effects was built based on the estimation of the dynamic between AP

and SU (i.e. it was built using the unadjusted multilevel cross-lagged model estimated in the last part of the firs set of analysis). Thus, to estimate school context effects, multilevel bivariate conditional cross-lagged models were estimated. The following subsections describe these procedures.

2.3.2.1 Operationalization of academic performance and substance use

The operationalization of SU, AP and the school level factors related to academic performance and substance use (measurement model) was estimated using two level CFA, based on the guidelines by Muthén (1991), who suggested steps to build longitudinal multilevel CFA. However, because of data limitations (small number of schools $k \approx 114$ for most of the final analysis); these steps were used as guidelines resulting in the estimation of the measurement in four steps.

First step: This step involved building the baseline model. This model was conceptualized as the measurement model ignoring the nested structure.

Second step: The second step involved the estimation of the measurement model adjusting the standard errors by the survey sampling design, this step was estimated accounting for the complex survey design.

Third step: The third step involved the estimation of variances and covariances (correlations) for all the indicators at the school level and at the student level, as well as estimating the Intra Class Correlation (ICC).[7]

Fourth step: The four step was based on the results of the previous step and built the multilevel factor structure using multilevel CFA (modeling simultaneously SU and AP and estimating variances and the correlations (covariances) between the SU and AP factors, at the student and school levels). Two multilevel CFA were estimated separately at each Wave (estimation for Wave 1 and another for Wave 2). Ideally, a fifth step is required, where the measurement model combines the two waves

[7] I used within level and student level indistinctly, as well as between level and school level across all chapters.

without testing any crossed or lagged effects among the latent factors. However, this step was not possible because of the limited amount of schools causing many technical problems in the estimations. These steps required more than 400 points of integration, in addition, the number of parameters to estimates at the school level was more than 40 and assuming that 10 cases are required for reliable estimates using CFA, at least 400 schools would be required. To solve this problem and continue with the estimation of school effects, factor scores were computed at each level.

2.3.2.2 Estimation of school context effects

Based on the factor scores estimated in the last step of the measurement model, the final models were estimated using a multilevel bivariate cross-lagged model, combining the ideas outlined by Bollen and Curran (2006) about Conditional Bivariate Autoregressive Cross-Lagged Models and the multilevel procedures developed by Muthén and Muthén (2010). This set of analyses were estimated in three parts. The first parts estimated the unconditional multilevel bivariate cross-lagged model for AP-SU relationship across the two waves of measurement.

The second part added, student level covariates and the third part estimated the school factor effects, generating models for each one of the four conceptualizations. A final model was estimated combining all school factors that had statistically significant effects.

All the Multilevel Analysis and CFA were carried out using Mplus version 6.2 (Muthén and Muthén, 2010). All CFA used the estimator Weighted Least Square Parameter Estimates (WLSMV), factor scores and multilevel models were computed using Maximum Likelihood with Robust standard Errors (MLR) estimator with numerical integration –for details about the estimators see Muthén and Muthén (2010). STATA 12 was used for descriptive statistics, complex cross-sectional survey analysis, and data manipulation (StataCorp., 2011). Finally, all analyses incorporated

the sample design either using complex design or multilevel analysis. A special composite weight was computed for the estimation of the two level models in MPLUS. This composite weight was created using the STATA command suggested by the Add Health documentation (Chantala, 2006).

CHAPTER III

Academic Performance and Substance Use Dynamic

3.1 Academic performance - substance use dynamic

This chapter presents the results related to the operationalization of academic performance and substance use, which includes the decomposition between student and school levels factors. Most important, this Chapter presents results that address research question 1: *How are academic performance and substance use related across time during adolescence?* This research question aims to address the dynamic between academic performance and substance use described in section 1.1.1. This dynamic was explained as a series of multiple effects between academic performance and substance use, where it is difficult to distinguish cause and effect. Thus AP and SU are assumed as two co-occurrences. This Chapter empirically tests this assumption.

Multilevel CFA was used to operationalized and decompose AP and SU between student and school levels. Within the CFA framework, this operationalization is referred as the "measurement model". To empirically test the dynamic between academic performance and substance use (co-occurrences assumption), multilevel bivariate cross-lagged models were used providing empirical evidence to supports this dynamic.

3.1.1 Building the student and school level factors for academic performance and substance use: multilevel measurement model

This step operationalized SU and AP and decomposed the measurements of AP and SU into two levels: student and school. Before presenting any results, briefly, I describe how the conceptualization of the outcomes at the school and student level was operationalized. The operationalization was done using two sets of multilevel CFA: The first set corresponds to Wave 1 and the second set corresponds to Wave 2. In each set of analysis, multilevel CFA simultaneously estimated the student and school level factors related to AP and SU. Each measurement model also estimated the correlation between AP and SU as well as the variance decomposition of the factor indicators: within variance (student level variance) and between variance (school level variance).

Note that each estimated multilevel CFA has five important assumptions related to the error structure, briefly these assumptions are outlined in the following paragraphs. These assumptions were not tested in part because of the limited number of schools and also because of the way the measurements were operationalized within waves rather than accross waves.

First assumption: The indicators of AP are explained only by a general latent factor of Academic Performance, no other possible source of variation was assumed to explain the AP indicators; this is reflected in no error structure.

Second assumption: The measurement of AP is similar but not identical across time. Perhaps, using an example based on a pre-test and post-test would provide better clarification about this assumption. When using a pre-test and a post-test; the two tests, usually, are built with the exact same items or equivalent items based on the number of parameters used in the Item Response Theory (IRT) model. In this case, measurement invariance across time could be assumed -meaning that the two tests are identical. Thus, the factor loadings should be the same in the pre-test

and the post-test. Returning to the measurements of AP, although, the indicators were labeled using the same names (for instance, grade in math in Wave 1 and grade in math in Wave 2); it cannot be assumed that the AP indicators would behave as pre-test post-test measurements. Conceptually the measurements of AP are similar because they relate to the same subject; however, they are different because the course is not the same, the teacher might not be the same implying that the gradings criteria are not the same, the tests or any other graded activities that were part of the final grade cannot be assumed to be the same. All these reasons, strongly suggest that it is reasonable to assume measurement non-invariance across waves. In other, words, the factor loadings were assumed to be different in each wave and were freely estimated.

Third assumption: Given that SU was conceptualized as a general latent factor of drug use, it would be inappropriate to think that only one factor would explain the variation among all the nine indicators, specially if nine accounted for three drugs. Therefore, it was important to account for a second sources of variation. This implied that the errors within in each substance (alcohol, marijuana, and cigarettes) cannot be assumed to be uncorrelated. Thus, the alcohol indicator errors were correlated among them and similarly the errors among the cigarettes indicators.[1] This assumption was not formally tested, but evidence supporting it was carried out comparing the goodness of fit between a model that assumed uncorrelated errors with the model that assumed correlated errors among alcohol indicators and among cigarettes indicators. The results provided partial evidence supporting the model with correlated errors.[2]

Fourth assumption: The measurement of SU is non-invariant across time. Although the SU questions used to build the indicators are exactly the same in the two waves, one conceptual reason drove me to assume non-invariance. The loadings of

[1]It is arbitrary to chose what errors to correlate. The marijuana errors were not correlated to avoid over specifications.

[2]Some researchers would prefer to run an EFA to explore the factor structure of SU. However, based on the literature on SU; fitting an EFA is redundant. Conceptually, it is clear that if three drugs are put together under one latent factor, second sources of variations should be taken into account.

the SU indicators can be interpreted in terms of probability (specially because probit models are used to fit CFA with categorical indicators). Assuming that the adolescent would have the same probability to endorse the items in both waves seems to be unlikely because SU can change dramatically with age, the older the adolescent the more likely to consume. SU can also change depending on previous experiences. Therefore, it seemed more reasonable to assume measurement non-invariance across time. In other words, the errors across time between the SU indicators were assumed to be uncorrelated.[3]

Fifth assumption: No Differential Item Functioning (DIF) is assumed and local independence was not tested. This means that it is assumed that the student probability of endorsing the AP and SU indicators depends only on the levels of the AP and SU latent factors respectively. In other words, it is assumed that students characteristics such as gender do not determine the probability to endorse an item.

Under these five assumptions, in each wave, the multilevel CFA estimated one general factor for AP, and one general factor for SU with errors correlated among alcohol indicators, and errors correlated among cigarettes indicators.

Table 3.1 presents a list of the indicators used to build the two-level factor structure for both outcomes in each wave of measurement.[4] For example, there are three smoking indicators the first indicator was called smoke and was labeled as "smoked regularly", its response categories were 0: never smoked, 1: smoked 1 or 2 puffs, and 2: smok ed one or more cigarette per day in a month.

The results of the building process to generate the final measurement model that accounts for the conceptualization of substance use and academic performance is described in the following four steps, as mentioned in the methods section.

The first step involved the estimation of the measurement model ignoring the

[3]Unfortunately this assumption could not be tested in the multilevel framework because of data limitations (only 114 schools).

[4]Please, see the methods section for details about how the indicators were constructed.

Indicator	Label	Scale
Academic Performance		
English	English	1: D-, 2:C, 3:B, and 4:A
Soc. Studies	Social Studies and History	1: D-, 2:C, 3:B, and 4:A
Science	Science	1: D-, 2:C, 3:B, and 4:A
Math	Mathematics	1: D-, 2:C, 3:B, and 4:A
Substance Use		
Smoke	Smoked regularly	0: never, 1: 1 or 2 puffs, and 2: 1+/day (month)
Dsmoke	Numb. of days smoked (month)	0: Never, 1:Less than 7, 2: 8-25, and 3: 26+
Nsmoke	Numb. of cigarettes per day	0: none, 1: 1 to 2, 2: 3-9, and 3: 10+
Alc	Numb. of days drank (year)	0: none, 1: 1-2, 2:1/month or 3-12/year, 3: 2-3/month, and 4: 1-7/week
Nalc	Numb. of drinks per day	0: none, 1: 1, 2: 2-3, 3:4-6, and 4: 7+
N5alc	Days drank 5+ drinks per sit	0: none, 1:1-2, 2:1-3/month or 3-12/year, 3:1+/week
Ndrunk	Days gotten drank (month)	0: none, 1:1-2, 2:1-3/month or 3-12/year, 3:1+/week
Mar	Times used marijuana (year)	0: none, 1:1-9, and 2: 10+
Nmar30	Times used marijuana (month)	0: none, 1:1-6, and 2: 7+

Table 3.1: Academic performance and substance use indicators. D-: D or lower grade, "+" after a number means "or more" (for example, 1+ 1 or more), "/month": per month, "/week": per week, and "/day": per day. Period of time in parenthesis indicate the tine frame, for example, in "Number of days drank (year) " indicate number of days the adolescent drank in the past year.

nested structure, this means that the clustering within school was ignored, thus students within each school comprised an independent sample implying that the factors indicators are identical independent distributed. Model 1, in table 3.2, shows the results for this model ignoring the nested structure in Wave 1; while, model 1, table 3.3 shows the model ignoring the nested structure for Wave 2. The goodness of fit indicators are good (mainly because of the error structure in SU). The correlations between SU and AP were negative -0.353, in Wave 1, and -0.303, in Wave 2. These correlations mean that on average, the higher the levels of the AP latent factor the lower the levels of the SU factor (for now let us ignore the interpretation of these factors; later in a more appropriate place, the reader will find a detailed interpretation of the two factors at both the student and the school levels).

The second step involved the estimation of the same model but this time correcting the standard errors by the sampling design. This step was estimated using complex survey analysis. The estimated measurement model accounting for the survey sampling design is shown in model 2 table 3.2 and table 3.3 for each wave. Note that, at Wave 1, there is a reduction of the Chi-square from 1098.37 to 361.60, notice also that the RMSEA reduces from 0.049 to 0.027 indicating that accounting for the survey structure improves the fit of the model. A similar result is observed in Wave 2 (the chi-square reduces from 1784.9 to 339.1 and the RMSEA reduces from 0.054 to 0.026).

The third step involved the estimation of variances and covariances for the SU and AP indicators. These estimations were carried out at both within and between levels. Given that the variances of the factor scores depend on the indicators that are used to build the factor models; Muthén (1991) recommends to look at the variances and covariances (correlations) among the indicators at both the school and students level.

The correlations matrices are presented in the following tables: table 3.4 and

	$Model1$	$Model2$	$Model3$	$Model4$
Chi-Square	1098.37***	361.60***	506.5***	
RMSEA	0.049	0.027	0.020	
CI (90%)	0.047-0.052	0.024-0.029		
CFI	0.998	0.998	0.999	
TLI	0.997	0.997	0.999	
LL				-87147.8
AIC				174425.6
BIC				174878.4
Correlations				
AP-SU corr.	-0.353***	-0.359***		
AP-SU cov.	-0.197***	-0.193***		
Within				
AP-SU corr.			-0.382***	-0.263***
AP-SU cov.			-0.460***	-0.569***
Between				
AP-SU corr.			0.195∼	0.784***
AP-SU cov.			0.021∼	0.313***
Variance				
Within				
SU			1.404***	2.094***
AP			1.035***	2.231***
Between				
SU			0.140***	0.808***
AP			0.080***	0.197***

Table 3.2: Two-level CFA: model fit and variance decomposition for substance use and academic performance (Wave 1). Model 1: Ignores nested structure; Model 2: Adjust standard errors by nested structure; Model 3: Two-level with smoke and alcohol errors correlated; and Model 4: Two-level model used to compute the Factor Scores at the between and within levels. $\sim p \leq 0.1$,$^{*}p \leq 0.05$,$^{**}p \leq 0.01$, and $^{***}p \leq 0.001$.

	$Model1$	$Model2$	$Model3$	$Model4$
Chi-Square	1784.9***	339.12***	513.12***	
RMSEA	0.054	0.026	0.020	
CI (90%)	0.052-0.057	0.023-0.028		
CFI	0.998	0.999	0.999	
TLI	0.997	0.998	0.998	
LL				-85743.2
AIC				171614.5
BIC				172060.4
Correlations				
AP-SU corr.	-0.303***	-0.313***		
AP-SU cov.	-0.166***	-0.116***		
Within				
AP-SU corr.			-0.362***	-0.255***
AP-SU cov.			-0.497***	-0.489***
Between				
AP-SU corr.			0.178∼	0.722***
AP-SU cov.			0.026∼	0.446***
Variance				
Within				
SU			1.590***	2.157***
AP			1.183***	1.710***
Between				
SU			0.166***	0.914***
AP			0.128***	0.417***

Table 3.3: Two-level CFA: model fit and variance decomposition for substance use and academic performance (wave 2). Model 1: Ignores nested structure; Model 2: Adjust standard errors by nested structure; Model 3: Two-level with smoke and alcohol errors correlated; and Model 4: Two-level model used to compute the Factor Scores at the between and within levels. $\sim p \leq 0.1$,$^{*}p \leq 0.05$,$^{**}p \leq 0.01$, and $^{***}p \leq 0.001$.

table 3.5 present the student level correlations for Wave 1 and Wave 2 respectively. Tables 3.6 and 3.7 present the school level correlations for Waves 1 and 2 respectively. It is worth mentioning one distinctive pattern in the correlation matrices in both waves. The correlations at the student level (see first two correlation tables) among the SU and AP indicators were negative. However, contrasting these results with the correlation at the school level, it can be appreciated that the SU and AP indicators were positive correlated -except for the indicators or marijuana use. These findings are interesting, and to the best of my knowledge, it is the first time that the correlation among SU and AP indicators at the school level have been explored. The interpretation of these findings will be discussed in detail in the last Chapter.

The most important result in this step is the estimation of the ICC for all indicators. Table 3.8 presents the observed and estimated ICCs for each one of the AP and SU indicators at each wave. The first two columns show the observed ICCs, in the case of AP the four indicators have ICCs between 0.058 and 0.078, meaning that about 6% to 7% of the total variation occurs between schools. These results are surprising given that previous research has shown that most of the standardized test scores (mostly in reading and mathematics) have ICCs ranging from .13 to .26 for students attending grades 9th to 12th (Hedges and Hedberg, 2007). However, in this case, the AP factors were composed by the adolescent reports about his or her grades in the last course taken in the school year in four subjects: Mathematics, English, History or Social Studies, and Science. The lack of more variation between schools might be partially accounted by the fact that the grades were in an ordinal scale from D or lowest to A, providing only four points of variation. A second reason might be that certain amount of measurement error in each indicators can also reduce the amount of variation among schools.

Similar to the case of AP, the SU indicators have observed ICCs ranging from .5 to 0.09 implying a low effect of the clustering structure. Hox (2002) suggested that,

	1	2	3	4	5	6	7	8	9	10	11	12
1. English	1											
2. Math	0.424	1										
3. Soc. Std.	0.551	0.369	1									
4. Science	0.488	0.411	0.497	1								
5. Smoke	-0.243	-0.234	-0.256	-0.246	1							
6. Dsmoke	-0.253	-0.229	-0.268	-0.258	0.918	1						
7. Nsmoke	-0.249	-0.226	-0.265	-0.248	0.907	0.973	1					
8. Nalc	-0.157	-0.163	-0.161	-0.176	0.568	0.566	0.568	1				
9. N5alc	-0.179	-0.190	-0.184	-0.213	0.562	0.585	0.582	0.849	1			
10. Ndrunk	-0.159	-0.176	-0.170	-0.194	0.577	0.609	0.606	0.842	0.905	1		
11. Mar	-0.237	-0.228	-0.229	-0.248	0.671	0.667	0.661	0.611	0.635	0.672	1	
12. Nmar30	-0.225	-0.183	-0.205	-0.224	0.569	0.642	0.626	0.566	0.622	0.657	0.927	1
13. Alc	-0.153	-0.142	-0.14	-0.157	0.556	0.543	0.543	0.832	0.829	0.836	0.625	0.617

Table 3.4: Within level correlations among substance use and academic performance indicators at Wave 1.

	1	2	3	4	5	6	7	8	9	10	11	12
1. English	1											
2. Math	0.406	1										
3. Soc. Std.	0.495	0.349	1									
4. Science	0.426	0.4	0.452	1								
5. Smoke	-0.246	-0.200	-0.229	-0.2	1							
6. Dsmoke	-0.251	-0.209	-0.226	-0.192	0.959	1						
7. Nsmoke	-0.251	-0.205	-0.221	-0.197	0.949	0.971	1					
8. Nalc	-0.131	-0.112	-0.081	-0.115	0.527	0.512	0.507	1				
9. N5alc	-0.153	-0.112	-0.100	-0.140	0.548	0.542	0.550	0.859	1			
10. Ndrunk	-0.155	-0.131	-0.103	-0.137	0.560	0.554	0.557	0.85	0.926	1		
11. Mar	-0.205	-0.176	-0.185	-0.185	0.634	0.624	0.611	0.586	0.603	0.649	1	
12. Nmar30	-0.224	-0.174	-0.209	-0.194	0.585	0.609	0.598	0.528	0.564	0.609	0.951	1
13. Alc	-0.136	-0.122	-0.083	-0.127	0.539	0.523	0.523	0.885	0.907	0.903	0.615	0.566

Table 3.5: Within level correlations among substance use and academic performance indicators at Wave 2.

	1	2	3	4	5	6	7	8	9	10	11	12
1. English	1											
2. Math	0.619	1										
3. Soc. Std.	0.723	0.528	1									
4. Science	0.516	0.578	0.723	1								
5. Smoke	0.010	0.184	0.035	-0.220	1							
6. Dsmoke	0.139	0.321	0.199	-0.101	0.987	1						
7. Nsmoke	0.172	0.354	0.231	-0.066	0.983	1	1					
8. Nalc	0.057	0.230	0.227	-0.102	0.871	0.903	0.885	1				
9. N5alc	0.184	0.222	0.288	-0.064	0.876	0.890	0.889	0.985	1			
10. Ndrunk	0.144	0.286	0.202	-0.124	0.94	0.927	0.917	0.974	0.974	1		
11. Mar	-0.245	-0.045	-0.308	-0.305	0.518	0.367	0.328	0.498	0.444	0.577	1	
12. Nmar30	-0.271	0.031	-0.332	-0.336	0.565	0.427	0.398	0.565	0.506	0.685	1.000	1
13. Alc	-0.032	0.168	0.178	-0.093	0.819	0.788	0.764	0.970	0.945	0.937	0.541	0.640

Table 3.6: Between level correlations among substance use and academic performance indicators at Wave1.

	1	2	3	4	5	6	7	8	9	10	11	12
1. English	1											
2. Math	0.794	1										
3. Soc. Std.	0.789	0.743	1									
4. Science	0.603	0.680	0.754	1								
5. Smoke	0.002	0.082	-0.017	-0.037	1							
6. Dsmoke	0.081	0.160	0.021	0.011	1.000	1						
7. Nsmoke	0.055	0.154	0.011	0.004	0.995	1.000	1					
8. Nalc	0.092	0.210	0.123	0.213	0.907	0.908	0.888	1				
9. N5alc	0.223	0.274	0.160	0.203	0.908	0.919	0.898	0.986	1			
10. Ndrunk	0.197	0.269	0.123	0.208	0.907	0.897	0.871	0.977	0.981	1		
11. Mar	-0.163	-0.055	-0.264	-0.244	0.566	0.512	0.488	0.652	0.572	0.687	1	
12. Nmar30	-0.130	0.034	-0.262	-0.288	0.508	0.451	0.413	0.546	0.469	0.590	0.995	1
13. Alc	0.173	0.262	0.204	0.285	0.844	0.832	0.801	0.973	0.971	0.971	0.647	0.574

Table 3.7: Between level correlations among substance use and academic performance indicators at Wave 2.

	Observed		*Estimated*	
	W1	W2	W1	W2
AP				
English	0.058	0.063	0.065	0.072
Soc. Studies	0.073	0.078	0.083	0.086
Mathematics	0.065	0.072	0.078	0.074
Science	0.065	0.078	0.068	0.092
SU				
Smoke	0.064	0.079	0.068	0.080
Dsmoke	0.090	0.096	0.103	0.096
Nsmoke	0.084	0.095	0.095	0.097
Alc	0.059	0.079	0.071	0.094
Nalc	0.063	0.079	0.073	0.090
N5alc	0.048	0.060	0.054	0.072
Ndrunk	0.067	0.077	0.078	0.088
Mar	0.089	0.064	0.094	0.076
Nmar30	0.092	0.071	0.109	0.082

Table 3.8: Observed and estimated intraclass correlations for indicators of substance use and academic performance.

in general cases, coefficients from .05 to .09 indicate a low effect, coefficients from .10 to .14 a moderate effect, coefficients from .15 indicate a large effect. Having low ICCs has implications in the modeling strategy at the school level, some caution is required because of the small amount of between school variance.

The fourth step involved that estimation of the multilevel factor structure. Based on the results from the school level correlations among indicators, it seems that marijuana cannot be conceptualized in the same way than alcohol and cigarettes at the school level. In addition to this, the factor loadings of marijuana were statistically non significant (see next section for more details).[5]

The final measurement model has two levels: within (student) and between (school). At the student level, the final models, for Wave1 and Wave 2, have the same indicators as model 1 and model 2 presented in tables 3.2 and 3.3. At the school level the final model has the same indicators for AP, but for SU the marijuana indicators were not included because of the reasons explained in the previous paragraph. The goodness of fit are presented in table 3.2 (Wave 1) and table 3.3 (Wave 2). These results showed more improvement in the RMSEA at both waves.[6]

3.1.2 Results for the multilevel factor structures for academic performance and substance use

The results of the multilevel confirmatory factor analysis. The first shows the results at the student level while the second shows the results at the school level.

[5]it is not uncommon in multilevel CFA that the within level has a different structure than the between level.

[6]If the errors among alcohol and among smoking were not correlated the differences in the goodness of fit would be even more dramatic between the model that ignored the hierarchical structure and the estimations that modeled this hierarchical structure.

3.1.2.1 Results at the student level

The results for the multilevel CFA for both waves are depicted in figure 3.1 for Wave 1 and figure 3.2 for Wave 2. Both measurement models have similar patterns in terms of loadings. As for the case of AP, English seemed to be driving the AP factors in both waves. The interpretation of this AP factor assumed the existence of latent levels of student academic performance; this latent structure of AP is not directly observed but reflected in the grades reported by the students. This factor can be interpreted as follows, higher values in the factor score indicate higher levels of Academic Performance and higher probabilities that the students would report grades towards A or B. On the contrary, lower levels in this factor would be interpreted as the student having lower probabilities of getting good grades conditioned to his or her estimated level of Academic Performance. This interpretation is identical in both waves.

Similarly in the case of substance use, as mentioned before, it was theoretically assumed the existence of a general latent trait of SU that is not directly measured but can be reflected in the responses that a student provided for each one of the questions used as indicators (alcohol, cigarettes, and marijuana indicators). Based on this assumption, it can be interpreted that higher levels of the latent SU factor would increase the probabilities of the student reporting more consumption of the three substances. I would like to highlight that the emphasis of the latent factors interpretations does not reside in the indicators but in the existence of a latent trait of substance consumption or latent trait of academic performance (Note this is a conceptual assumption). Therefore, factor scores cannot be interpreted as a combined average grade among the four courses or as an average use of drugs among the three substances. Note also that CFA analysis assumes that different levels of the adolescent's estimation of the latent factors determine his or her responses to the SU and AP indicators observed in the surveys. For example, a student with higher levels

of academic performance would be more likely to obtain higher grades in the four subjects, while a student with higher levels of substance use would be more likely to report higher consumption of alcohol, cigarettes and marijuana. [7]

3.1.2.2 Results at the school level

The results for the school level CFA for both waves are depicted on the right side in figure 3.1 for Wave 1 and figure 3.2 for Wave 2. The correlation between SU and AP is positive at the school level. The factor loadings, in the case of AP, did not follow a similar structure than the loadings at the individual level. In the case of SU, there are no marijuana indicators at the school level, and the loading structure seemed to be different. These results suggest that the factor structures at the school level are not exactly the same as the factor structures at the individual level (more details about this results in the final Chapter).

In this dissertation the school level factor related to the students academic performance is referred as school 'levels of academic performance'. Higher levels of this school factor reflect school contexts, that, on average, have students with higher levels of academic performance. The SU latent factor at the school level is interpreted as 'school rates of substance use'. Higher scores in this factor represent environments with elevated proportions of students consuming substances. On the contrary, lower levels of the score would imply schools with low proportions of students who engage in substance use.

In addition, in both waves, the residual variances at the school level are smaller than at the student level, according to Muthén (1991), this is usually the case in multi level settings. Because the multilevel measurement models for Wave 1 and Wave 2 were estimated separately, the following step would be to put the two models together in order to account for the longitudinal relationships across time. However, this step

[7] the responses to the SU and AP questions are assumed to be conditioned only by the SU and AP factors (local independence assumption, no DIF was assumed to exist).

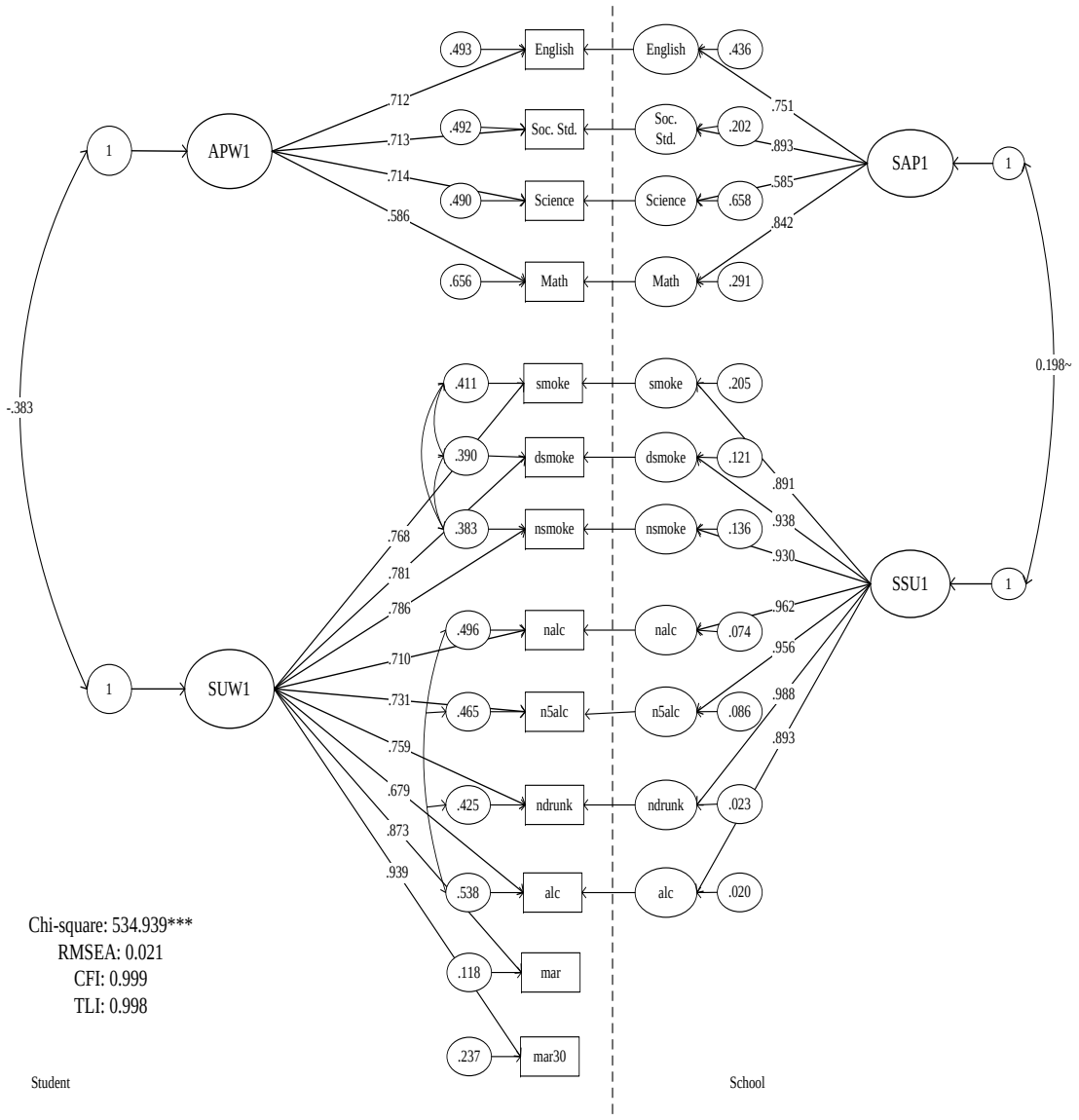

Figure 3.1: Measurement model for substance use and academic performance: multilevel CFA (Wave 1, $n = 7984$, $k = 114$).

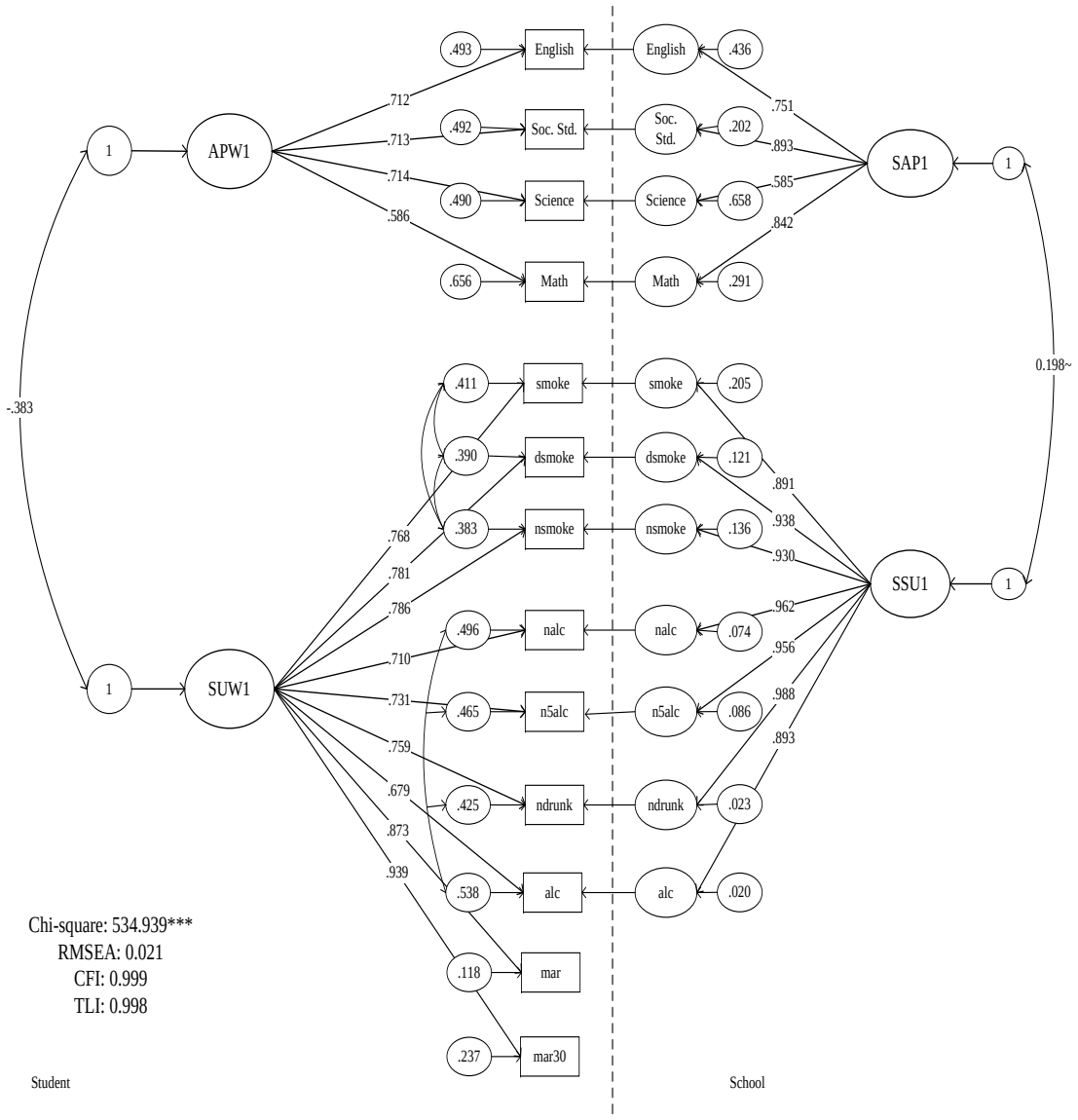

Figure 3.2: Measurement model for substance use and academic performance: multilevel CFA (Wave 2, $n = 7984$, $k = 114$).

could not be estimated, among the main reasons being: (a) the relative small number of schools (114), which does not allow for the estimation of the cross lagged effects between SU and AP including all the measurement models for the four outcomes. (b) This estimation, in the measurement part; included many categorical indicators with several categories, thus the estimation of crossed-lagged effects ran into several problems ranging from empty cells, cells with small number of cases, problems with the starting values and statistical power problems (the multilevel measurement model has more than 40 parameters to estimate at the school level and ideally we would like to have at least 10 cases per estimate to get reliable results, which required more than 4 times the number of available schools). (c) Moreover, if the indicators of all the school latent factors were to be included in the multilevel SEM estimations; the models were non-identifiable because there are more unknowns than number of cases.

In summary, the models show evidence contradicting the initial idea that the AP and SU school factors would mimic the inverse relationship between SU and AP at the student level. In fact, evidence points to a positive relationship between the school levels of academic performance and the school rates of drug use. However, to further test these results and to provide a basic model to test school context effects, the relationship across time has to be estimated among SU, AP, and their respective school factors.

3.2 Academic performance and substance use dynamic

As mentioned in the methods section, one not so ideal, but practical approach was to use the multilevel measurement models described above and estimate the within and between factors scores at the student and school levels. Then, these scores were modeled to test the crossed-lagged relationship between substance use and academic performance and to estimate the school effects. The remaining sections of this Chapter describe the unconditional models for both waves, the crossed-lagged effects and the

within model (student level model). The next Chapter presents the results for the school factors effects.

This section presents the results related to the dynamic between AP and SU addressing directly research question 1: (*how are academic performance and substance use related across time during adolescence?*). To fully address this question, the time relationship among all the estimated factors related to SU and AP needs to be included in the final modeling.

One way to model this dynamic across time is by using multilevel crossed-lagged models. This section presents the results for four fitted models: unconditional correlated models (AP and SU correlated in Wave 1 and AP and SU correlated in Wave 2), unconditional bivariate crossed-lagged model, and student level conditional bivariate crossed-lagged model (controlling by student level covariates).

Given the considerably large amount of information to process, I organized the remaining parts of this section in four subsections. The first subsection presents the goodness of fit for the four models. The second subsection presents the variances and correlations (covariances) for the four models. The third subsection has the results for the unconditional cross-lagged model, and the last subsection, shows the results for the student level multilevel conditional cross-lagged model (controlling by student level covariates).

3.2.1 Goodness of fit

The SEM literature has developed several ways to test how well an estimated model fits the data. Each one of these ways developed a Fit statistics that expresses a specific idea to capture goodness of fit. However, the basic idea across all of them is to see how well or how bad the estimated model can reproduce the observed correlated matrix (this idea is very similar to the reproduction of the correlation matrix based on the results of a linear regression).

Four of the most used indicators are the likelihood ration test (Chi-square test), RMSEA, TLI, and CFI. The Chi-square tests compares the estimated model with a saturated model (model that fits the data perfectly). In this case the null hypothesis contains the estimated model and the alternative hypothesis the saturated model; this means that failing to reject the null hypothesis provides evidence supporting the estimated model (implying that we are looking for a large p-value). One of the problems of the Chi-square is that with large samples sizes the null hypothesis is more likely to be rejected; which does not necessarily mean that the estimated model does not have a good fit. Therefore other fit indexes were developed.

The RSMEA is an indicator of misfit where lower values are expected as representation of goodness of fit. There is no consensus to determined universal cutoff points to decide when a model does not fit the data (this also applies for other fit indicators). However, the most used cutoff point for the RMSEA is 0.05; according to Steiger (1999) an RMSEA below 0.05 can be understood as a very good fit, Hu and Bentler (1999) adds, to the point estimate, as another aspect of the RMSEA to consider; according to the authors, the RMSEA 90% confidence interval should range from 0.0 to 0.08.[8] As for the case for the TLI and CFI, Hu and Bentler (1999) suggest values above 0.90 or above 0.95.

Table 3.9 shows the goodness of fit for these four models. All indicators seemed to be good, according to what was described above, suggesting that *all* models fit the data very well.

[8]However, more recent publications suggest that to set a universal cutoff point is unwarranted and depends on many factors; for example, Chen et al. (2008) suggested that there is little empirical evidence to determine a universal cutoff point. Moreover, the choice of the cutoff point depends on the model specification, degrees of freedom, and sample size, this choice is also related to levels of power and Type I error to be achieved.

	Uncond. w2	*Uncond. w1*	*Crossed-Lagged*	*Within*
LL	-25958.04	-26463.38	-49257.09	-48382.02
AIC	51936.08	52946.75	98566.18	96862.05
BIC	52005.75	53016.43	98747.33	97203.37
BIC Adj.	51973.97	52984.65	98664.71	97047.66
Chi-square	0.000	0.000	1.865	10.259
RMSEA	0.000	0.000	0.000	0.01
CFI	1.000	1.000	1.000	0.999
TLI	1.000	1.000	1.000	0.991

Table 3.9: Multilevel crossed-lagged model: goodness of fit (waves 1 and 2). *Uncond. w1 and Uncond. w2*: Unconditional correlated model at waves 1 and wave 2 respectively. *Crossed-lagged:* Multilevel unconditional crossed-lagged model. *Within*: Multilevel unconditional crossed-lagged model (Within model) controlling for individual covariates at Wave 1 (gender, age, SES, grade, ethnicity, and grade retention before Wave 1); $n = 7984$ and $k = 114$). All coefficients are significant at $p \leq 0.001$.

3.2.2 Variance and correlations

Table 3.10 shows the variance decomposition and correlations between SU and AP at both waves. The first two columns present the the variances and correlations for the correlated unconditional model for Wave 2 and Wave 1, the third column is related to the unconditional cross-lagged model and the last column presents results for the student level conditional model (level controlling by level 1 covariates).

The crossed-lagged model showed a decrease of the within and the between variances for both SU and AP factor scores at Wave 2 due to the effect of SU and AP at Wave 1. The within variance at Wave 2 decreased from 2.512 to 1.537 for SU and from 1.098 to 0.767 for AP. Similarly, the between (or school level) variance decreased from 0.305 to 0.191 for SU and from 0.226 to 0.169 for AP (see table 3.10). When accounting for individual covariates, there is a small decrement of variance at the within level for both measurements at both waves (see table 3.10).

Please note that the ICCs are not computed based on the factor scores because

	Uncond. w2	*Uncond. w1*	*Cross-Lagged*	*Within*
Within correlation				
AP-SU (W2)	-0.532		-0.219	-0.229
AP-SU (w1)		-0.648	-0.648	-0.611
Between correlations				
AP-SU (W2)	0.156		0.106	0.156
AP-SU (w1)		0.122	0.122	0.122
Within variance				
SU W2	2.512		1.537	1.513
AP W2	1.098		0.767	0.737
SU W1		2.227	2.227	2.128
AP W1		1.474	1.474	1.336
Between variance				
SU W2	0.305		0.191	0.305
AP W2	0.226		0.169	0.266
SU W1		0.266	0.266	
AP W1		0.108	0.108	

Table 3.10: Multilevel bivariate cross-lagged model: variance decomposition and correlations between SU and AP. *Uncond. w1 and Uncond. w2*: Unconditional correlated model at waves 1 and wave 2 respectively. *Crossed-lagged:* Multilevel unconditional crossed-lagged model. *Within*: Multilevel unconditional crossed-lagged model (Within model) controlling for individual covariates at Wave 1 (gender, age, SES, grade, ethnicity, and grade retention before Wave 1); $n = 7984$ and $k = 114$). All coefficients are significant at $p \leq 0.001$.

the results for the decomposition of variance (ICCs) should be taken from the AP and SU indicators used to construct the factors scores (Muthén, 1991). The ICCs for all these indicators were presented in the previous section of this chapter.

3.2.3 Unconditional multilevel bivariate cross-lagged model between academic performance and substance use

As said before, to fully account for the theoretical conceptualization of the dynamic between academic performance and substance use, it is necessary to estimate longitudinal relationships using crossed and lagged effects between SU and AP, as well as cross and lagged effects between the school factors for AP and SU. To estimate these crossed and lagged effects a multilevel bivariate crossed-lagged models were estimated. The result for this model is depicted in figure 3.3 showing empirical evidence that suggests lagged and crossed influences.

3.2.3.1 Results at the student level

At the student level, the results provide empirical evidence suggesting unadjusted lagged effects for substance use (SU in Wave 1 had an effect on SU in Wave 2) and lagged effects of academic performance (AP in Wave 1 had an effect on AP in Wave 2). These results also showed the presence of crossed effects: SU in Wave 1 has an effect on AP at Wave 2, and AP at Wave 1 had an effect on SU in Wave 2.

As expected, the lagged effects are positive suggesting that, on average, previous substance use consumption in Wave 1 increases levels of consumption in Wave 2 (0.647, $p \leq 0.001$). Similarly, the higher the levels of academic performance in Wave 1, on average, the higher the levels of AP in Wave 2 (0.446, $p \leq 0.001$). In other words, as the previous levels of AP increased by 1 standard deviation, the levels of AP increase by a factor of 0.447 standard deviations; and for SU the increment factor is 0.647.

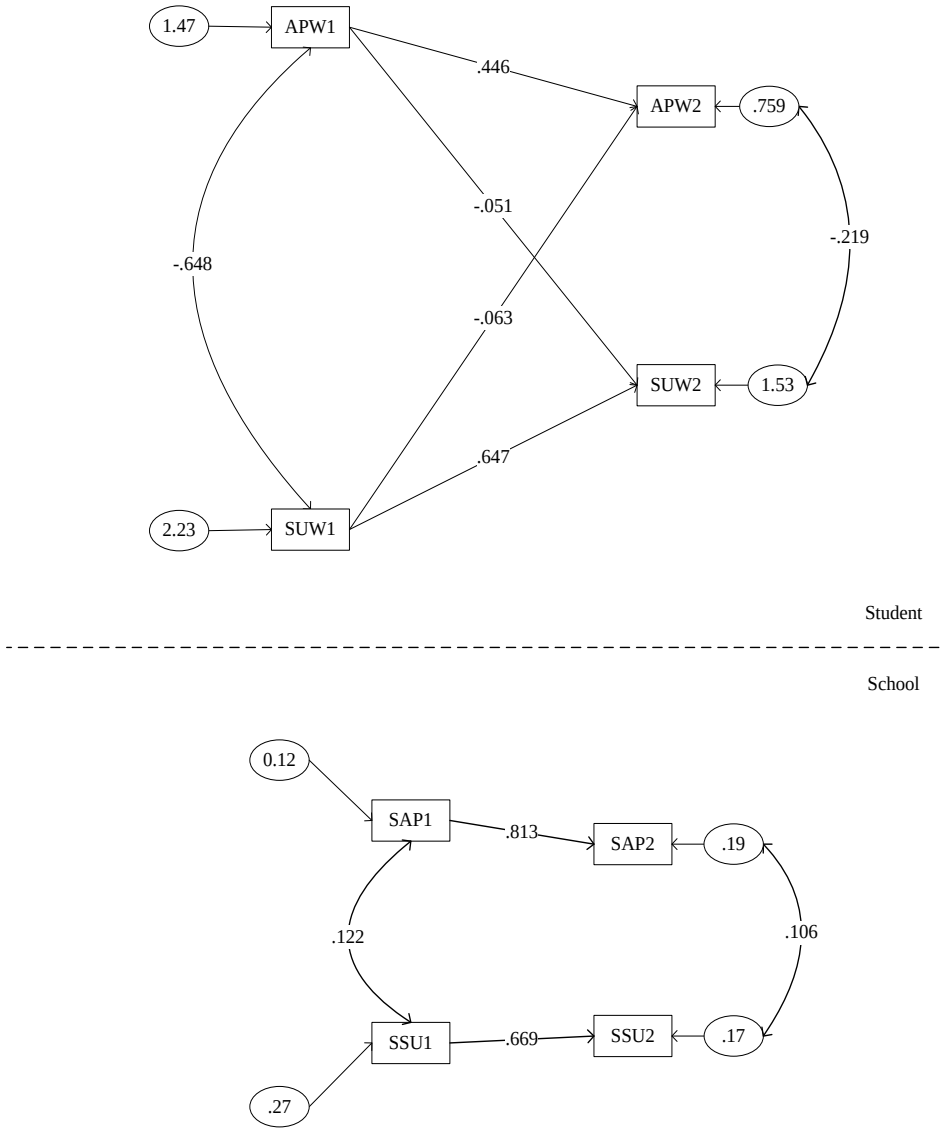

Figure 3.3: Multilevel unconditional crossed-lagged model between substance use and academic performance. All coefficients are significant at $p \leq 0.001$, except for the effect of AP at Wave 1 on SU at Wave 2 (All coefficients are significant at $p \leq 0.01$; $n = 7984$, and $k = 114$).

The cross effects were also consistent with previous studies finding that higher levels of SU were related to lower levels of AP and vice versa. More precisely, the decreasing effect of SU (Wave1) on AP (Wave 2) is -0.063 ($p \leq 0.001$), on the other hand, the decreasing effect of AP (Wave 1) on SU (Wave 2) is -0.051 ($p \leq 0.001$). This means that for each standard deviation of change in SU and AP in wave AP and SU decreases by -0.063 and -0.051, respectively.

As found in the previous section, where the measurement part was modeled the correlation between SU and AP is negative at the student level, meaning that, on average, higher levels of SU are associated with lower levels of AP within each wave. It is interesting to notice that once accounting for cross influences the correlations between SU and AP (at Wave 2) decrease suggesting that part of the cross-sectional correlations can be explained by previous levels of AP and SU.

These results strongly suggest that during adolescence SU and AP are inter related in a co-occurring inverse relationship, where it is difficult to distinguish one specific unidirectional effect either from SU to AP or from AP to SU. Thus, the dynamic between SU and AP is well represented by the cross - lagged effects model.

3.2.3.2 Results at the school level

At the school level, the school levels of academic performance and the school rates of substance use were found to be related only through lagged effects. These effects were .813 ($p \leq 0.001$) for the case of the AP school factors and 0.669 ($p \leq 0.001$) for the case of the SU school factors. Thus, for each increment of one standard deviation in Wave 1, these two factors increment in .813 for the factors related to AP and 0.669 for the factor related to SU. These results mean that schools that were more likely to have students who had higher levels of academic performance, in Wave 1, remained as schools that were more likely to have students with higher levels of AP, in Wave 2. Similar interpretation for the school rates of substance use; the higher these school

rates in Wave1, the more likely the school would be composed of students who engage in more substance use in Wave 2.

As mentioned in the previous section, contrary to what was found at the student level, at the school level, the correlations between the the school levels of academic performance and the school rates of substance use were positive, reflecting, on average, that higher levels of substance use rates can be associated with higher levels of academic performance.[9] In other words, schools that are more likely to have students that attain good grades are also environments that are more likely to promote SU. This interpretation of this relationship can be related to the student body composition, more details about this interpretation in the final chapter; however, broadly it can be said that, on average, students who have more resources cluster in the same schools. More resources can be used either to generate more opportunities to consume drugs, such as alcohol and cigarettes; or generate more opportunities to achieve higher levels of academic performance.

3.2.4 Student level conditional multilevel bivariate crossed-lagged model between academic performance and substance use

The results for the student level conditional bivariate crossed-lagged model (controlling by student level covariates) is displayed in table 3.11. A quick inspection of these results show similar patterns to the ones observed in the literature that accounts for SU and AP. For example, African American were less likely to consume substances than White adolescents but also were less likely to obtain same grades as their White counterparts. Age had a quadratic effect only in SU at Wave 2, however, grade level is related to SU at both Waves such that students attending lower grades are less likely to consume substances, the effect of age could vanished because of the correlation between grade and age (older students are more likely to attend higher

[9] similar results was found when taking into account the measurement part in the first section.

	$Wave2$		$Wave1$	
	SU	*AP*	*SU*	*AP*
Within				
SU (Wave1)	0.630***	-0.066***		
AP (Wave 1)	-0.075***	0.409***		
Age			0.121∼	
Age square			-0.087*	
Female		0.136***		0.242***
SES		0.069***		0.194***
Race (White)				
Hispanic	-0.108∼	-0.160	0.136∼	-0.206*
African American	-0.330***	-0.082*	-0.447***	-0.286***
Asian	-0.125*	0.182***	-0.622***	0.551***
Other	-0.138∼	-0.109	0.061	-0.037
Repeat	-0.147**	-0.134***	0.196*	-0.425***
Grade (Grade 11)				
Grade 9	-0.112***		-0.427***	
Grade 10	-0.138***		-0.213**	

Table 3.11: Multilevel bivariate crossed-lagged model: student level model. Controlling for individual covariates at Wave 1: gender, age, SES, grade, ethnicity, and grade retention before Wave 1. Reference category for categorical variables are enclosed within parenthesis. $\sim p \leq 0.1$,$^{*}p \leq 0.05$,$^{**}p \leq 0.01$, and $^{***}p \leq 0.001$; $n = 7984$, and $k = 114$.

grades). Student SES had a positive effect on AP, the higher the SES the more likely the student to had higher levels of AP in both waves. Female students tend to score higher than male students in AP scores. This could be explained by the fact that the AP scores are driven by English and females, historically, have scored higher in English than male students.

Without getting into much detail about these student level results (because they are not the focus of this dissertation), the following subsection summarizes all the main results found in this Chapter.

3.2.5 Summary

In summarizing all the results of this chapter, four important findings can be highlighted about the relationship between academic performance and substance use.

1. The conceptualization and interpretation of academic performance and substance use is different depending on whether these two constructs are conceptualized at the student level or at the school level. At the student level, the conceptualization and interpretation of academic performance and substance use is similar to the interpretation in previous research. However, at the school level, the conceptualization and interpretation seem to be slightly different; perhaps, reflecting that at the school level the rates of substance use are not driven by the same substances than at the student level. At the school level the substance use factor reflects only on alcohol and cigarettes items, while at the student level the SU factors reflects on three substances (alcohol, cigarettes, and marijuana) indicators. Similarly in the case of academic performance, it seems that at the school level the factors are driven evenly by social studies, math, and English; while at the student level mathematics clearly has the stronger association with academic performance.

2. These results showed that most of the variation occurs at the student level for both academic performance and substance use. This is based on the intraclass correlations of the indicators used to construct the factor scores related to both outcomes (the ICCs ranged from 5 to 10 percent) .

3. As in the case of previous research focused on adolescent substance use and educational outcomes, the correlations between academic performance and substance use are negative at the student level; however, at the school level the correlations between the academic performance and substance use school

factors are positive. To the best of my knowledge, this is the first time that research shows this relevant result.

4. At the student level, academic performance and substance use have cross and lagged effects between Wave1 and Wave2. This means that previous levels of academic performance can increase future levels of academic performance and decrease substance use levels. Similarly, previous levels of substance use can increase future levels of substance use and decrease academic performance in the future. However, at the school level only strong lagged effects were found, higher levels of academic performance at Wave 1 might generate school environments with higher levels of academic performance at Wave 2. Similarly, higher levels of school substance use rates at Wave 1 might generate school environments with higher substance use rates at Wave 2. The results summarized here were expanded with the addition and estimation of school level factors, which are presented in the following chapter.

CHAPTER IV

School Context Effects Results

In the first chapter of this dissertation, I proposed a distinction between peripheral, concentric, and intrinsic school contexts. Following these distinction, this dissertation is focused on exploring concentric context effects on the dynamic between academic performance and substance use. As a reminder, the peripheral and intrinsic context were excluded from this dissertation because of theoretical reasons presented in Chapter I. As mentioned before, given that this dissertation uses only the concentric context, school context will always refer to concentric context.

The school context was organized in four blocks of school factors following four guiding conceptualizations to interpret the empirical work of this dissertation. This chapter address a general research question does school context influence the dynamic between academic performance and substance use? This general research question was decomposed in four more specific questions, which are:

Question 2: *Does the composition of the student body influence the relationship between school levels of academic performance and school rates of substance use, thus affecting academic performance and substance use?*

Question 3: *Do school institutional features influence the relationship between school levels of academic performance and school rates of substance use, thus affecting AP and SU?*

Question 4: *Do school policies affect the relationship between the school levels of academic performance and the school rates of substance use, thus affecting the AP-SU relationship?*

Question 5: *Does the school academic pressure influence the relationship between school levels of academic performance and school rates of substance use, thus affecting the relationship between AP and SU?*

These questions were addressed based on the final results estimated in the student level conditional multilevel bivariate crossed-lagged model presented in the final part of the previous chapter. The presentation of all results addressing these questions is organized in six sections. The first section presents the goodness of fit for all models in this chapter, the other following four sections show the results of the multilevel conditional bivariate crossed-lagged estimations. Finally, as a summary, the last section presents the results of an integrated model with all significant school factors.

4.1 School level models: goodness of fit, variances and correlations

Goodness of fit

The goodness of fit, variances, and correlations are presented for each of the models containing statistically significant results. School factors that were not statistically significant are not presented in the results but they are mentioned when needed. For readers not familiar with SEM, an interpretation of the fit indicators was presented in Chapter III. (As a quick reminder, the usual cutoff points for a good fit are: below 0.05 for RMSEA, with a 90% CI below .09; preferably above .95 for TLI and CFI; and the Chi-square test is expected to be non significant).

Table 4.1 shows the goodness of fit for each of the estimated school models controlling by student level characteristics. All fit index are very good, RMSEA, CFI,

	$Full1$	$Full2$	$Full3$	$Full4$	$Full5$
LL	-46559.945	-46572.122	-47836.75	-48411.30	-48407.58
AIC	93235.89	93258.243	95787.5	96938.7	96931.15
BIC	93637.69	93653.115	96183.909	97342.7	97335.161
BIC Adj.	93453.378	93471.981	96002.774	97158.4	97150.85
Chi-square	25.636	27.254	29.529	28.781	29.72
RMSEA	0.008	0.008	0.008	0.009	0.009
CFI	0.998	0.998	0.998	0.997	0.997
TLI	0.994	0.994	0.992	0.992	0.991

Table 4.1: Multilevel bivariate crossed-lagged model: model fit for school factor effects. All models are controlling for individual covariates (gender, age, SES, grade, ethnicity, and grade retention before Wave 1). Full 1: Model testing the effect of Student Body Composition risk factor. Full 2: Model testing the effects of School Structural Characteristics: School Problems. Full 3: Model testing the effect of Practices and Policies: Sanctions for Delinquent Behaviors; Full 4: Model testing the effect of Selective Academic Pressure; and Full 4: Model testing the effect of Generalized Academic Pressure. $n = 7984$ and $k = 114$.

and TLI indicate a good fit of the data. The bottom line from this table is that the models tested fitted the data very well.

Variances

Variances and correlations were also estimated, table 4.2 shows the variance decomposition and correlations among SU and AP at the student and at the school level factors.

The school variances, at Wave 2, in the unconditional models were .305 and .226 for SU and AP respectively; and at Wave 1, the unconditional models had variances of .266 and .108. Before further interpreting these variances, next is a quick note to understand how these variances are expected to vary. Note that in general the reduction of the school variance is modest in all school models tested. In part, because there is not much variance to explain and also because of the following two reasons. First, most of the between level variance at Wave 2 were explained by the outcome

factors at Wave 1.

Second, for each school factor five possibilities were tested. The isolated effect of the school factor in each outcome at each wave, and the combined effect on the four outcomes. To make it more clear, for instance, the effect of the school selective academic pressure was tested five times. The first time its effect was tested simultaneously on the four outcomes in both waves. The second time its effect was tested only on the school levels of AP at Wave 1; the third only on the school levels of AP at Wave 2. The forth and fifth times, the effect of the school selective academic pressure factor was tested only on the school rates of substance use at each wave respectively.

Thus, the model presented in the respective table for the effect of academic selective pressure (and all tables in this chapter) only show the significant effects that were significant in any of the five steps. This way of testing the school effects was followed to test the school context effects of all the school factors presented in the methods chapter. With this in mind, in general, it can be expected a modest reduction of variance only in the outcomes with significant school effects as described above.

Correlations

Similar to the case of variances, a reduction of the residual correlations between the school levels of academic performance and the rates of substance use in schools are expected to vary only in the Waves where the school level predictors were statistically significant. In general a reduction of these residual correlations was observed providing some evidence that school factors can affect the relationship between SU and AP. However, none of the models, including the model with all school level predictors together can fully explain these residual correlations. As in the case of the variances, the greatest reduction in the residual correlation at Wave 2 happed when the the previous measurements of the school factors for AP and SU, at Wave 1, were included.

As a summary, the goodness of fit is very good for all the estimated models.

	$Full1$	$Full2$	$Full3$	$Full4$	$Full5$
Within correlation					
AP-SU (W2)	-0.229	-0.232	-0.229	-0.229	-0.229
AP-SU (w1)	-0.624	-0.624	-0.611	-0.611	-0.611
Between correlations					
AP-SU (W2)	0.108	0.106	0.104	0.106	0.106
AP-SU (w1)	0.112	0.113	0.123	0.114	0.126
Within variance					
SU W2	1.513	1.513	1.512	1.514	1.514
AP W2	0.744	0.744	0.738	0.740	0.740
SU W1	2.124	2.124	2.119	2.127	2.127
AP W1	1.332	1.332	1.334	1.337	1.337
Between variance					
SU W2	0.185	0.189	0.192	0.191	0.186
AP W2	0.171	0.166	0.16	0.169	0.168
SU W1	0.226	0.253	0.268	0.237	0.258
AP W1	0.103	0.103	0.109	0.106	0.106

Table 4.2: Multilevel bivariate crossed-lagged model: variance decomposition and correlations between SU and AP for school effect factors. All coefficients are significant at $p \leq 0.001$. Full 1: Model testing the effect of Student Body Composition risk factor. Full 2: Model testing the effects of School Structural Characteristics: School Problems. Full 3: Model testing the effect of Practices and Policies: Sanctions for Delinquent Behaviors; Full 4: Model testing the effect of Selective Academic Pressure; and Full 4: Model testing the effect of Generalized Academic Pressure. $n = 7984$ and $k = 114$.

The variances and residual correlations reduction at Wave 2 is due mainly to the variation of previous levels of the outcomes at Wave 1. There is modest reduction of the school variance and outcomes residual correlations due to school factors. The results accounting for school context effects are described in the next sections.

4.2 Student body composition: risk factor

The student Body Composition Risk Factor measurements were derived from the first guiding conceptualization. This conceptualization assumes that the composition of the student body composition, which was represented by an overall school risk factor, can disrupt I-C spaces; thus generating school environments that put students at more risk. This in turn, would promote SU among students and would be detrimental for adolescents' academic performance. On the contrary, lower levels of the overall school risk factor might promote AP and might discourage SU.

In Chapter II, this overall school risk factor was operationalized using one school latent factor where greater values in its score imply higher risk levels. On the contrary, lower levels in the score of the overall school risk factor mean more protective environments. The results for the estimation of the school context effect of the school risk factor on the dynamic between academic performance and substance use are presented in table 4.3.

The results show significant effects of the school risk factor only on the levels of school rates of substance use at both waves. Holding constant all other factors, these effects were positive and strong (0.375 at $p \leq 0.001$ in Wave 2; and 0.164 at $p \leq 0.1$ in Wave 1). These results imply that, *ceteris paribus*, as the levels of school rates of substance use increases, the school environment increases its propensity to promote substance use among its students. This increment factor was estimated by the regression coefficients, per each standard deviation of increment, there is an increment on schools' substance use rates of .375 and .164 at Wave 2 and Wave 1

	$Wave2$		$Wave1$	
	SU	AP	SU	AP
Within				
SU (Wave1)	0.632***	-0.068***		
AP (Wave 1)	-0.076***	0.406***		
Age			0.097	
Age square			-0.073∼	
Female		0.136***		0.242***
SES		0.068***		0.191***
Race (White)				
Hispanic	-0.105∼	-0.165	0.122	-0.22*
African American	-0.319***	-0.081∼	-0.449***	-0.289***
Asian	-0.109*	0.191***	-0.642***	0.547***
Other	-0.12	-0.099	0.036	-0.055
Repeat	-0.144**	-0.142***	0.193*	-0.419***
Grade (Grade 11)				
Grade 9	-0.109**		-0.442***	
Grade 10	-0.13***		-0.223**	
Between				
SU (Wave1)	0.624***			
AP (Wave 1)		0.749**		
School Risk Factor	0.09∼		0.188***	

Table 4.3: Multilevel bivariate crossed-lagged model: effect of school risk factor on SU and AP. $\sim p \leq 0.1$,$^{*}p \leq 0.05$,$^{**}p \leq 0.01$, and $^{***}p \leq 0.001$. Reference categories are in parenthesis; $n = 7984$ and $k = 114$.

respectively. The final Chapter expands the interpretation and discussion of these results. In advance, based on the theoretical conceptualization, the results suggest that the higher the scores of the school risk factor the riskier the school environment generating less stable I-C spaces that in turn can promote substance use and affect academic performance.

4.3 School institutional features: school problem factors

Similar to the case of the composition of the student body, the guiding conceptualization used to frame the effects of school context related to school institutionalized features assumes that institutionalized features, in this case reflected as institutionalized troubles or problems in the school, can affect I-C spaces. In turn, changes in the I-C spaces can affect the rates of substance use and the school levels of academic performance; thus, affecting the dynamic between SU and AP.

The conceptualization of school trouble factors included two measurements of this school context, one was reported by the principals in the In-school survey and the other was based on the report of the students in the In-School questionnaire (see Chapter II for more details about the measurement part of this factors). Based on the principals' report, two school institutional trouble factors were created: a factor of school general troubles and a factor of drug and pregnancy troubles. These factors were not significant in any of the four measurements related to AP nor SU at the school level.

Based on the students' reports in the In-School questionnaire, one school factor was created. This factor accounted for variation among four indicators (doing homework, paying attention, getting along with teachers, and other students). This factor was called school social and academic problems. The effect of this factor, *ceteris paribus*, was negative and significant on the school levels of academic performance at Wave 2 (-0.052 at $p \leq 0.05$; see table 4.4).

	$Wave2$		$Wave1$	
	SU	AP	SU	AP
Within				
SU (Wave1)	0.632***	-0.068***		
AP (Wave 1)	-0.076***	0.406***		
Age			0.097	
Age square			-0.073∼	
Female		0.136***		0.242***
SES		0.068***		0.191***
Race (White)				
Hispanic	-0.105∼	-0.165	0.122	-0.220*
African American	-0.319***	-0.081∼	-0.449***	-0.289***
Asian	-0.109*	0.191***	-0.642***	0.547***
Other	-0.120	-0.099	0.036	-0.055
Repeat	-0.144**	-0.142***	0.193*	-0.419***
Grade (Grade 11)				
Grade 9	-0.109**		-0.442***	
Grade 10	-0.130***		-0.223**	
Between				
SU (Wave1)	0.688***			
AP (Wave 1)		0.753**		
School soc/acad problems		-0.052*		

Table 4.4: Multilevel bivariate cross-lagged model: effect of school social and academic problems. $\sim p \leq 0.1$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, and $^{***}p \leq 0.001$. Reference categories are in parenthesis. $n = 7984$ and $k = 114$.

This result means that as the school levels of academic and social troubles increase, and keeping all other factors constant, schools are, on average, more likely to become environments with lower levels of AP, thus affecting the student academic performance.

4.4 School practices and policies factors

As hypothesized in the guiding conceptualization 3 (Chapter I), School Practices and Polices represent a part of the school context that is assumed to modify the I-C spaces. This means that effects on the school levels of academic performance and school rates of substance use are expected to generate contexts with more or less propensity to promote o detriment SU and AP.

In this dissertation, school policies were represented by two factors reflecting on indicators reported by the school administrator. These indicators were about the school policies against several common problems such as fighting with another student, injuring another student, and possessing alcohol (for more details, please, refer to the measurement part in the Methods Chapter). Using these school problem indicators, two factors were estimated, policies against delinquent behaviors and polices against drug use an possession. Higher values in these factors indicate that the schools have higher probabilities or concerns to apply stronger policies or sanctions against delinquent behavior or against possession and use of drugs. The effects of these factors were tested pointing only to one significant result: policies against delinquent behavior was statistically significant on the factor related to AP at the school level at Wave 2. This result is shown in table 4.5.

As quick note, the non-significant effect of the other school policy factors on school rates of substance use could suggest that the existence of stronger sanctions might no be enough to capture school policy effects. Another explanation, implies that other aspects, not measured in the surveys, such as the implementation and reinforcement

of the policies could account for stronger impacts of policies.

Returning to the significant effect and holding all other factors constant, the effect of school policies against delinquent behavior is negative on school levels of academic performance (-0.232, $p \leq 0.05$). It seems counter intuitive that as the levels of policies against delinquent behavior increases the school levels of AP decreases. However, the latent factor of school policies against delinquent behaviors places schools within a continuum from the absence of policies and sanctions to the presence of stronger policies and sanctions. It seems that schools placed in higher levels of this continuum have stronger policies because of the need to have stronger polices; reflecting more the presence of delinquent behaviors rather than the normative and regulatory effects of the policies. Thus the negative relationship could be confounded with the existence of delinquent behaviors at schools.

A second interpretation could be that higher levels of policies against delinquent behavior, indeed, promote school environments where it is harder to achieve higher grades. Stricter policies might reflect a general strict environment, which includes more strictness in grading and more emphasis on discipline than learning; therefore the school is less likely to have, on average, higher levels of academic performance among its students. As in the case of the other results Chapter IV expands these ideas and interpretations.

4.5 School academic pressure factor

The fourth conceptualization assumes that the school context related to academic pressure transmits students a sense of academic goals and expectations, expressed as academic pressure. This pressure is transmitted to the students mainly through academic standards, curriculum, goals to achieve, academic practices, and a set of expectations to perform as good students. The assumption is that the student gets from the context a general feeling of academic demands that cannot be directly ob-

	$Wave2$		$Wave1$	
	SU	*AP*	*SU*	*AP*
Within				
SU (Wave1)	0.630***	-0.067***		
AP (Wave 1)	-0.077***	0.405***		
Age			0.115	
Age square			-0.083*	
Female		0.136***		0.242***
SES		0.071***		0.191***
Race (White)				
Hispanic	-0.102∼	-0.154	0.133∼	-0.198*
African American	-0.322***	-0.079∼	-0.444***	-0.276***
Asian	-0.121*	0.192***	-0.625***	0.563***
Other	-0.128∼	-0.105	0.056	-0.027
Repeat	-0.148**	-0.133***	0.196*	-0.419***
Grade (Grade 11)				
Grade 9	-0.112**		-0.430***	
Grade 10	-0.135***		-0.214**	
Between				
SU (Wave1)	0.616***			
AP (Wave 1)		0.794**		
School Delinq. Policy		-0.112*		

Table 4.5: Multilevel bivariate crossed-lagged model: effect of school delinquent behavior policies on SU and AP. $\sim p \leq 0.1$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, and $^{***}p \leq 0.001$. Reference categories are in parenthesis $n = 7984$ and $k = 114$.

served, thus conceptualized as a latent factors. Academic pressure can provide more structure and stability to the I-C spaces generating more propitious learning environments. More structure and more learning-oriented I-C spaces can generate school contexts that increase the overall school levels of academic performance as well as decrement school rates of substance use. Thus affecting the relationship between academic performance and substance use.

As described in the Methods section, the school academic pressure was operationalized using two factors. One factor was called selective academic pressure while the other was called generalized academic pressure (see the measurement part for more details about how these two factor were estimated and interpreted). The selective academic pressure factor was interpreted as a factor that accounts for academic pressure only on a selective group of students at the school. On the contrary, in the generalized academic pressure factor, higher values imply schools contexts that are more likely to exert academic pressure on all students.

After testing the effect of these two factors, holding all covariates constant, the results showed significant effects of the selective academic pressure factor on the factors related to SU and AP at Wave 1; similar, *centeris paribus*, was the effect of the generalized academic pressure factor being also significant on the factors related to SU and AP at Wave 1. These results are presented in table 4.6 for the selective academic pressure factor, and in table 4.7, for the generalized academic pressure factor.

As mentioned, the effect of the academic selective factor was significant and positive on both measurements related to AP (0.142,$p \leq 0.1$) and SU ($0.327 \leq 0.001$) at Wave 1. It was expected that academic pressure could haver a positive effect on the school levels of academic performance; as the levels of selective academic pressure increase schools become environments with more students obtaining good grades. However, a positive effect on the factor related to SU is counter intuitive. One possible

	$Wave2$		$Wave1$	
	SU	*AP*	*SU*	*AP*
Within				
SU (Wave1)	0.63***	-0.066***		
AP (Wave 1)	-0.075***	0.409***		
Age			0.121∼	
Age square			-0.087*	
Female		0.136***		0.242***
SES		0.069***		0.194***
Race (White)				
Hispanic	-0.108∼	-0.16	0.136∼	-0.206*
African American	-0.33***	-0.082*	-0.447***	-0.286***
Asian	-0.125*	0.182***	-0.622***	0.551***
Other	-0.138∼	-0.109	0.061	-0.037
Repeat	-0.147**	-0.134***	0.196*	-0.425***
Grade (Grade 11)				
Grade 9	-0.112***		-0.427***	
Grade 10	-0.138***		-0.213**	
Between				
SU (Wave1)	0.669***			
AP (Wave 1)		0.813***		
Selective Acad. Pres.			0.169***	0.047∼

Table 4.6: Multilevel bivariate crossed-lagged model: effect of school selective academic pressure on SU and AP. $\sim p \leq 0.1$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, and $^{***}p \leq 0.001$. Reference categories are in parenthesis. $n = 7984$ and $k = 114$.

interpretation is based on the term "selective", where academic pressure is differentially applied to students (some might get more pressure while other might be left behind). This selectivity would imply that schools have split environments based on who receive more or less academic pressure; therefore academic pressure might create an environment for students to better perform in academic endeavors while at the same time, selectivity might create another environment for students with lack of academic pressure; thus, on average, schools are also more likely to increase the risk of substance use engagement among most students.

On the contrary the generalized academic pressure factor has a positive effect increasing the school levels of academic performance (.359, $p \leq 0.1$) and a negative effect decreasing the school rates of substance use (-.402, $p \leq 0.1$). This interesting result might communicate that treating students in a more egalitarian fashion demanding higher levels of academic engagement would results in increasing students AP and decreasing SU.

As summary, this section presented results that suggest that academic pressure can act in two different ways depending on whether it is selective or generalized. Higher levels of academic selectivity was found to increase the school levels of academic performance as well as the school rates of substance use. On the other hand, higher levels of the generalized factor might increase school levels of academic performance but decreased the school rates of drug use.

The way this two factors exert influences on student academic performance and substance use is through changes in the academic and non-academic I-C spaces generated at schools. Thus, both types of I-C spaces potentially restrict the individual probabilities to achieve better or worse grades and/or engage in different levels of substance use.

Based on all these results accounting for school context effects presented in these sections, a final analysis tested for the combined influences of all the factors with

	$Wave2$		$Wave1$	
	SU	*AP*	*SU*	*AP*
Within				
SU (Wave1)	0.63***	-0.066***		
AP (Wave 1)	-0.075***	0.409***		
Age			0.121∼	
Age square			-0.087*	
Female		0.136***		0.242***
SES		0.069***		0.194***
Race (White)				
Hispanic	-0.108∼	-0.16	0.136∼	-0.206*
African American	-0.33***	-0.082*	-0.447***	-0.286***
Asian	-0.125*	0.182***	-0.622***	0.551***
Other	-0.138∼	-0.109	0.061	-0.037
Repeat	-0.147**	-0.134***	0.196*	-0.425***
Grade (Grade 11)				
Grade 9	-0.112***		-0.427***	
Grade 10	-0.138***		-0.213**	
Between				
SU (Wave1)	0.669***			
AP (Wave 1)		0.813**		
Generalized Acad. Pres.			-0.207∼	0.118∼

Table 4.7: Multilevel bivariate crossed-lagged model: effect of school generalized academic pressure on AP and SU. $\sim p \leq 0.1$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, and $^{***}p \leq 0.001$. Reference categories are in parenthesis. $n = 7984$ and $k = 114$.

statistically significant effects; the next section presents the results of this combined model.

4.6 School context model

The final model presented in this section was developed testing simultaneously all school factors that had significant effects. A preliminary model showed that the selective academic pressure factor was not significant, therefore it was removed from the final model presented here. This final model estimated, controlling by student level covariates, the effects of the school risk factor derived from the student body composition, the school institutional academic and social problems factor, policies against delinquent behaviors factor and generalized academic pressure factor. The results are shown in figure 4.1 (displays standardized coefficients) and table 4.8 (displays non standardized coefficients). The goodness of fit is excellent, RMSEA, CFI and TLI suggested that the model fitted very well the data.

The crossed-lagged effects at the individual level remained very similar to the results presented in the previous section (within model including only students level covariates); previous levels of AP increased future levels of AP as well as previous levels of SU increased future levels of SU. The cross effects were smaller but suggested, as in the student level correlation, that AP and SU have a negative relationship parallel in time as well as across time (see student level model in fig 4.1). At the school level the relationship between the factors related to AP and SU show only lagged effects (crossed effects were not included given that previous model showed non significant cross relationship), the correlations were positive among the school factors related to AP and SU in both waves, as displayed in figure 4.1.

These results show that the school risk factor was positively related, holding all other factors constant, to the school rates of substance use in both waves. In other words, as the levels of school risk increases by one standard deviation the school

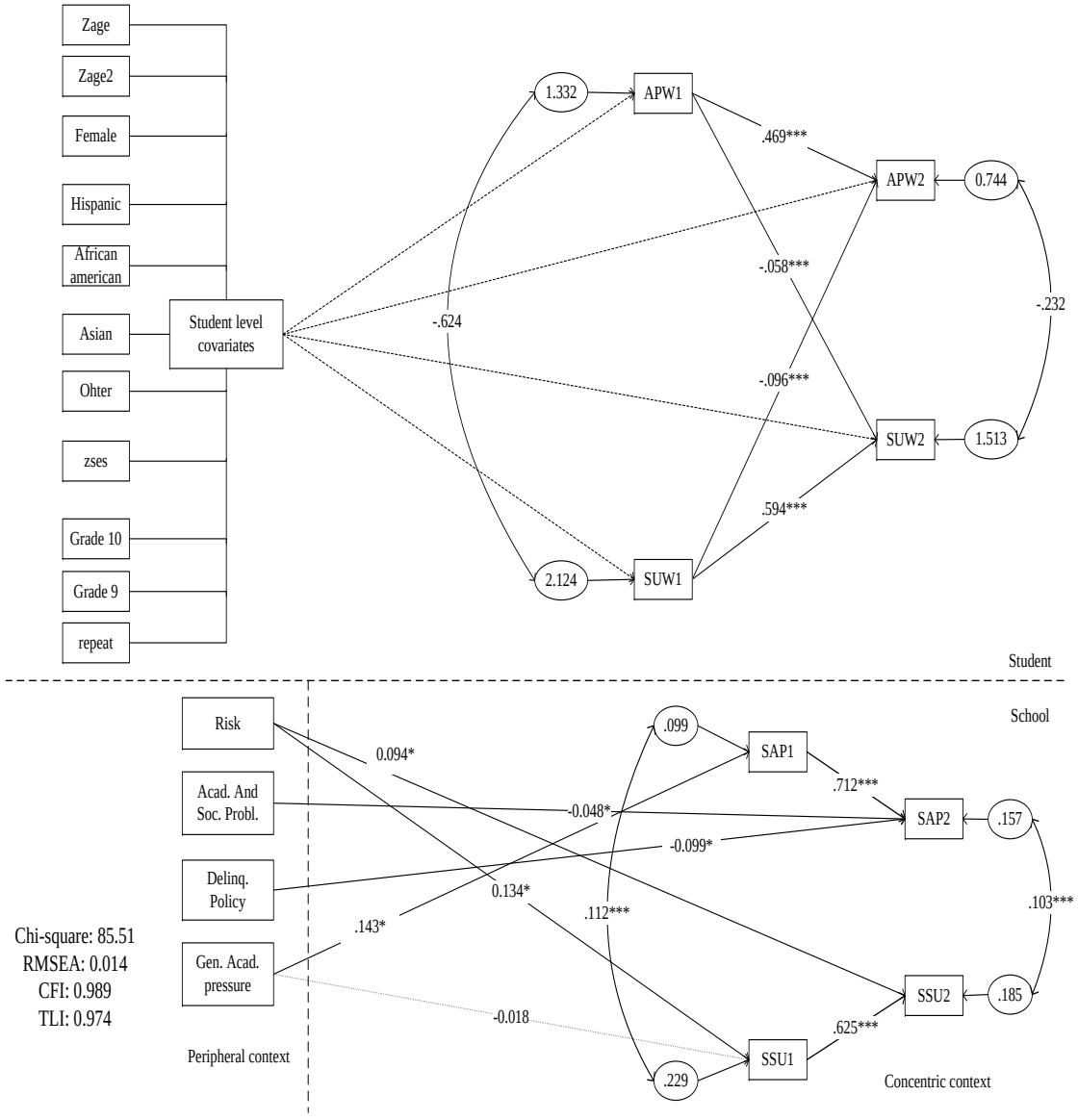

Figure 4.1: Multilevel bivariate crossed-lagged model: effect of school factors on SU and AP. School factors are: school risk factor, school social and academic problems, school policies against delinquent behavior, and generalized academic pressure. Coefficients are standardized. This model controls by student level (within level) characteristics (gender, age, SES, grade, ethnicity, and grade retention before Wave 1), the coefficients for the student level are omitted for simplicity. $\sim p \leq 0.1$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, and $^{***}p \leq 0.001$. $n = 7984$ and $k = 114$.

	$Wave2$		$Wave1$	
	SU	*AP*	*SU*	*AP*
Within				
SU (Wave1)	0.632***	-0.068***		
AP (Wave 1)	-0.076***	0.406***		
Age			0.097	
Age square			-0.073∼	
Female		0.136***		0.242***
SES		0.068***		0.191***
Race (White)				
Hispanic	-0.105∼	-0.165	0.122	-0.22*
African American	-0.319***	-0.081∼	-0.449***	-0.289***
Asian	-0.109*	0.191***	-0.642***	0.547***
Other	-0.12	-0.099	0.036	-0.055
Repeat	-0.144**	-0.142***	0.193*	-0.419***
Grade (Grade 11)				
Grade 9	-0.109**		-0.442***	
Grade 10	-0.13***		-0.223**	
Between				
SU (Wave1)	0.625***			
AP (Wave 1)		0.712***		
Sch. Risk Factor	0.094*		0.134*	
Sch. Acad. and Soc. Probl.		-0.048*	0.143*	
Sch. Delinq. Policies		-0.099*		
Sch. Gen. Acad. Press.			-0.018	0.143*

Table 4.8: Multilevel bivariate crossed-lagged model: effect of school factors on SU and AP. School factors are: school risk factor, school social and academic problems, school policies against delinquent behavior, and generalized academic pressure. Coefficients are standardized. Coefficients are non standardized. This model controls by student level (within level) characteristics (gender, age, SES, grade, ethnicity, and grade retention before Wave 1). $\sim p \leq 0.1$, $^{*}p \leq 0.05$, $^{**}p \leq 0.01$, and $^{***}p \leq 0.001$; $n = 7984$ and $k = 114$.

rates of SU increases by a factor of .173 ($p \leq 0.1$) in Wave 2, and by a factor of .747 ($p \leq 0.001$) in Wave 1. These results imply direct and indirect effects of the school risk factor on SU. Note that the indirect effect seems to be stronger than the direct path towards Wave 2. This might suggest that effects on younger ages could be stronger.

The academic and social problem factor, *centeris paribus*, was negatively related to the school factor accounting for AP in Wave 2. The decrement effect was -0.103 ($p \leq 0.05$), meaning that per standard deviation of increment in the scores of the academic and social problem factor, there was a decrement of -0.103 in the school levels of academic performance. These results also show that, holding all factors constant, school policies against delinquent behaviors have a negative effect on the factor related to AP at the school level. Per one standard deviation of variation in this policy factor the school levels of academic performance might fluctuate by a magnitude of .212 ($p \leq 0.05$). Finally, the results present a significant and positive effect of generalized academic pressure on the school levels of AP, such that per standard deviation increment in generalized academic pressure, schools become environments with higher levels of AP (0.446 ($p \leq 0.05$). Note that the effect of this academic pressure factor was not significant on the school rates of substance use, as it was when this factor was tested separately. This non-significant result could be due to power issues or because once controlling by the school risk factor, the effect of academic pressure on the school rates of substance use disappears.

All these results strongly suggest the existence of school context effects on the dynamic between academic performance and substance use. These final results are discussed in more detail in the next Chapter.

CHAPTER V

Discussion and Conclusions

5.1 Recapitulation

This dissertation relies on the idea that the school context provides a set of opportunities or conditions under which certain behaviors and outcomes are more likely to happen. To provide a rationale to explain how this contextual effects can be translated into academic performance and substance use, a new theoretical framework was proposed in Chapter I. This theoretical framework has three key components: (i) a detailed definition of the school context; (ii) a division of the school context into peripheral, concentric, and intrinsic; and (iii) four guiding conceptualizations to interpret empirical results.

As mentioned before, this dissertation focuses only on the concentric context mainly because both the peripheral and intrinsic context bring other layers of theoretical and methodological complications; thus using only the concentric context provides a more parsimonious approach to explore school context effects on the dynamic between academic performance and substance use.

To complement this structural part of the school context definition, a functional-systemic component was assumed to explain how the concentric context generates environments or settings that are more or less propitious for substance use and for achieving different levels of academic performance. This functional-systemic was rep-

resented by the I-C spaces, which exist along the different hierarchies of the school context. It is assumed that the variations in the school context can alter the I-C spaces that are more academically oriented and can also create or promote I-C spaces that are less structure and more oriented to leisure including risk behaviors, thus generating environments that restrict or promote the probabilities of substance use and also restrict or promote the probabilities of obtaining certain levels of academic performance.

The empirical results presented in Chapter III related to the dynamic between academic performance and substance use, while the results presented in Chapter IV related to the existence of school contextual effects on the dynamic between substance use and academic performance. The empirical results presented in the two previous chapters are discussed in the first two sections, then policy and practical implications are outlined in the third section, and finally, the last section presents final remarks and conclusions.

5.2 Dynamic between academic performance and substance use

5.2.1 The importance of defining the school context

It can be argued that the theoretical perspective in this dissertation is one attempt to participate in an open dialogue about theoretical concerns related to how school effects are defined and interpreted. Based on empirical results mainly in education research, it seems that it is a consensus that the school context can influence academic outcomes. In addition, it appears there is a growing trend in other social sciences, whereby researchers have been documenting contextual school effects on non-academic outcomes; however, from a theoretical perspective, there is no clear consensus in our understanding on the school context definitions and explanations on

how the school context can be translated into student behaviors, performances, and achievements.

For instance, Sörensen and Morgan (2000) have pointed to the existence of a basic flow in most school effects research, they argue that there is not enough conceptualization of how the school and students interact in the learning process. This critique could be extended to the relationship between academic performance and substance use. To my knowledge and after an extensive literature review, there is no current theoretical explanations of how the school context can affect this relationship.

In more general terms related to contextual effects models, Blalock (1984) has argued that when claiming contextual effects, it cannot be assumed that "... all actors in any given settings can be can be characterized by identical processes. This requirement implies... (the need) for social psychological theories linking these actors to their contexts" (Blalock, 1984, 361).

In addition, definitions of the school context can also determine individual level factors that need to be included when modeling school effects. For example, it is interesting to notice that Sellström and Bremberg (2006) argue that the inclusion of pupil level predictors in multilevel models needs to depend on *theoretical considerations* of how schools and communities are interconnected and how pupils and their families are influenced by school contextual factors. These claims imply that we can expand more our theoretical understanding of school actors and their school context can be linked.

As an attempt to address these theoretical issues, the definition of school context including the functional-systemic concept of I-C space can provide a theoretical framework that links school contextual effects to individual level of substance use and academic performance; thus providing an interpretation of how the school context can influence the dynamic between academic performance and substance use.

5.2.2 The dynamic between academic performance and substance use

The main results related to the dynamic between academic performance and substance use address research question 1, which explores how this dynamic can be represented at the student and school levels. The results presented in Chapter III strongly suggest that the operationalization of academic performance and substance use can go beyond the use of school aggregated means; using multilevel CFA providing more flexibility to incorporate the measurement part as well as test assumptions –such as identical measurement structures at the student and school levels– that cannot be tested when using only the aggregated mean. In this dissertation, for example, the school factor related to substance use only accounts for variations in the alcohol and cigarettes items, but marijuana remained unexplained at the school level. This suggests clues for the need of more complex structures to capture substance use at the school level. Modeling only intercepts, expressed as adjusted means could erroneously assumed that marijuana was part of the substance use operationalization at the school level.

The results in Chapter III showed that the operationalization of the school factors for both academic performance and substance use had different measurement structures and different interpretations than the corresponding student level operationalizations of these constructs.

Note that these results represent only 'one way' to operationalize these school factors. In fact, it is also the case that substance use and academic performance can be operationalized in other ways. In other words, despite the fact that the measurement model has good fit indicators, it does not imply that there might not be alternative ways to capture substance use and academic performance as well as the school levels of academic performance and the school rates of substance use. Further research can explore other measurement models that represent other ways to operationalize these factors for substance use and academic performance.

Turning our attention to the construction of all factors used in this dissertation, in their construction unidimensionality was imposed and sometimes the error structure attempt to compensate for a more complex structure. Relaxing the unidimensional restriction opens the possibilities to explore multidimensionality in how the academic performance and substance use can be operationalized at both levels. In other words, the measurement models can be richer. For example, it is possible to account for multiple dimensions of substance use and academic performance. Future research can also explore a vast range of possibilities available in the SEM framework. However, I have imposed unidimensional models to have simple structures simplifying the complexity of the relationship between academic performance and substance use and allowing for a more parsimonious exploration of school effects on this relationship.

In discussing the interpretation of the school factors a limitation needs to be addressed related to academic performance. There is, as mentioned before, a substantial difference between grading and test scores. In grading, the so called "subjective" and "authentic" components of the evaluation of academic performance cannot be ignored. In other words, what teachers bring (ideas, stereotypes, conceptions, experience), school culture and climate, non academic characteristics of the students, and classmates opinions can affect the ways in which teachers assign grades to their students. *A fortiori*, grades develop constantly based on the interaction between the students, teachers, and classmates. The grades, then, become a posteriori evaluation.

Thus, it is complicated to incorporate and operationalize academic performance based on school grades. At the student level the concept of academic performance is widely accepted represented mainly by the grades; however at the school level, aggregating the grades using the only means has no meaning, given the ordinal nature of grades. In order to aggregate the ordinal grades using the mean, a strong assumption is made: grades are not measured in an ordinal scale but interval scale, where numerical differences can be represented by the mean. The advantage of SEM and multilevel

CFA is that the ordinal nature of the scale can be preserved and expressed in terms of probabilities using ordinal probit or logistic models. In addition, SEM allows for the conceptualization and estimation of more complex models such as multidimensional models that could capture more accurately academic performance, for example, other indicators could be used in addition to the students' reports. Other sources, such as transcripts and teacher reports could bring more reliability. Academic performance can also include other areas of evaluation during the school year, such as teacher reports of student progress.

5.2.3 School level relationship between academic performance and substance use

At the core of this dissertation is the central idea that by the time adolescents attend middle and high schools, academic performance and substance use are conceptualized in an inter connected dynamic where both co-occur and it is difficult to distinguish cause and effect. Thus the way this dynamic was modeled reflects the co-occurrences between two waves of measurement. Future research can expand the number of time points to explore non linear estimates of the relationship between academic performance and substance use.

An important finding is that the empirical evidence suggest that at the school level the relationship between academic performance and substance use was positive at both waves, after controlling by the school context. The fact that these correlations were positive can be partially explained by the student body composition. Given that the allocation of students to schools mainly depends on the school district. It is very likely that students with similar levels of economic resources are clustered in the same schools.

In other words, students with higher levels of economic resources could have access to greater opportunities to achieve higher academic performance, however at the same

time another group of students, also with higher resources, can have economic power to purchase drugs such as alcohol and cigarettes. Thus, the positive correlation at the school level can be reflecting that accessibility to more educational resources could imply accessibility to some drugs (alcohol and cigarettes). On the contrary, students with less resources could be clustering in schools that provide less opportunities to achieve higher levels of performance but also these students may not have enough resources to purchase drugs. More research is needed to explore in more detail this school level correlation.

It is also important to note that economic resources aggregated at the school level can generate school settings that provide more opportunities to consume drugs and academically perform better. For example, let us take one student who has a family with fewer economic resources and place him in a public school with a student body composition with more economic resources. The positive correlation between the school levels of academic performance and the school rates of substance implies two ideas: (i) the school context has peers who can engage in more academic work in and out the school. Then, in general, this student can benefit from these peers and improve his academic performance. (ii) At the same time, this student can also have more access to drugs, even if he does not have the economic resources to spare on cigarettes and beer, eventually this student can find peers that can share a cigarette or a beer. Thus, the same school environment, on average, can provide contexts that promote both substance use and academic performance among their students.

More important is to notice that the positive correlation between academic performance and substance use, at the school level, reflects that schools are composed by students who can achieve higher levels of academic performance and also by students who can engage in substance use. In other words, both substance use and academic performance co-exist in schools. This results have important policy implications that are outlined later. It is also worth mentioning that no cross effects were significant at

the school level. This, as expected, reflects that schools are not active environments that reduce substance use in order to promote academic performance.

Interestingly, a closer look at the correlation matrix among indicators, reveal that at the school level the marijuana indicators and the academic performance indicators were negatively related in both waves. This provides clues pointing to multidimensionality in the conceptualization of the substance use-academic performance relationship. Assuming unidimensional constructs provides parsimonious results; however, it restricts the construction of reality and does not consider differentiations among dimension of substance use and academic performance.

Multidimensional models add more complexity but can provide differential estimations that account for multiple dimensions of a construct. In relation to this topic, Muthén (1991), referring to unidimensional versus multidimensional models in mathematics achievement, expressed that estimates of a general mathematic achievement factor are not biased but are undifferentiated when compared to estimates that accounts for several areas or dimensions of mathematic achievement. Similar ideas have been explored in the case of substance between the discussion of a general substance use factor compared to specific factors reflecting each drug (Bachman et al., 2008). Taking into account multidimensionality in conceptualizing and modeling the school context effects on the dynamic between academic performance and substance use is another interesting and exciting topic that future research can address.

5.3 Concentric school context effects

5.4 Empirical results

This section discusses the results that address research questions 2 to 5 related to the effects of the peripheral context. These four research questions derived from four guiding conceptualizations, which are:

Question 2: *Does the composition of the student body influence the relationship between school levels of academic performance and school rates of substance use, thus affecting academic performance and substance use?*

Question 3: *Do school institutional features influence the relationship between school levels of academic performance and school rates of substance use, thus affecting AP and SU?*

Question 4: *Do school policies affect the relationship between the school levels of academic performance and the school rates of substance use, thus affecting the AP-SU relationship?*

Question 5: *Does the school academic pressure influence the relationship between school levels of academic performance and school rates of substance use, thus affecting the relationship between AP and SU?*

The main objective of these four questions is to seek for empirical evidence that supports the existence of concentric school context effects on the school levels of academic performance and school rates of substance use, thus affecting the relationship between academic performance and substance use. This empirical evidence was presented in Chapter IV pointing to four main results that are summarized and discussed in the next paragraphs.

(a) Results related to research question 2: The findings showed effects of the student body composition represented as a general school risk factor. Higher levels of this risk factor represent overall riskier environments for adolescent development while lower levels of this factor represent environments that can be more protective for adolescent development (for more details about this school risk factor see the methods section as well as appendix A). The results present evidence supporting positive effects only on the school rates of substance use; this means that as the levels of general school risk factor increases, schools are more likely to become environments that promote substance use, thus affecting adolescent substance use. These results resonate with

peer effects, which is one of the main individual factors that explain substance use. In fact the student body composition can be seen as a 'macro' representation of peer compositions. However, this macro representations does not explain why the effect of the general school risk factor can be translated into adolescent substance use.

Interestingly, the school risk factor had no effect on the school levels of academic performance; the lack of effects can be explained based on the idea that the overall school risk factor can promote mainly other risk behaviors such as substance use but not have much of an impact on academic factors. To explain how the effect of the school risk factor translates into substance use, I rely on one conceptual definition, the existence of I-C spaces.

The effect of the school risk factor on the school rates of substance use can be explained by changes in I-C spaces, mainly I-C spaces that are non-academic in nature such as I-C spaces created during free time and recess. School with higher levels of risk can generate I-C spaces that are more oriented towards drug use, thus increasing the probability that students engage in substance use.

Note in this dissertation the effect of the school context is assumed to transcend the physical boundaries of the school. This idea is consistent with the idea of the meso-system, which aims to capture the interaction among contexts and individuals (Bronfenbrenner, 1979). Limitations and alternative explanations about the I-C space explanation are discussed in subsection 5.5.

(b) Results related to research question 3: The school institutional features were estimated based using three school factors: school institutional problems, school drug and pregnancy problems, and school social and academic problems. The school institutional problems and the school drug and pregnancy problems did not show any statistically significant effects in the school rates of substance use. It is surprising that these two factors did not show effects on substance use. One possible explanation is that these two problems might not be so common among schools, occurring at similar

rates among all schools, thus not really showing significant effects.

As a matter of fact, the school institutional features is the part of the concentric context that had the weakest effects on both school factors related to academic performance and substance use. This seems to be consistent with the literature in education, where the student body composition and school academic factors have been documented as having more consistent influences on academic achievement/performance (Hanushek et al., 1997; Konstantopoulos, 2006; Caldas and Bankston, 1997).

From these three factors tested, the school social and academic problems factor showed statistically significant effects only on the school levels of academic performance in Wave 2. The effect was negative meaning that as academic and social problems increase in schools, schools become environments where it is less likely to obtain better grades, thus affecting academic performance. How this effect is translated in effects on academic performance can be explained by the I-C space idea.

On average and holding all other factors constant, increments in academic and social problems can disrupt I-C spaces, especially academic I-C spaces, thus reducing the probabilities of achieving higher levels of academic performance; which is reflected on the significant effects of this academic and social problems found on the school factor related to academic performance. For example, problems in communication between teachers and his or her students and students not being able to pay attention in class can clearly generate academic I-C spaces during classes that are more troublesome. In fact, if these problems become a general school trait, then the majority of academic I-C spaces would be disrupted, ultimately decreasing academic performance among students.

(c) Results related to research question 4: Two school factors, policies against drug use and possession and policies against delinquent behavior were used as operationalizations of school policies and practices. Policies against drug use and possession was not statistically significant. One reason that might explain this result

is that drug consumption within the schools might be more scare and harder to detect, resulting on few variation among schools, which in turn would results in small non-significant effects. Another reason could be that, indeed, drug policies in the school cannot have a direct effect on the school rates of substance use. Meaning that regardless of the existence of the policy, schools remain as environments with same levels of drug risk.

Note also that this factor only reflects on the principals' reports on the existence of policies towards drug use and possession; this factor does not relate to whether policies were implemented and enforced. In other words the existence of policies *per se* might not be enough to generate school environments that protect adolescents against drug use. More information is needed about the implementation and enforcement of these policies to account for effects on the school rates of substance use.

It is interesting to note, however, that policies against delinquent behavior had a negative statistically significant effect on the school levels of academic performance. Three explanations are possible. (a) The existence of policies against delinquent behavior might be capturing school contexts where delinquent behaviors are a problem, thus the factor becomes a proxy of delinquent problems at schools, having a negative effects on the school levels of academic performance. (b) A less likely interpretations is that schools with stricter policies might be more demanding environments with higher expectations, then the effect of delinquency might be spurious reflecting a negative correlation that could be explained by a general factor of stricter traditions in the school. Unfortunately, there are no data available to test this hypothesis. (c) The third explanation, indeed, reflects the fact that having stronger policies against delinquent behaviors generate environments that are more focused on exerting control over students and less focused on learning and academic activities; thus becoming school settings that are detrimental for students' academic performance.

(d) Results related to research question 5: Two factors were tested rep-

resenting academic pressure. One factor was called selective academic pressure and the other was called generalized academic pressure. Both factors had statistically significant effects on the school rates of substance use and the school levels of academic performance; however, when they were tested in the final model among the other school factors, only the generalized academic pressure factor retained statistically significant results on the school levels of academic performance at Wave 1. As a quick reminder, the differences between the generalized academic pressure factor and the selective academic factor pivots around the idea that the selective factor reflects academic pressure only on a group of students in the schools while the generalized factor reflects academic pressure on all students at schools.

It was interesting to see that the selective academic pressure factor had a positive effect on the school rates of substance use and school levels of academic performance. Reflecting the dual nature of providing academic pressure on a group of students while leaving other groups unattended; the lack of academic pressure on the unattended group of student can increment their probabilities to engage in risk behaviors such as substance use. However, as mentioned before, these effects became non-significant once controlling by the other school factors.

The effect of the generalized academic pressure factor remained statistically significant after controlling by the other school factors. This effect was positive meaning that school contexts that transmit a generalized sense of academic demands are more likely to become environments where adolescents can get higher levels of academic performance. It can be argued that increments in the school generalized academic pressure can generate I-C spaces that are more focused on academic tasks, generating school environments that might promote higher levels of academic performance.

Note that this generalized academic pressure factor had no significant influence on the school rates of substance use after controlling by other school factors. However, with no controls, increments in the generalized academic factor seemed to decrease

these school rates; a promising result that could not be held after controlling by other school factors.

Up to this point, the results suggest the existence of school context effects either on the school levels of academic performance or the school rates of substance use. The fact that the measurement parts of the school factors were omitted can underestimate some of these results. Future research can utilize data with more schools and fully incorporate the measurement models in the operationalizations of the academic performance and substance use factors, which can provide more reliable estimates.

Before moving towards another topic, it is interesting to highlight that the correlations and school level variances were reduced when school context factors remained significant. However, most of these reductions in and between the school outcomes for substance use and academic performance at Wave 2 is explained by previous levels of these factors at Wave 1. In other words, school levels of academic performance and school rates of substance use at Wave 1 explain most of the variation and correlation in Wave 2. The low reduction of variance in the school level outcomes can also be explain for the small amount of variances in the ICCs (7 to 10) among all the indicators of AP and SU.

The explanations provided in this dissertation rely on an assumed mechanism that explain how the school effects can be translated into student levels behaviors or achievements. In the following section, I discuss the functional-systemic roles of the I-C space.

5.5 I-C space: functional-systemic explanation

This functional-systemic part assumes the existence of I-C spaces. This I-C concept is not that simple to understand and interpret but provides an interesting mechanism. The I-C space conceptualization relies on six assumptions, in addition to its nature of being interactional and conceptual. These six assumptions are: (i) relative

to the actors and to time, (ii) the I-C space depends on the physical space, (iii) but its influences can transcend physical boundaries, (iv) the school I-C space is dynamic, it can be changed, (v) the I-C space can be related to academic and non-academic matters, and (vi) I-C space mirrors the school hierarchical structure.

Despite its complexity, the I-C space idea represents a way to translate the school context effects into student behaviors and achievements. The fact that it is defined as interactional implies subjectivity and inter subjectivity; the fact that is defined as conceptual implies a process in construction with symbolic representations in our minds. In other words, the I-C space is constructed and commonly shared among school actors. Because it is constructed and commonly shared it can exert influences in the individual.

Note that the I-C space is not equivalent to the individual mediation or interpretation of the context, the I-C space can be understood as mental representation of specific parts of the school context; representations that are symbolic, subjective, dynamic, temporal, inter-subjective, and anchored to the physical space. These representations can become meaningful, which represent one way to translate the school context into influences on adolescents' behaviors and achievements.

A limitation of this dissertation is the fact that there is no empirical evidence supporting the proposed theoretical conceptualization of I-C spaces. However, looking for empirical evidence is a future long term endeavor that will require specific design studies to address measurement issues such as how to operationalize I-C spaces as well as more theoretical work to define and set the I-C space within theoretical explanations on how the school context can affect students' achievements and behaviors. Further research can also focus on new modeling techniques that can estimate the effects of I-C spaces on individual behaviors and outcomes.

Despite the limitations mentioned, it seems that the I-C space concept can provide additional clues for deeper understanding on how the school context can affect the

dynamic between academic performance and substance use.

5.6 Policy and practical implication

As mentioned in the the first chapter, the implications for policy, educational programs, and drug prevention program pivot around two main ideas: the conceptualization of the school context and the empirical results.

(a) Related to the conceptualizations of the school context, three implications are mentioned. First, it can be useful to define the school context because in the process of defining a theoretical ground for policies and programs, we can provide a common understating of what is being defined, expected and implemented in each particular policy or program. Thus increasing transparency in policies and programs.

Second, in addition to the common understanding, definitions can help with setting clear targets to be achieved in the implementation and evaluation of policies and programs. This is important because it restricts the complexity of the school context making the details of the implementations and evaluation more focus and less diffuse under the school complexity.

Third, definitions can also help with the operationalization of concepts, construct, objectives, and outcomes. Thus providing theoretical support to the empirical evidence to be collected and analyzed. This theoretical support can be helpful in the interpretation of empirical results that providing explanations about the effectiveness of the policy or program.

(b) The policy and practical implications related to the empirical results point to two main directions: substance use and academic performance need to be understood as two phenomena that co-occur rather than one being the cause for the other, at least from middle school onwards. Thus, at the individual level, programs and policies need to aim both trying to increase adolescent performance and decrease substance use.

At the school level, the pragmatic implications pivot around the idea that schools are composed by students who engage in substance use as well as by students who can achieve high levels of academic performance.[1] Thus policies and programs need to consider that in improving academic performance does not imply effects on behaviors such as substance use or delinquency. This implies that any focus on changing policies that only aim to reduce substance use or promote academic performance might not be enough to exert influences on both substance use and academic performance. This idea could be expanded to other risk behaviors.

Despite this limitation, it seems that the student body composition risk factor and the generalized academic pressure factor are the two school level factors that policy makers and program designers could pay some attention. The school risk factor is reflecting what students bring to schools. In other words, the more problems students bring to schools, the more challenging the school environment can became. This has interesting implications for policies that rely only on academic measurements. For example, imagine a school composed by students with higher gang involvement within and outside the school, such that students involved in gangs attend the school and use it as another ground for ganging, and the rest, who are not involved in gangs, attend this school scared of the gangs. What would be more intermediate to solve: the gang problem or academic problems? The gang problem most likely claims more relevance because it threatens more basic factors such as physical safety and emotional stability. If this school makes progress in dealing with the gang problem, then this school is improving its context to make it safer, thus generating environments that can reduce drug use and perhaps promote academic outcomes. However, if policies ignore this

[1]The correlation could be adjusted by aggregated levels of the student economical resources to test whether or not the correlation disappears once controlling by this aggregated levels of economic resources. Unfortunately, it was not possible to generate a reliable estimate of aggregated levels of SES. An alternative is to model SES as individual and school level factors. In other words, allow the estimations of an SES factor at the school level based on the student level. This method is called the latent covariant approach and has as main advantage no bias in the estimate. For more details see Lüdtke et al. (2008). Future research can test this hypothesis and see how the correlations vary in the presence of latent estimates of SES at the school level.

problem and hold accountable schools based only on tests scores, then schools are being penalized for attending to more urgent matters.

In other words, evaluating the role of schools only on a few academic indicators does not really help to improve schools nor the education of our children and adolescents. This whole idea can be extended to all the non academic challenges that schools face based on its student body composition.

Ultimately, society decides the purpose of schools, whether we want them to be more technical organizations that aim mostly to develop academic domains or we think of school as communities where the academic development is one more area to be considered. In the former, we could hold schools more accountable on academic matters; on the latter, we need to understand that the more we demand from schools the less we could get from specific areas. Regardless of what we think of schools, students still will bring to schools their existences, including their problems and virtues.

The empirical implications of the generalized academic pressure can be directly related to academic performance and substance use prevention programs. It seems that the more academic demands are exerted on students the more likely they might be to improve their academic performance and perhaps reduce their drug use. This idea is consonant with the conceptualization of academic performance and substance use co-occurrences. Thus programs and policies can attempt to modify the levels of academic pressure and evaluate its effects on academic performance and substance use.

5.7 Final remarks and conclusions

Finally, I would like to present five final remarks and conclusions.

(i) The empirical results need to be interpreted with caution. In general, it is difficult to claim school effects, this dissertation is not the exception. The results do

not show clear patterns; however, the empirical evidence points to two promising set of factors: academic pressure and student body composition.

(ii) The conceptualization of school effects is, as any other conceptualization, a theoretical exercise with the need of more empirical support and the need of theoretical improvement. However, the idea of I-C spaces seems to be a promising concept that deserve more attention to understand and operationalized. Future research can consider its operationalization and test mediation effects and inter level interactions of school context characteristics on academic performance-substance use dynamic.

(iii) This dissertation is an attempt to uncover a complex subject, by itself school effects is a difficult topic, by itself the dynamic between academic performance and substance use is another complex topic. Bringing these two topics together has been a valuable learning experience with several challenges. Some of them were overcome, but some others still need to be address in future research. For example, future research can explore other dimensions of this topic such as incorporating the measurement part of the models in the final set of analyses. The focused could be turned into student patterns of drug consumption or different patterns of academic success, thus modeling school context effects on either latent classes or individual growth trajectories. Other contexts could be incorporated in the analysis, such as neighborhoods, allowing the possibility to explore cross-classified effects.

(iv) Novelty in this dissertation relies in the conceptualizations of academic performance and substance use as co-occurrences, in modeling student level and school levels outcomes in different ways, and offering a new conceptualization and interpretation of school context effects. The major implication is that at the school level, as expected, academic performance and substance use are positively related; meaning that schools are composed by students that can achieve higher levels of academic performance and also by students that can engage in substance use. It is important to notice that the fact that schools can be composed by 'good' students that

achieve higher grades does not imply that schools do not have students that consume substance use. It is also interesting that there are no crossed effects, at the school level, between academic performance and substance use. This result is also expected, as schools are not systematically reducing substance use to improve academic performance. In few words, academic performance and substance use are student level outcomes; however, schools are environments that are composed by students who can engage in substance use as well as achieve higher levels of academic performance.

(v) Much more remains to be done. I understand this dissertation as a starting point to understand how the school context can affect the dynamic between academic performance and substance use. My intention is to continue exploring in more detail several of the topics mentioned in this final chapter. Finally, all my gratitude to the readers; it is my hope that more than delivering content, this dissertation had opened a mental dialog between the reader and the text. If this has been the case, I feel great gratitude.

APPENDICES

APPENDIX A

School level factors

A.1 School context Factors

This appendix provides further detail in how the school level factors were operationalized and constructed. There are three parts in this appendix, the first part presents details for the student body composition risk factor. The second part is related to the school institutional features factors and the school policies factors.

A.1.1 Student body composition: student level factors

This subsection describes how school level factor indicators used in the construction of the student body composition risk factor. As mentioned before this school level factor was constructed in two steps. The first one was performed at the school level and estimated the following factor scores: Emotional Problems (Anxiety/Depress), Somatic Symptoms, Risk Behaviors, Drug Use, Self-Esteem, Sense of Belonging, and Health and Physical Problems.

Once the score factors were estimated, they were aggregated to the school level to be used as indicators for the student body composition risk factor, described in

the methods section. Before more details on how these student level factors were constructed a quick note about the aggregation procedure.

Because of non-response rates the aggregation was performed in two ways that resulted in very similar aggregated values. The first way used a non-response weight and the second used a post stratification weight. Although, the correct weight to use is the school non-response weight specified in step 8 in the weight documentation describing the construction of the In-School weights; it is not clear, in this documentation, that the non-repose weight available in the data set truly corresponded to the formula for the non-response weight. The school factors were build at the student level and then, as mentioned before, the factor scores were aggregated at the school level using the post-stratification weight. It would have been preferred to use a student weight without the national post stratification for the purposes of aggregating to the school level, but it was not available. There might be some threat to the validity of the findings of the results using aggregated data due to small error in the aggregation using adjustments to national rather than school level. This might over-represent the contributions of Hispanics and Blacks in school aggregates for schools with low enrollments of Hispanics and Blacks, and under-represent their contributions in the other schools[1]

As mentioned before in the methods section, the factor structures were estimated using two procedures. The first procedure uses only CFA. This procedure was used when the wording of the indicators clearly suggested a factor structure. The second procedure used EFA with a random sub-sample using half or one third of the total sample, and then CFA was used to confirm the factor structure suggested by the EFA.

[1]Several attempts were done to get the non-response weight. First, I had communicated with Russel Hathaway, who is the person in charge of Add Heath data at ICPSR here at the University of Michigan. Second, I had communicated with Joyce Tabor who is the person in charge for questions related to Add health. Joyce suggested me to use the post stratification weight and not to use the non-response weight. Finally, I searched for more specialized help and I had communicated with Dr. Jim Lepkowski who kindly advised me about the topic and tried to help me get the non response weight. Unfortunately the correct non-response weight was untraceable.

The CFA used a sub-sample containing the students who were excluded from the EFA analysis. Finally, the factors scores were estimated for the whole sample using CFA. This procedure was used when the wording of the indicators did not suggested a clear structure. In all cases, the correlations of errors are based on conceptual decisions always accounting for a second conceptualization that accounts for another source of variation not accounted for the main factor or compensating the existence of two factors suggested by the EFA but estimating only one factor.

Table A.1 and table A.2 present a list of all the indicators used in the construction of the latent factors using the In-school questionnaire. These questions asked about drug use, health, mental health, risk behaviors, self esteem, physical condition, and student perception of his school. The following paragraphs describe the construction of each one of these factors: emotional problems, somatic symptoms, risk behaviors, drug use, self esteem, sense of belonging, physical well being, and general health status.

Emotional problems (anxiety/depression) and somatic symptoms: These two factors used as categorical indicators the items derived from question 60a to 60o (see table A.1). Based on an inspection of the items a CFA analysis was estimated using items 60b, 60i-60o as the indicators for emotional problems (mainly anxiety and depression). The second factor structure was hypothesized as a general somatic factor having as indicators items 60a-60j. table A.3 shows the factor loadings.

The goodness of fit suggested that the the two factor structure model fitted very well the data (RMSEA CI between 0.05 and 0.051, and TLI and CFI above 0.970). The emotional problems factor was interpreted as a factor that accounts for depression and anxiety problems. This factor assumed a correlated error structure that accounts for anxiety (items 60i, 60j, 60l, 60n, and 60o were correlated to each other). The somatic factor was interpreted as a general factor indicating psycho-somatic symptoms. These two factors were aggregated to the school level and then standardized with

Indicator	*Response Scale*
49. Ever drink more than two or three times	dichotomous
50. In general, how is your health?	ordinal: 5 +/−
54. Difficulty using your limbs	dichotomous
56. Use cane/crutchs/walkr/orth. shoes/whlchr/scooter	dichotomous
57. Ever used brace on limbs	dichotomous
58. Have you used artificial limbs	dichotomous
59. *How often did you (past 12 months):*	
a. Smoke cigarettes	ordinal: 7 −/+
b. Drink beer, wine, or liquor	ordinal: 7 −/+
c. Get drunk	ordinal: 7 −/+
d. Race on a bike/skateboard/roller blades/boat/car	ordinal: 7 −/+
e. Do something dangerous because of being dared to	ordinal: 7 −/+
f. Lie to your parents or guardians	ordinal: 7 −/+
g. Skip school without an excuse	ordinal: 7 −/+
60. *how often (past 12 months):*	
a. Did you feel really sick	ordinal: 5 −/+
b. Did you wake up feeling tired	ordinal: 5 −/+
c. did you have skin problems	ordinal: 5 −/+
d. Were you dizzy	ordinal: 5 −/+
e. Did you have chest pain	ordinal: 5 −/+
f. Did you have a headache	ordinal: 5 −/+
g. Did you have aches/pains/soreness in muscles/joints	ordinal: 5 −/+
h. Did you have a stomachache	ordinal: 5 −/+

Table A.1: List of indicators used in building the student body composition latent factors. Dichotomous items were dummy coded (1: mark, 0: not marked), ordinal responses range and direction are indicated for for example in ordinal: "5 −/+" 5 indicates the number of ordinal categories and "−/+" represents an ascending scale where bigger numbers represent higher order. Number next to the wording of he indicator represent the question number in the In-School questionnaire.

Indicator	*Response Scale*
60. *how often (past 12 months):*	
i. Did you have trouble eating, or a poor appetite	ordinal: 5 −/+
j. Did you have trouble falling asleep or staying asleep	ordinal: 5 −/+
k. Did you feel depressed or blue	ordinal: 5 −/+
l. Did you have trouble relaxing	ordinal: 5 −/+
m. were you moody	ordinal: 5 −/+
n. did you cry a lot	ordinal: 5 −/+
o. were you afraid of things	ordinal: 5 −/+
62. *How strongly do you agree or disagree:*	
a. I have a lot of energy	ordinal: 5 −/+
b. I feel close to people at this school	ordinal: 5 −/+
c. I seldom get sick	ordinal: 5 −/+
d. When I do get sick, I get better quickly	ordinal: 5 −/+
e. I feel like I am part of this school	ordinal: 5 −/+
f. I am well coordinated	ordinal: 5 −/+
g. The students at this school are prejudiced	ordinal: 5 −/+
h. I have a lot of good qualities	ordinal: 5 −/+
i. I am happy to be at this school	ordinal: 5 −/+
j. I am physically fit	ordinal: 5 −/+
k. I have a lot to be proud of	ordinal: 5 −/+
l. The teachers at this school treat students fairly	ordinal: 5 −/+
m. I like myself just the way I am	ordinal: 5 −/+
n. I feel like I am doing everything just right	ordinal: 5 −/+
o. I feel socially accepted	ordinal: 5 −/+
p. I feel loved and wanted	ordinal: 5 −/+
q. I feel safe in my neighborhood	ordinal: 5 −/+
r. I feel safe in my school	ordinal: 5 −/+

Table A.2: List of indicators used in building the student body composition latent factors (cont). Dichotomous items were dummy coded (1: mark, 0: not marked), ordinal responses range and direction are indicated for for example in "ordinal: 5 −/+" 5 indicates the number of ordinal categories and "−/+" represents an ascending scale where bigger numbers represent higher order. Number next to the wording of he indicator represent the question number in the In-School questionnaire.

Indicator	*Factor loadings*	
	Emotional	*Somatic*
60. *How often (past 12 months):*		
a. did you feel really sick		0.649
b. did you wake up feeling tired	0.082	0.489
c. did you have skin problems		0.417
d. were you dizzy		0.714
e. did you have chest pain		0.655
f. did you have a headache		0.683
g. did you have aches/pains/soreness in muscles/joints		0.568
h. did you have a stomachache		0.702
i. did you have trouble eating, or a poor appetite	0.296	0.389
j. did you have trouble falling asleep or staying asleep	0.351	0.284
k. did you feel depressed or blue	0.819	
l. did you have trouble relaxing	0.783	
m. were you moody	0.758	
n. did you cry a lot	0.734	
o. were you afraid of things	0.618	

Table A.3: Factor structure for emotional problems (anxiety/depress) and somatic factors. Loadings are standardized, all loadings are significant at $p \leq 0.001$. Error structure in emotional factor accounts for anxiety (correlated errors among 60i, 60j, 60l, 60n, and 60o). RMSEA = 0.050, RMSEA 90% CI = (0.050,0.051), CFI=0.978, and TLI =0.970); $n = 84233$.

Indicator	*Factor loadings*	
	Risk behavior	*Drug Use*
49. Ever drink more than two or three times		0.83
59. how often did you (past 12 months):		
a. Smoke cigarettes		0.793
b. Drink beer, wine, or liquor		0.879
c. Get drunk		0.885
d. Race on a bike/skateboard/roller blades/boat/car	0.216	
e. Do something dangerous because of being dared to	0.603	
f. Lie to your parents or guardians	0.568	
g. Skip school without an excuse	0.778	

Table A.4: Factor structure for drug use and risk behavior factors. Loadings are standardized, all loadings are significant at $p \leq 0.001$. Error structure in drug use factor accounts for alcohol (correlated errors among 49, 59b, and 59c). RMSEA = 0.046, RMSEA 90% CI = (0.045,0.048), CFI=0.998, and TLI =0.996), $n = 86028$.

mean 0 and standard deviation 1, higher values in the factor scores imply greater levels in the latent of Anxiety/Depression and higher levels of Somatic Symptoms.

Risk behaviors and Drug use factors: These two factors used categorical indicators from questions 49 and 59a-59g in the In-school questionnaire (see table A.1). Based on the wording of the questions, a two factor structure was tested. The two factors in this structure are Drug use and Risk behaviors. Table A.4 presents the factor loadings. The model goodness of fit also suggests that the factor structure fits well the data (RMSEA = 0.046, RMSEA 90% CI = (0.045,0.048), CFI=0.998, and TLI =0.996). The interpretation of the drug use factor is driven by the alcohol use while the Risk behaviors factor seems to reflect a general risk structure. These two factors were aggregated to the school level and then standardized with mean 0 and standard deviation 1, higher values in the factor score imply greater levels in the latent factors.

Self esteem, sense of belonging and physical well being factors: These three factors were constructed using as indicators the responses to question 60a - 60p in the In-school questionnaire. These three factors were constructed in two steps. First, an EFA estimated the factor structure using a random sample of 24579 students. The EFA suggested the presence of three factors with eigenvalues greater than one, (these eigenvalues were 6.624, 1.265 and 1.229 for factors 1,2, and 3 respectively). The EFA also suggested that question g2l, 62q and 62 r did not load in any of the three factors.[2]. These three items were excluded in the CFA, Based on this three factor structure, a CFA was estimated. This CFA was carried out in a second random sample of 56802 students that excluded students belonging to the random sample used to estimate the EFA. After the factor structure was confirmed, another CFA using the whole sample was estimated to generate the factors scores for each one of the three factors: Self esteem, Sense of belonging and Physical well being. Table A.5 and table A.6 show the model fit and factor loadings respectively. Model 1 show the results of the CFA used to confirm the factor structure suggested by the EFA; and model 2 shows the results of the CFA used to estimate the factor scores for the whole sample.

As in the case of the other latent factors, the goodness of fit is very good (see tableA.5). Based on the wording of the indicators, the results of the CFA in model 1, see table A.5 show three clear factors that account for Self-Esteem with indicators such as "I have a lot to be proud", physical well being with indicators such as "I am physical well fit", and Sense of belonging with indicators such as "I feel like i am part of this school". These three factors were aggregated to the school level and then standardized with mean 0 and standard deviation 1, higher values in the factor score imply greater levels in the latent factors.

health and physical problems: This factors was constructed using CFA using as indicators the responses to questions 50, 54, 57, 56, and 58 in the In-school

[2]Please, see table A.2 for the wording of the questions

Model fit	*Model 1* ($n = 56802$)	*Model 2* ($n = 81430$)
Chi-square	10121.7	14580.7
RMSEA	0.053	0.053
RMSEA 90% CI	0.052-0.054	0.052-0.054
CFI	0.985	0.985
TLI	0.978	0.978

Table A.5: Model fit for sense of belonging, physical well being and self-esteem factor structure. Model1: CFA used to confirm EFA results. Model2: CFA used to estimate factor scores. Loadings are standardized, all loadings and chi-square are significant at $p \leq 0.001$. Error structure in PWB accounts for health (correlated errors among 62c, and 62d); correlated errors accounting for social dimension in self-esteem are 62o correlated with 62p; physical ability accounted by correlated errors among 62f, 62h, and 62j; and individual dimension accounted by correlated errors among 62m, 62n, 62h, and 62k.

questionnaire. Table A.7 shows the factor loadings estimated by the CFA. The CFA goodness of fit is very good, the factor structure suggest the existence of physical problems with the limbs. In addition, a general health status was accounted by the correlation of indicators 50 and 54. The factor scores were aggregated to the school level and then standardized with mean zero and standard deviation of one. Higher values in the factor score reflect higher levels of physical problems and poorer health (item 50 ranges from 1 excellent to 5 poor).

A.1.2 School institutional features factors and school policies factors indicators

Model fit	*Model 1* ($n = 56802$)			*Model 2* ($n = 81430$)		
Indicator	*SB*	*PWB*	*S-E*	*SB*	*PWB*	*S-E*
62. *How strongly do you agree or disagree:*						
a. I have a lot of energy		0.739			0.739	
b. I feel close to people at this school	0.728			0.728		
c. I seldom get sick		0.375			0.379	
d. When I do get sick, I get better quickly		0.525			0.530	
e. I feel like I am part of this school	0.857			0.858		
f. I am well coordinated		0.706			0.711	
h. I have a lot of good qualities			0.731			0.731
i. I am happy to be at this school	0.779			0.779		
j. I am physically fit		0.783			0.782	
k. I have a lot to be proud of			0.828			0.828
m. I like myself just the way I am			0.712			0.712
n. I feel like I am doing everything just right			0.708			0.708
o. I feel socially accepted	0.321		0.520	0.308		0.520
p. I feel loved and wanted			0.758			0.758

Table A.6: Factor structure for sense of belonging, physical well being and self-esteem. Model1: CFA used to confirm EFA results. Model2: CFA used to estimate factor scores. Loadings are standardized, all loadings and chi-square are significant at $p \leq 0.001$. Error structure in PWB accounts for health (correlated errors among 62c, and 62d); correlated errors accounting for social dimension in self-esteem are 62o correlated with 62p; physical ability accounted by correlated errors among 62f, 62h, and 62j; and individual dimension accounted by correlated errors among 62m, 62n, 62h, and 62k.

Indicator	*Loadings*
50. In general, how is your health?	0.089
54. Difficulty using your limbs	0.564
56. Use cane/crutchs/walkr/orth. shoes/whlchr/scooter	0.829
57. Ever used brace on limbs	0.756
58. Have you used artificial limbs	0.725

Table A.7: Factor structure for health status factor. Loadings are standardized, all loadings are significant at $p \leq 0.001$. Error structure accounting for a general health status using correlated errors between 50 and 54). RMSEA = 0.036, RMSEA 90% CI = (0.033,0.039), CFI=0.986, and TLI =0.953), $n = 85788$.

Indicator	*Response Scale*
Schl. Inst. Prob., and Drugs and Preg. Factors	
24.*Are any of the following a problem at your school*	
a.Smoking or tobacco use	ordinal: 3 −/+
b.Drug use	ordinal: 3 −/+
c.Alcohol use	ordinal: 3 −/+
d.Gang violence	ordinal: 3 −/+
e.Sexual harassment	ordinal: 3 −/+
f.Teenage pregnancy	ordinal: 3 −/+
g.Vandalism/thieving	ordinal: 3 −/+
h.Eating disorders	ordinal: 3 −/+
i.Racial conflict	ordinal: 3 −/+
j.Stress or pressure	ordinal: 3 −/+
School Social and Academic Problems Factor	
46.*How often have you had trouble:*	
a. getting along with your teachers?	ordinal: 5 −/+
b. paying attention in school?	ordinal: 5 −/+
c. getting your homework done?	ordinal: 5 −/+
d. getting along with other students?	ordinal: 5 −/+

Table A.8: School institutional problems, and drugs and pregnancy indicators. Ordinal responses range and direction are indicated for for example " in ordinal: 3 −/+" 3 indicates the number of ordinal categories and "−/+" represents an ascending scale where bigger numbers represent higher order. Number next to the wording of he indicator represent the question number in the In-School questionnaire.

Indicator	*Response Scale*
Schl. Inst. Prob., and Drugs and Preg. Factors	
31. *What happens to a student who is caught*	
c. Fighting with another student	ordinal: 7 −/+
e. Injuring another student	ordinal: 7 −/+
g. Possessing alcohol	ordinal: 7 −/+
i. Possessing an illegal drug	ordinal: 7 −/+
k. Possessing a weapon	ordinal: 7 −/+
m. Drinking alcohol at school	ordinal: 7 −/+
o. Using an illegal drug at school	ordinal: 7 −/+
q. Smoking at school	ordinal: 7 −/+
s. Verbally abusing a teacher	ordinal: 7 −/+
u. Physically injuring a teacher	ordinal: 7 −/+
w. Stealing school property	ordinal: 7 −/+

Table A.9: School policies factors ondicators. All items are about the first occurrence. Ordinal responses range and direction are indicated for for example "in ordinal: 7 −/+" 7 indicates the number of ordinal categories and "−/+" represents an ascending scale where bigger numbers represent higher order. Number next to the wording of he indicator represent the question number in the In-School questionnaire.

BIBLIOGRAPHY

BIBLIOGRAPHY

Allott, R., Paxton, R., and Leonard, R. (1999). Drug education: a review of british government policy and evidence on effectiveness. 14(4):491–505.

Anderson, C. S. (1982). The search for school climate: A review of the research. *Review of Educational Research*, 52(3):368–420.

Bachman, J. G., O′Malley, P. M., Schulenberg, J. E., Johnston, L. D., Freedman-Doan, P., and Messersmith, E. E. (2008). *The education-drug use connection: how successes and failures in school relate to adolescent smoking, drinking, drug use, and delinquency*. L. Erlbaum Associates, New York.

Barr, R. (1975). How children are taught to read: Grouping and pacing. *The school review*, 83(3):479–498.

Bellmore, A. and Nishina, A. (2012). School context protective factors against peer ethnic discrimination across the high school years. *American Journal of Community Psychology*, 49:98–111.

Bergen, H. A., Martin, G., Roeger, L., and Allison, S. (2005). Perceived academic performance and alcohol, tobacco and marijuana use: Longitudinal relationships in young community adolescents. *Addictive Behaviors*, 30(8):1563–1573.

Bidwell, C. E. (1965). The school as a formal organization,. Handbook of organizations, pages 972–1022. Rand McNally, Chicago, IL.

Bidwell, C. E. and Quiroz, P. A. (1991). Organizational control in the high school workplace: A theoretical argument. *Journal of Research on Adolescence*, 1(3):211–229.

Blalock, H. M. (1984). Contextual-effects models: Theoretical and methodological issues. *Annual Review of Sociology*, 10:353–372.

Bollen, K. A. and Curran, P. J. (2006). *Latent Curve Models*. Wiley Series in Probability and Statistics. Wiley & Sons, INC., Hoboken: New Jersey.

Botticello, A. (2009). School contextual influences on the risk for adolescent alcohol misuse. *American Journal of Community Psychology*, 43:85–97.

Bradizza, C. M., Stasiewicz, P. R., and Paas, N. D. (2006). Relapse to alcohol and drug use among individuals diagnosed with co-occurring mental health and substance use disorders: A review. *Clinical Psychology Review*, 26(2):162–178.

Bronfenbrenner, U. (1979). *The Ecology of Human Development*.

Brook, J., Stimmel, M. A., Zhang, C., and Brook, D. W. (2008). The association between earlier marijuana use and subsequent academic achievement and health problems: A longitudinal study. *American Journal of Addictions*, 17(2):155–160.

Bryant, A. L., Schulenberg, J. E., Bachman, J. G., O′Malley, P. M., and Johnston, L. D. (2000). Acting out and lighting up: Understanding the links among school misbehavior, academic achievement, and cigarette use. monitoring the future occasional paper 46. Technical Report 143, Monitoring the Future, Inst. for Social Research, Univ. of Michigan.

Bryant, A. L., Schulenberg, J. E., O′Malley, P. M., Bachman, J. G., and Johnston, L. D. (2003). How academic achievement, attitudes, and behaviors relate to the course of substance use during adolescence: A 6-year, multiwave national longitudinal study. *Journal of Research on Adolescence*, 13(3):361–397.

Bryant, A. L. and Zimmerman, M. A. (2002). Examining the effects of academic beliefs and behaviors on changes in substance use among urban adolescents. *Journal of Educational Psychology*, 94(3):621 – 637.

Bryk, A. S. and Driseoll, M. E. (1988). *The school as community: Theoretical foundations, contextual influences, and consequences for students and teachers*. National Center on Effective Secondary Schools, University of Wisconsin., Madison,WI.

Bryk, A. S., Lee, V., and Holland, P. B. (1993). *Catholic schools and the common good*. Harvard University Press, Cambridge,MA.

Bryk, A. S., Sebring, P. B., Kerbow, D., Rollow, S., and Easton, J. Q. (1998). *Charting Chicago School Reform: Democratic Localism As a Lever for Change*. Westview Press.

Caldas, S. J. and Bankston, C. (1997). Effect of school population socioeconomic status on individual academic achievement. *The Journal of Educational Research*, 90(5):269–277.

Carroll, J. B. (1989). The carroll model: A 25-year retrospective and prospective view. *Educational Researcher*, 18(1):26–31.

Chantala, K. (2006). Guidelines for analyzing add health data. Technical report, Carolina Population Center University of North Carolina at Chapel Hill.

Chen, F., Curran, P. J., Bollen, K. A., Kirby, J., and Paxton, P. (2008). An empirical evaluation of the use of fixed cutoff points in rmsea test statistic in structural equation models. *Sociological Methods Research*, 36(4):462–494.

Coleman, J., Hoffer, T., and Kilgore, S. (1982). Achievement and segregation in secondary schools: A further look at public and private school differences. *Sociology of Education,*, 55(2):162–182.

Coleman, J. S., Campbell, E. Q., Hobson, C. F., McPartland, J. M., Mood, A. M., Weinfield, F. D., and York, R. L. (1966). Equality of educational opportunity. Technical report, National Center of Educational Statistics.

Crosnoe, R. (2006). The connection between academic failure and adolescent drinking in secondary school. *Sociology of Education*, 79(1):44–60.

Crum, R. M. (2006). Educational Achievement and Early School Behavior as Predictors of Alcohol-Use Disorders: 35-Year Follow-Up of the Woodlawn Study. *Journal of studies on alcohol*, 67(1):75–85.

D′Amico, E. J., Edelen, M. O., Miles, J. N., and Morral, A. R. (2008). The longitudinal association between substance use and delinquency among high-risk youth. *Drug and Alcohol Dependence*, 93(2):85 – 92.

Darling, N. (2005). Participation in extracurricular activities and adolescent adjustment: Cross-sectional and longitudinal findings. *Journal of Youth and Adolescence*, 34(5):493–505.

Dewey, J. (1916). *Democracy and Education. An introduction to the philosophy of education.* Free Press, Rockland: NY.

Dewey, J. (1943). *The school and society.* University of Chicago Press, Chicago: IL.

Dornbusch, S. M. and Lin, K. L. G. I.-C. (1996). The social structure of schooling. *Annual Review of Psychology*, 47(1):401–429.

Eccles, J. S. and Midgley, C. (1989). Stage-environment fit: Developmentally appropriate classrooms for young adolescents. volume 3 of *Research on motivation in educatio*, pages 139–186. Academic Press, San Diego,CA.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., and Iver, D. M. (1993). Development during adolescence: The impact of stage-environment fit on young adolescents' experiences in schools and in families. *American Psychologist*, 48(2):90–101.

Eccles, J. S. and Roeser, R. W. (2010). An ecological view of schools and development. Handbook for research on schools, schooling, and human development, pages 6–22. Taylor and Francis, New York,NY.

Eccles, J. S. and Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of Research on Adolescence*, 21(1):225–241.

Eitle, D. J. and Eitle, T. M. (2004). School and county characteristics as predictors of school rates of drug, alcohol, and tobacco offenses. *Journal of Health and Social Behavior*, 45(4):408–421.

Ellickson, P. L., Collins, R. L., and Bell, R. M. (1999). Adolescent use of illicit drugs other than marijuana: How important is social bonding and for which ethnic groups?. *Substance Use and Misuse*, 34(3):317–346.

Ellickson, P. L. and Hays, R. D. (1991). Antecedents of drinking among young adolescents with different alcohol use histories. *Journal of studies on alcohol*, 52:398–408.

Engeström, Y. E., Miettinen, R., and Punamäki, R.-L. (1999). *Perspectives on activity theory*. CambridgeUniversity Press, Cambridge, UK.

Ennett, S. T., Flewelling, R. L., Lindrooth, R. C., and Norton, E. C. (1997). School and neighborhood characteristics associated with school rates of alcohol, cigarette, and marijuana use. *Journal of Health and Social Behavior*, 38(1):pp. 55–71.

Evans-Whipp, T., Beyers, J. M., Lloyd, S., Lafazia, A. N., Toumbourou, J. W., Arthur, M. W., and Catalano, R. F. (2004). A review of school drug policies and their impact on youth substance use. 19(2):227–234.

Fletcher, A., Bonell, C., and Hargreaves, J. (2008). School effects on young people′s drug use: A systematic review of intervention and observational studies. *Journal of Adolescent Health*, 42(3):209 – 220.

Freire, P. (1972). *Pedagogy of the Oppressed*. Herder and Herder, New York, NY.

Fuller, B. and Clarke, P. (1994). Raising school effects while ignoring culture? local conditions and the influence of classroom tools, rules, and pedagogy. *Review of Educational Research,*, 64(1):119–157.

Gaddy, G. D. (1988). High school order and academic achievement. *American journal of education*, 96(4):496–518.

Green, J., Liem, G. A. D., Martin, A. J., Colmar, S., Marsh, H. W., and McInerney, D. (2012). Academic motivation, self-concept, engagement, and performance in high school: Key processes from a longitudinal perspective. *Journal of Adolescence*.

Guilamo-Ramos, V., Jaccard, J., Turrisi, R., and Johansson, M. (2005). Parental and school correlates of binge drinking among middle school students. *American Journal of Public Health*, 94(5):894–899.

Hanushek, E. A., Kain, J. F., O′Brien, D. M., and Rivkin, S. G. (2005). The market for teahcer quality (working paper 11154). Technical report, National Bureau of Economic Research, Cambridge,MA.

Hanushek, E. A., Kain, J. F., and Rivkin, S. G. (1997). New evidence about brown v. board of education: The complex effects of school racial composition on achievement. *Journal of Labor Economics*, 27(3):349–383.

Haralambos, M., Holborn, M., and Heald, R. (2008). *Sociology: Themes and Perspectives*. Harper Collins Publisher Limited, London, UK, 7 edition.

Harris, K. M. (2011). Design features of add health. Technical report, Carolina Population Center. University of North Carolina at Chapel Hill.

Harris, K. M. and Udry, J. R. (1998). National longitudinal study of adolescent health wave i. adolescent in-home questionnaire code book. Technical report, Carolina Population Center. University of North Carolina at Chapel Hill.

Harris, K. M. and Udry, J. R. (1999). National longitudinal study of adolescent health wave ii. adolescent in-home questionnaire code book. Technical report, Carolina Population Center. University of North Carolina at Chapel Hill.

Harris, K. M. and Udry, J. R. (2002a). National longitudinal study of adolescent health (add health), icpsr 27021 1994-2002: Core files [restricted use]. original add health wave i school administrator data codebook. Technical report, Inter-university Consortium for Political and Social Research. University of Michigan - Ann Arbor.

Harris, K. M. and Udry, J. R. (2002b). National longitudinal study of adolescent health (add health), icpsr 27021 1994-2002: Core files [restricted use]. original add health wave ii school administrator data codebook. Technical report, Inter-university Consortium for Political and Social Research. University of Michigan - Ann Arbor.

Hedges, L. V. and Hedberg, E. C. (2007). Intraclass correlation values for planning group-randomized trials in education. *Educational Evaluation and Policy Analysis*, 29(1):60–87.

Heeringa, S. G., West, B. T., and Berglund, P. A. (2010). *Applied survey data analysis*. Chapman & Hall/CRC, Boca Raton, FL.

Henry, K. L., Smith, E. A., and L., L. C. (2007). Deterioration of academic achievement and marijuana use onset among rural adolescents. *Health Education Research; Oxford*, 22(3):372.

Hoffmann, J. P. (2006). Extracurricular activities, athletic participation, and adolescent alcohol use: Gender-differentiated and school-contextual effects. *Journal of health and social behavior*, 47(3):275–290.

Hox, J. (2002). *Multilevel analysis*. Lawrence Erlbaum Associates, Mahwah, NJ.

Hu, L.-T. and Bentler, P. M. (1999). *Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives*, volume 6.

Jeynes, W. H. (2002). The relationship between the consumption of various drugs by adolescents and their academic achievement. *The American Journal of Drug and Alcohol Abuse*, 28(1):15.

Johnston, L. D., O′Malley, P. M., Bachman, J. G., and Schulenberg, J. E. (2011a). Monitoring the future national results on adolescent drug use: Overview of key findings, 2010. Technical report, Institute of Social Research. The University of Michigan, Ann Arbor,Mi.

Johnston, L. D., O′Malley, P. M., Bachman, J. G., and Schulenberg, J. E. (2011b). Monitoring the future national survey results on drug use, 1975-2010. volume i: Secondary school students. Technical report, Institute for Social Research, The University of Michigan, Ann Arbor.

Konstantopoulos, S. (2006). Trends of school effects on student achievement: Evidence from nls: 72, hsb: 82, and nels: 92. *Teachers College record*, 108(12):2550–2581.

Lee, V. E. and Smith, J. B. (1999). Social support and achievement for young adolescents in chicago: The role of school academic press. 36(4):907–945.

Lee, V. E. and Smith, J. B. (2001). *Restructuring high schools for equity and excellence: What works*. Teacher College Press, New York.

Leithwood, K. and Jantzi, D. (2009). A review of empirical evidence about school size effects: A policy perspective. *Review of Educational Research*, 79(1):275–313.

Lüdtke, O., Marsh, H., Robitzsch, A., Trautwein, U., Asparouhov, T., and Muthén, B. (2008). The multilevel latent covariate model: A new, more reliable approach to group-level effects in contextual studies. *Psychological Methods*, pages 203–229.

Mayberry, M., Espelage, D., and Koenig, B. (2009). Multilevel modeling of direct effects and interactions of peers, parents, school, and community influences on adolescent substance use. *Journal of Youth and Adolescence*, 38:1038–1049.

McDill, E. L., Natriello, G., and Pallas, A. M. (1986). A population at risk: Potential consequences of tougher school standards for student dropouts. *American Journal of Education*, 94(2):135–181.

McNeely, C. and Falci, C. (2004). School connectedness and transition into and out of health-risk behaviour among adolescents: a comparison of social belonging and teacher support. *Journal of School Health*, 74(2):84–92.

Muthén, B. O. (1991). Multilevel factor analysis of class and student achievement components. *Journal of Educational Measurement*, 28(4):338–354.

Muthén, L. and Muthén, B. O. (2010). (1998-2010). mplus user guide. sixth edition. Technical report, Muthén & Muthén, Los Angeles, CA.

Newcomb, M. D. and Bentler, P. M. (1986). Drug use, educational aspirations, and work force involvement: The transition from adolescence to young adulthood. *American Journal of Community Psychology*, 14(3):303–321.

Owens, T. J., Shippee, N. D., and Hensel, D. J. (2008). Emotional distress, drinking, and academic achievement across the adolescent life course. *Journal of Youth and Adolescence*, 37(10):1242–1256.

Raghunathan, T. E., Lepkowski, J. M., Hoewyk, J. V., and Solenberger, P. (2001). A multivariate technique for multiply imputing missing values. using a sequence of regression models. *Survey Methodology*, 27(1):85–95.

Raghunathan, T. E., Solenberger, P. W., and Hoewyk, J. V. (2011). Iveware: Imputation and variance estimation version 0.2 users guide (supplement). Technical report, Survey Methodology Program. Survey Research Center, Institute for Social Research University of Michigan.

Raudenbush, S. and Bryk, A. S. (1986). A hierarchical model for studying school effects. *Sociology of Education,*, 59(1):1–17.

Raudenbush, S. W. and Bryk, A. S. (2002). *Hierarchical linear models: applications and data analysis methods*. Sage Publications, Thousand Oaks, second edition.

Ready, D. D., Lee, V. E., and Welner, K. G. (2004). Educational equity and school structure: School size, overcrowding, and schools-within-schools. *Teachers College record*, 106(10):1989–2014.

Reynolds, D. and Teddlie, C. (2000). The process of school effectiveness. The International Handbook of School Effectiveness Research, pages 134–159. Falmer Press, New York,NY.

Rockoff, J. E. and Lockwood, B. B. (2010). Stuck in the middle: Impacts of grade configuration in public schools. *Journal of public economics*, 94(11-12):1051–1061.

Sampson, R., Morenoff, J., and Gannon-Rowley, T. (2002). Assessing "neighborhood effects": Social processes and new directions in research. *Anual review of Sociology*, 2.

Sellström, E. and Bremberg, S. (2006). Is there a "school effect" on pupil outcomes? a review of multilevel studies. *Journal of Epidemiology and Community Health*, 60(2):149–155.

Shouse, R. (1996). Academic press and sense of community: Conflict, congruence, and implications for student achievement. *Social Psychology of Education*, 1(1):47–68.

Simmons, R. G. and Blyth, D. A. (2010). *Moving Into Adolescence: The Impact of Pubertal Change and School Context*. Aldine de Gruyter, Hawthorne,NY.

Sörensen, A. B. and Morgan, S. L. (2000). *School effects: Theoretical and methodological issues*. The Handbook of the Sociology of Education. Kluwer/Plenum., New york.

StataCorp. (2011). Stata statistical software: Release 12.

Steiger, J. (1999). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioural Research*, 25:173–180.

Stigler, J. W. and Hiebert, J. (1999). *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom*. Free Press, New York,NY.

Teddlie, C. and Reynolds, D. (2000). *The International Handbook of School Effectiveness Research*. Falmer Press, New York,NY.

Tourangeau, R. and Shin, H.-C. (1999). National longitudinal study of adolescent health grand sample weight. Technical report, Carolina Population Center. University of North Carolina at Chapel Hill.

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press, Boston,MA.

Wayne, A. J. and Youngs, P. (2003). Teacher characteristics and student achievement gains: A review. *Review of Educational Research*, 73(1):89–112.

Weber, M. (1968). *Economy and Society: An Outline of Interpretive Sociology. (Edited by Guenther Roth and Claus Wittich. Translators: Ephraim Fischoff and others)*, page 1469. Bedminster Press, New York, NY.

Weng, L.-J., Newcomb, M., and Bentler, P. M. (1988). Factors influencing noncompletion of high school: A comparison of methodologies. *Educational Research Quarterly*, 12(2):8–22.

West, P., Sweeting, H., and Leyland, A. (2004). School effects on pupil′s health behaviors: evidence in support of the health promoting schools. *Research Papers in Education*, 19(4):477–481.

Willms, J. D. (1985). Catholic-school effects on academic achievement: New evidence from the high school and beyond follow-up study. *Sociology of Education,*, 58(2):98–114.

Wimpelberg, R. K., Teddlie, C., and Stringfield, S. (1989). Sensitivity to context: The past and future of effective schools research. *Educational Administration Quarterly*, 25(1):82107.