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THE RELATIONSHIP BETWEEN THE IMPLEMENTATION OF THE ISO 9000 QUALITY MANAGEMENT SYSTEM AND EDUCATIONAL OUTCOMES OF SCHOOLS

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ABSTRACT

With an ever growing public concern over the quality of education, an increasing number of K-12 schools are adopting the ISO 9000 quality management system. However, little is known about the effects of ISO 9000 participation on the educational outcomes of schools. The purpose of this study was to investigate empirical evidence regarding how the implementation of ISO 9000 is related to school performance, which was measured by student achievement on the state-mandated standardized tests and the student attendance rates of schools – or the graduation rates, in the case of high schools. The study also examined whether the ISO 9000 standardized education system helps foster more educational equality by mitigating the effect of school socio-economic status on the overall student achievement of a school.

The study was conducted using schools in the U.S. that participated in ISO 9000. The unit of analysis was a school, and the sample was selected from 30 school districts including 8 school districts implementing ISO 9000. The sample consisted of 330 schools at the primary school level, 157 schools at the middle school level, and 112 schools at the high school level; among them, 101 primary schools, 62 middle schools, and 36 high schools were implementing ISO 9000 as of 2004.

The dependent variables were a) average passing rates of students of schools on the state-mandated tests, b) average passing rates of economically disadvantaged students of schools on the state-mandated tests, and c) the student attendance rates of schools or, in the case of high schools, graduation rates. Independent variables were a) the percentage of students in a school who receive free/reduced lunches, b) school-wide student-teacher ratio, c) annual per-pupil expenditure of school district, and d) ISO 9000 participation. The data were taken from various sources including official 2003-2004 school year state and district report cards and the National Center for Educational Statistics (NCES). Taking into account the hierarchical nature of the data, this study employed a Hierarchical Linear Modeling (HLM) statistical technique.

The study found that a) there is no relationship between ISO 9000 participation and student achievement of schools – across students in general and economically disadvantaged students in particular; b) there is a significant relationship between ISO 9000 participation and the student attendance rates in elementary and middle schools; and c) the effect of school SES, measured by the percentage of students receiving free/reduced priced lunches, on student achievement of a school does not differ between ISO 9000 schools and non-ISO 9000 schools.

The study results provide two important policy implications. First, the ISO 9000 quality management system in education, focusing on procedural standardization of classroom activities, may not work well as a quick-fix solution to improve school performance – especially, student learning. Due to the long-established institutional features of education such as value-orientation, diversity, complexity, and unpredictability, procedural standardization of teaching and learning by ISO 9000 may be more difficult and less appropriate than ambitious business-oriented school reformers had expected. Second, given the relationship between student attendance and achievement, however, this study does not completely rule out the possibility that ISO 9000 could positively influence school performance in the long run. By helping schools become more organized and thus function well in the areas of essential school operations such as

student and teacher attendance, ISO 9000 could contribute to building a school climate which helps enhance school performance without intimidating other important values such as teachers' professional autonomy and creativity in classrooms.

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Chapter 1

Introduction

Background

Education reform is one of the prevalent issues in most societies today. The effort to reform public schools is a norm for educators as well as outside reformers who want to develop a "world-class" workforce (Carnoy, 2000; Tyack & Cuban, 1995). During the past few decades, schools have been the place of a variety of educational experiments. The most salient feature in the recent reform movement is the infusion of the business sector's ideas regarding schooling – for example, Management by Objectives (MBO), Zero Based Budgeting (ZBB), School Choice, or the Voucher Program (Apple, 2000; Chubb & Moe, 1990; Friedman, 2004; Hanushek, 1994; Murphy, 1996). With a growing awareness of the importance of education in the future economy, many business-minded innovators have aggressively addressed the problems of public schooling and suggested various solutions to improve schools' performance. In the case of the US, the influential report "*A Nation at Risk: The Imperative for Educational Reform,"* published in 1983, triggered greater involvement of the private sector in "reinventing schooling" (Murphy, 1990; Friedman, 2004; Tyack & Cuban, 1995). With the recent spread of "*educational consumerism*" (Labaree, 2000) – a market-based perspective from which "education is seen as simply one more product like bread, cars, and television" (Apple, 2000, p. 39) –

these business-oriented solutions have been gaining greater popularity among the public and policy makers.

Among the many business-minded reform approaches, the one observed with the keenest interest by education reformers in recent years has been the quality management system in education. In particular, the application of ISO 9000 standards, a set of international quality standards and guidelines, as a quality management system has been spotlighted as an ambitious attempt to improve public schools. In many countries, the ISO 9000 quality management system (ISO 9000), focusing on the improvement of day-to-day processes of schooling, flourishes as an efficient and scientific tool that maintains high standards in public education (Bevans-Gonzales & Nair, 2004; Russo, 1995; Thonhauser, 2005; Van Den Berghe, 1997, 1998; Zuckerman & Rhodes, 2000). No formal statistics are available on the number of ISO 9000-certified educational institutions, but according to a survey by Craig Johnson, a well-known management consultant at Florida State University, about 200 public schools, colleges, and community colleges have earned ISO 9000 registration in the US up to date (Core Business Solutions, 2003). With an ever-growing public concern over the quality of education, the number of educational institutions adopting ISO 9000 is increasing (Bevans-Gonzales & Nair, 2004).

Statement of the Problem

In evaluating the relationship between ISO 9000 implementation and student achievement of schools, experts come to two opposing conclusions. For most business-oriented reformers, ISO 9000 is seen as the best way to improve school performance and eventually the efficiency of the entire public education system (Ayudhya, 2001; Doherty, 1995; Stimson, 2003; Van Den Berghe, 1997; Zuckerman & Rhodes, 2000). They claim that more systematic and standardized process control will give overall excellence to under-performing schools. To the contrary, some educators are skeptical about ISO 9000's effects on the real world of education. They argue that ISO 9000 may be effective in the workplace, but is useless and counterproductive in a school setting (D. Burkhardt, personal communication, January 25, 2005; C. Stevenson, personal communication, January 20, 2005). For those educators, ISO 9000 is just "one more fad that will soon be forgotten (Bevans-Gonzales & Nair, 2004, p.177)."

No matter which side of the debate one finds oneself on, the problem is that neither the reformers' assertions nor the educators' counter-arguments are based upon empirically supported research results. While some research (Moreland & Clark, 1998; Stimson, 2003; Thornhauser, 2005) has been conducted on ISO 9000's impact on the efficiency of school administration, little attention has been given to its effects on student achievement. Therefore, very little is known about the degree to which being registered to ISO 9000 standards – that is, implementing the ISO 9000 quality management system – can be in fact associated with improvement in student achievement of schools.

The second problem concerns the relationship between schools' ISO 9000 participation and educational equality. A number of researchers have suggested that a more systematic and standardized approach to educational operations ensures the *consistent* quality of education in any organization or group of people (Ayudhya, 2001; Moreland & Clark, 1998; Stimson, 2003; Van Den Berghe, 1997). In addition, some previous international comparative studies (Organization for Economic Cooperation and

Development, 2004; National Center for Education Statistics, 2001; Riordan, 1997) indicate that student achievement in nations with standardized education systems is higher and more equitable than that in nations without such systems. One may, then, speculate that standardization of schooling by ISO 9000 creates more consistent, equitable educational outcomes among schools by mitigating the influence of socioeconomic conditions and school resources that vary from school to school. But again, almost no research has been done to directly investigate what influence the ISO 9000 quality management system has on educational equality.

The third problem concerns the lack of research about the relationship between schools' participation in ISO 9000 and the changes in the attitude of students toward school. There have been some studies that describe how the implementation of ISO 9000 influences the attitude of school members toward schools (Ayudhya, 2001; Bevans-Gonzales & Nair, 2004; Moreland & Clark, 1998). The studies suggest that while ISO 9000 positively motivates the staff by helping to define clear goals, monitor their improvement, and pursue corrective action, its bureaucratic mechanism also produces discouraging effects on the attitude of the staff, creating the sense of exclusion and powerlessness. In any case, however, most previous studies have paid attention to the changes in the perceptions or attitudes of the management or of teachers, not of students. As a consequence, very little is known about how the implementation of ISO 9000 is related to the changes in the attitude of students toward school.

Finally, given the growing perceptions of ISO 9000 as a school reform initiative among policy makers, business leaders, and some educators, little effort has been made to illuminate "ISO 9000 in education" in the context of school reform. If ISO 9000 is viewed from the public school reform standpoint, much more complicated factors including historical and institutional backgrounds of public schooling, along with social and ideological contexts of ISO 9000 in education, need to be considered. In addition, given the implementation of ISO 9000 as a means to achieve educational goals, it is important to know what educational outcomes ISO 9000 brings to schools. Nonetheless, as Singels, Ruel, & Van De Water (2001) note, in many cases ISO 9000 registration is viewed as an end in itself, not as a means to achieve the organization's goals and objectives – "ISO 9000 in education" is no exception. In short, even without solid empirical evidence and careful consideration of the role of ISO 9000 as an instrument for school reform, the ISO 9000 quality management system, originally a business practice geared toward manufacturing, is under consideration as an effective mechanism for the reform of American public schools.

Significance of the Study

This study is significant both on a theoretical and a practical level. First, the current study is important on a theoretical level because it will contribute to the theoretical analysis of "ISO 9000 in education." There have been some case studies to describe how the ISO 9000 system has been successfully developed in certain educational organizations (Ayudhya, 2001; Bevans-Gonzales & Nair, 2004; Moreland & Clark, 1997; Peters, 1999; Stimson, 2003; Zuckerman & Rhodes, 2000). Although these earlier studies are adequate for the analysis of the development of ISO 9000 in certain organizations, they do not capture all aspects of ISO 9000 in education. This study takes the analysis one step further by presenting a comprehensive conceptual framework to better understand “ISO 9000 in education.” Further, this study, guided by the institutional theory perspective, implicitly addresses two important theoretical questions – how the business ideologies and methodologies of ISO 9000 could be matched with the long-established institutional features of public schools and the educators’ mindset, and, thus, how appropriate the ISO 9000 mechanism could be for reforming American public schools. And, this study will also provide an important clue towards determining whether standardization of schooling by the ISO 9000 system promotes educational equality.

On the practical level, this study suggests some policy implications to policy makers, business leaders and educators who opt for such an allegedly scientific business practice despite a lack of practical evidence. Although some studies show the possible benefits and costs of ISO 9000 based on case studies (Bevans-Gonzales & Nair, 2004; Moreland & Clark, 1997; Peters, 1999; Van Den Berghe, 1997; Zuckerman & Rhodes, 2000), most of them do not deal directly with the relationship between being registered to ISO 9000 standards and the quality and equality of education. This study will offer solid evidence regarding the relationship between being registered to ISO 9000 standards educational outcomes of schools, and further, provide a replicable research methodology to measure the impact of ISO 9000 on school performance.

Purpose of the Study

The purpose of this study was threefold: First, the study set out to investigate empirical evidence to determine the relationship between being registered to ISO 9000 standards and student achievement of schools, particularly by comparing average passing rates of students on the state-mandated tests between schools participating in ISO 9000 and schools not participating in ISO 9000. Second, it intended to examine whether the ISO 9000 quality management system helps foster educational equality. More specifically, this study explored both the relationship between ISO 9000 implementation and the academic achievement of disadvantaged students and whether schools with lower SES perform better under the ISO 9000 system. Third, the study meant to examine how standardization of schooling by ISO 9000 is related to the changes in the students' school attendance rates, or, in the case of high schools, graduation rates.

An extensive review and analysis of the literature and data were conducted in order to answer the following four research questions:

1. Is there any relationship between a school district's having the ISO 9000 quality management system and average passing rates of students of schools within that district on the state-mandated test?
2. Is there any relationship between a school district's having the ISO 9000 quality management system and average passing rates of economically disadvantaged students of schools within that district on the state-mandated test?

3. Is there any relationship between a school district's having the ISO 9000 quality management system and the student attendance rates of schools within that district, or, in the case of high schools, the graduation rates?
4. Does the relationship between school SES and student achievement of a school differ between ISO 9000-participating schools and non-ISO 9000-participating schools?

Limitations

This study had several limitations. First, due to the lack of a central data system to identify ISO 9000 registered school districts, this study was conducted with the nonprobability sample. Thus, the first limitation concerns the generalizability of the results. Although this study employed appropriate statistical techniques to use inferential statistics with the nonprobability sample (see Huck, 2004 for more discussion on this issue), its results should be interpreted with caution. Secondly, some ISO 9000 schools studied in this research have been implementing the ISO 9000 quality management system for only one or two school years. The effects of a newly adopted system, however, might not be apparent after such a short period. Thirdly, there is variation in the ways ISO 9000 is implemented across institutions. Thus, it is important to understand that the various ways of ISO 9000 implementation could result in different effects on the outcome variables. It should be noted that given the exploratory nature of this study, the sampled schools are categorized only into two groups – ISO 9000 schools versus non-

ISO 9000 schools. Finally, although this research focused on student achievement and attendance rates in studying the impact of ISO 9000 on public schools in general, the influences of having the ISO 9000 system could be captured in other various aspects of schooling – such as other behavioral tendencies among students, educational attainment in years, and the reputation of the school or school district. In addition, there is the possibility that the effects on the general public schools are different from those on vocational schools.

Definition of Terms

ISO 9000 quality management system. A set of procedures, activities, feedback mechanism and management actions based on ISO 9000 standards and guidelines, which intend to ensure the consistent quality of products and services delivered (Van Den Berghe, 1997). In this study, "being registered to the ISO 9000 standards" is understood as "having the ISO 9000 quality management system" – that is, implementing the ISO 9000 quality management system.

ISO 9000 in education. Adoption of the ISO 9000 quality management system to educational institutions to improve or maintain the quality and equality of education.

Educational outcomes of a school (school performance). The consequences (results) of schooling in relation to educational values and goals. In this study, attention was given to student achievement and attitude toward schools, which are measured by the percentage of students in a school who passed state standards on statewide mandated tests as well as by students' attendance rates, or, in the case of high school students, graduation rates.

Economically disadvantaged students. In this study, economically disadvantaged students were operationally defined as students who receive free/reduced priced school lunches. Improvement in academic achievement of economically disadvantaged students was used as an indicator of educational equality.

Institutional perspective. A viewpoint that socially-constructed norms and taken-for-granted assumptions guide individual and organizational behaviors. In this study, school is perceived as a social institution, a set of organized cultures, norms, rules, values, beliefs, and day-to-day practices to which individuals and groups comply (Powell & DiMaggio, 1991; Scott, 1998).

Conceptual Framework

The main concept of this analysis is guided by David Tyack and Larry Cuban's groundbreaking 1995 study "*Tinkering Toward Utopia: A Century of Public School Reform.*" In their book, the authors sketch the historical tensions between various outside-in school reform initiatives and a long-established "grammar of schooling" that has resisted those reforms (p. 85)

The empirical part of this study is designed based on a sociological perspective that considers school SES context and school resources as the most influential factors in determining school performance. During the past few decades, a great deal of studies have been conducted to examine the effects of family background and school resources on educational outcomes. Some studies concluded that the role of family background including parents' educational attainment, family SES, and cultural capital of family is more important than school resources in determining student achievement (Coleman et al., 1966; Coleman & Hoffer, 1987; Fowler & Walberg, 1991; Goldschmidt & Wang, 1999; Lee & Bryk, 1989; Lee & Smith 1999; Mayer, 1991; PDE 2002a; Rumberger, 1995; Wilson, 1959). In contrast, other studies have found that school factors such as school size, class size, and teacher quantity/quality are more influential (Finn & Achilles, 1999; Heyneman & Loxley, 1983; McNeal 1997; National Education Association, n.d.; Molnar et al., 1999; Mosteller, 1995; Rumberger & Thomas, 2000). Given that ISO 9000 has been adopted as a means to make schooling more efficient, ISO 9000 in education may be understood as an attempt to achieve better educational outcomes by influencing school factors (see Figure 1-1). In this context, the model to measure the relationship between having ISO 9000 and educational outcomes of schools includes independent variables that represent both family background and school resources, specifically the school SES and class size, together with average per pupil expenditure in the school district.

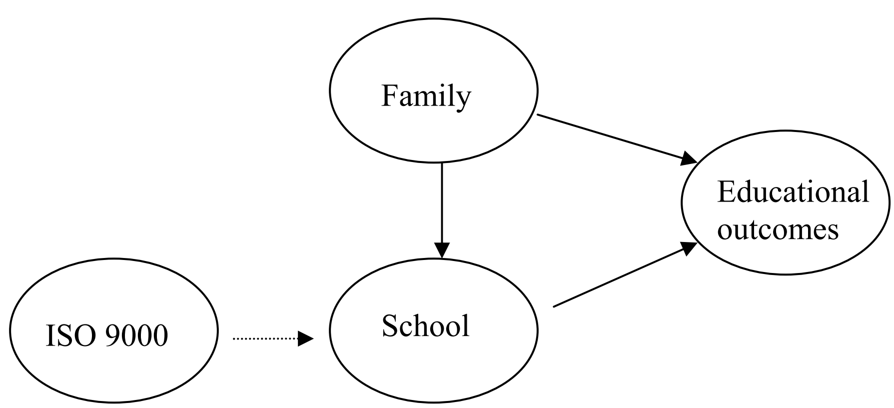

Figure **1-1.** The conceptual framework of this study

Chapter 2

Review of the Literature

In the US, the application of ISO 9000 standards to educational organizations dates back to 1999, when the School District of Lancaster in Pennsylvania became the first school district nationwide to obtain ISO 9000 certification. Because of this short history, little literature and empirical data are available concerning the application of these standards to education. Furthermore, few, if any, studies have been conducted on the relationship between earning ISO 9000 certification and better educational outcomes in public schools. Therefore, this literature review incorporates a variety of sources, ranging from scholarly articles to public documents to commercial advertisements by ISO 9000 certification-consulting companies.

For a better understanding of ISO 9000 in education, an explanatory model has been created based on a systems theory perspective (see figure 2.1). Systems theory is conceptually useful in that it helps us to understand not only each element of the whole system but also the relation between its parts (Bertalanffy, 1972; Kast & Rosenzweig, 1972).

Based on the model of ISO 9000 in education, this literature review is divided into the following sections:

- ISO 9000 standards: An overview (Input)
- Social contexts of ISO 9000 in education (Environments)

- Implementation of ISO 9000 in education (Process)
- Benefits and costs of ISO 9000 in education (Output)
- Contradictory notions regarding ISO 9000 in education
- Summary

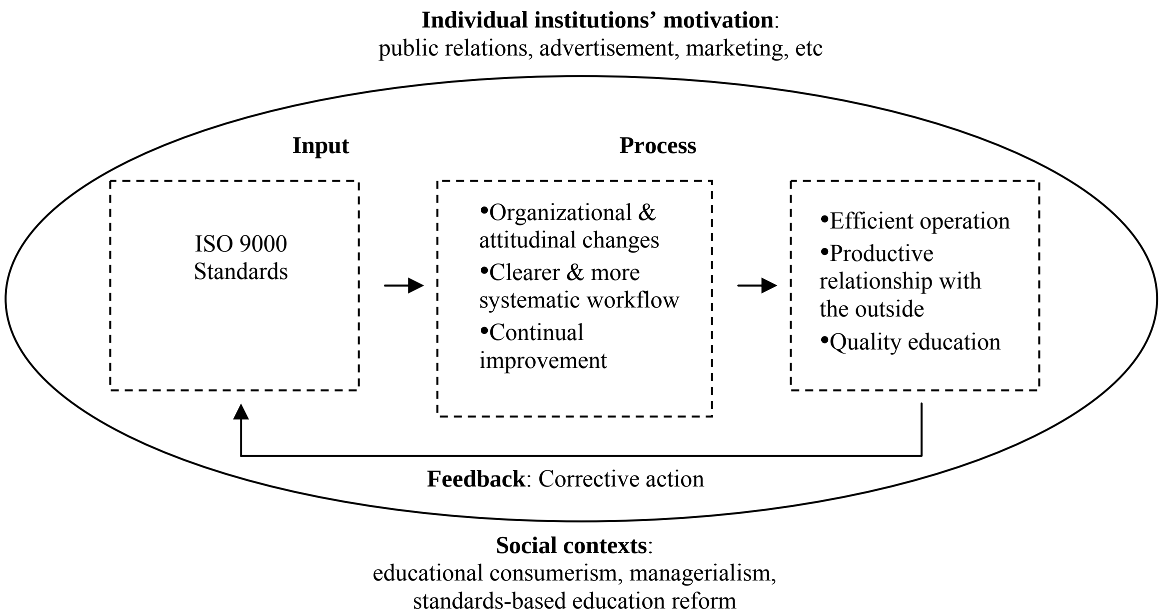

Figure **2-1.** The model of ISO 9000 in education

ISO 9000 standards: An Overview

ISO 9000 is a set of international quality management standards and guidelines. It was originally published in 1987 by the International Organization for Standardization (ISO), and was revised in 1994 and again in 2000. With an ever-increasing number of IS0 9000-certified companies around the world, ISO 9000 has become the most widely accepted quality management system. According to the 2003 ISO survey of ISO 9000 certificates, more than 0.5 million ISO 9000 certificates had been granted in 149 countries and economies as of 2003 (ISO, 2004b, ¶3).

Among the many features of ISO 9000 standards, the following two are most frequently mentioned: emphasis on process and wide applicability. First, ISO 9000 is primarily concerned with "quality assurance," which refers to what an organization does to ensure that its products and services are consistent with the customer's requirements (Chan & Lai, 2002; Goetsch & Davis, 2002; Moreland & Clark, 1998; Peters, 1999; Russo, 1995; Thornhauser, 2005; Van Den Berghe, 1997, 1998). In an attempt to obtain constant conformity, ISO 9000 puts a greater emphasis on the methods of organizational operation – namely, on processes. That is, ISO 9000 is a system standard, not a product standard.

Secondly, ISO 9000 utilizes "generic" management system standards. Although the traditional focus of ISO 9000 has been manufacturing companies, it can be applied to any organization, including public services and non-profit organizations (Chan & Lai, 2002; ISO, 2004a; Russo, 1995; Van Den Berghe, 1997, 1998). Such wide applicability of ISO 9000 paves the way for its application to educational institutions. Nonetheless, it is also important to note that both in theory and practice, ISO 9000 as a system standard is not implemented in the same way in every organization (Thornhauser, 2005). Each school and school district can develop its own quality management system taking into account its particular needs and the requirements of the ISO 9000 standards (Singels, Ruel, & Van De Water, 2001; Van Den Berghe, 1998). Hence, the ISO 9000 standards need to be interpreted within a specific organizational context.

The eight management principles of the ISO 9000 quality management system include (ISO, 2004a):

- Customer focus;
- Leadership;
- Involvement of people;
- Process approach;
- System approach to management;
- Continual improvement;
- Factual approach to decision making; and
- Mutually beneficial supplier relationships.

Social Contexts of ISO 9000 in Education

In order to better understand why ISO 9000 has been received with such keen interest, it is important to know its broader social contexts in which it has evolved. In this section, three environmental driving forces are discussed: the standards-based school reform movement, managerialism in education, and educational consumerism.

The first social context in which ISO 9000 in education has been developed is the recent standards-based education reform movement. As Linn (2000) states, a key characteristic of the recent education reform is "the creation of standards" – in the case of the US, every state but Iowa has initiated some form of quality standards of education (Friedman, 2004). According to some researchers, the key elements of the standards-based reform model include: an official document describing the goals of student performance at given grade levels, a classroom curriculum expected to convey that agreed-upon knowledge, a set of assessment tools to measure whether students have achieved the goal, and a scheme of rewards and penalties (Cohen, 1996; Darling-Hammond, 2004; Friedman, 2004; Meier, 2000). As will be discussed later, these basic mechanisms have much in common with those of ISO 9000 in education. According to Stimson (2003) and Bevans-Gonzales & Nair (2004) who conducted a study on an ISO 9000-certified high school in Virginia and nine vocational schools in Pennsylvania, respectively, ISO 9000 provides standards for students and teachers, alignment between curricula and those standards, expert instruction, proper measurement of results and accountability within schools.

Secondly, the application of business management practices to the public school setting is highly associated with the infusion of the ideology and practice of "managerialism" (Apple, 2000; Carnoy, 2000; Chan & Lai, 2002; Tyack & Cuban, 1995). Regarding the recent trend of managerialism in education, Tyack and Cuban state that, during recent decades, education reformers who wanted to change the public schools often turned to ideas from the business sector, and that "businesslike" was commonly perceived as "scientific" (p. 114). In essence, ISO 9000 in education would be the typical successor for the "business of schooling" (Tyack & Cuban, 1995, p. 114). In a study about the development of quality education in Hong Kong, Chan and Lai (2002) state that the ISO 9000 mechanism contains many managerialist approaches to the running of schools that emphasize efficiency, effectiveness, and accountability. Similarly, in case studies of three ISO 9000-certified educational organizations, Moreland and Clark (1998) report that the new system strengthened the intervention of management in areas that previously belonged to the realm of educational professionals' discretion. Further, they report that the ISO 9000 system enhanced management control over staff by requiring that they follow established procedures.

Thirdly, ISO 9000 in education reflects the recent spread of educational consumerism. Educational consumerism has roots in a market-based perspective of schooling, from which schools are in the position of "trying to sell educational products to student customers" (Labaree, 1998, ¶2). Such a business perspective on public schooling is in line with the principles of ISO 9000. In practice, the key term of "customers" in ISO 9000 standards has been translated into "students" in an education context (Chan & Lai, 2002; Stimson, 2003; Van Den Berghe, 1997, 1998). Moreover, customer satisfaction, a major principle of the ISO 9000 quality system, can be linked to the mindset of educational consumerism (Chan & Lai, 2002; Goetsch & Davis, 2002; Lo & Sculli, 1996; Russo, 1995; Van den Berghe, 1997, 1998).

Implementation of ISO 9000 in Education

The idea of ISO 9000 is simple: "Say what you do, do what you say, prove it, and improve it" (Zuckerman & Rhodes, 2000, ¶20). Given ISO 9000's generic feature, the above processes can be applied to the educational setting. The following list includes some key aspects of the processes in the implementation of ISO 9000 in educational organizations, which are commonly mentioned in related literature and case studies (Ayudhya, 2001; Moreland & Clark, 1998; Peters, 1999; Stimson, 2003; Thornhauser, 2005; Van Den Berghe, 1997; Zuckerman & Rhodes, 2000):

- Translation of the standards to educational language;
- Definition of mission, objectives, and best practice based on consultation with staff;
- Documentation of the new work procedures and quality manual;
- Training of professional educators and educational administrators to institutionalize the quality system;
- Regular internal and external audits to verify the improvement of performance; and
- Continuous assessment and corrective action for continual improvement.

It should be noted that, in practice, establishing the new quality system has considerable costs and is a time-consuming task (Bevans-Gonzales & Nair, 2004; Zuckerman & Rhodes, 2000). Moreover, given its business and industry orientation, special efforts must be made in order to successfully transplant business practices into the educational setting.

With regard to obstacles in developing the new quality system, some studies indicate that the first concern was translating the language of ISO 9000 into useable educational terms (Bevans-Gonzales & Nair, 2004; Moreland & Clark, 1998; Zuckerman & Rhodes, 2000). In most cases, according to these researchers, external experts were hired to help educators understand ISO 9000 terminology in the educational context. A superintendent whose school district had once implemented ISO 9000 pointed out, "ISO 9000 was very cumbersome and required a tremendous amount of time. Also technical/industrial terms had to be translated to educational terms" (D. Burkhardt, personal communication, January 25, 2005).

The second concern is related to the resistance of staff to organizational changes. As schools adapt the business management practice, educators usually doubt that the creative and empathic aspects of their work can be standardized (Seddon, 2001; Singels, Ruel, & Van De Walter, 2001; Zuckerman & Rhodes, 2000). Therefore, building behavioral consent among staff is regarded as one of the most important factors for success of the newly-adopted system (Bevans-Gonzales & Nair, 2004; Moreland & Clark, 1998).

Benefits of ISO 9000 in Education

Through a number of case studies on educational institutions having the ISO 9000 quality system, researchers have come to determine its various benefits. Although some studies concern higher education institutions and career and technical centers, many of the findings may be applied to the general K-12 school setting. In this section, the term "benefits" is interchangeable with "effects" and "impact." Most reported benefits fall into three interrelated categories: 1) internal benefits: efficient and effective organizational operation, 2) external benefits: productive relationship with the outside, that is, the market and customers, and 3) better educational outcomes.

Internal Benefits: Efficient and Effective Organizational Operation

The most common benefit is improvement of efficiency of operation. Mostly based on case studies, many researchers argue that ISO 9000 helps organizations to operate better in terms of customer satisfaction and efficiency (Bevans-Gonzales & Nair, 2004; Chan & Lai, 2002; Doherty, 1995; Moreland & Clark, 1998; Peters, 1999; Singels, Ruel, & Van De Water, 2001; Stimson, 2003; Zuckerman & Rhodes, 2000). According to these sources, the mechanisms through which efficiency of an organization's operation was achieved can be grouped into three categories.

First, *higher quality awareness among staff* is a benefit most frequently reported by many previous studies. This benefit reflects the cultural and attitudinal shift within an organization, and many case studies suggest the same results.

In his report for the "European Centre for the Development of Vocational Training," Van Den Berghe (1997) reports that the ISO 9000 system greatly improved quality awareness and commitment among staff, and that staff became more sensitive to quality-related issues in day-to-day work processes. In the same way, in case studies on three educational institutions in the UK that adopted ISO 9000, Moreland and Clark (1998) found that the ISO 9000 system enabled staff to make sense of its new educational context, in which the concepts of quality and customer satisfaction are newly emerged and strongly emphasized. Moreover, Ayudhya (2001) conducted a case study on two private schools in Thailand implementing ISO 9000. Through interviews with staff, she found that there had been psychological and behavioral changes in school members. The teachers and staff whom Ayudhya interviewed showed more positive and internationalizing attitudes, were more active in monitoring their own job performance to prevent any mistakes, and worked actively at all times to be ready for quality verification. According to Ayudhya, all faculty and staff members – whether teachers, drivers, cooks, or cleaners – need to change their attitudes to respond to the international standards requirement.

Secondly, previous studies report a *more systematic and standardized approach to educational operations* as a fundamental benefit of ISO 9000. Case studies on schools in Hong Kong and Thailand, conducted by Lo and Sculli (1996) and Ayudhya (2001), respectively, found that schools could have clearer and more systematic workflow and procedures through the ISO 9000 mechanism. According to these researchers, schools can check whether their educational activities are being carried out as planned by consulting systematically and clearly documented quality manuals. Zuckerman & Rhodes (2000), conducting studies on American schools and school districts having ISO 9000, report similar findings that ISO 9000 made schools and school districts more efficient, systematic, and customer-focused. Finally, Bevans-Gonzales & Nair (2004), conducting a study on ISO 9000 implementation at nine career and technical centers in Pennsylvania, point out that ISO 9000 helps teachers be aware of what they have to do to maintain standards. In summary, key components of the ISO 9000 mechanism to make organizational operations more systematic and reliable are more realistic goal setting, well-developed quality manuals and standardized procedures, well-defined duties and responsibilities, and continuous quality control throughout the entire process (Ayudhya, 2001; Bevans-Gonzales & Nair, 2004; Moreland & Clark 1998; Stimson 2003; Van Den Berghe, 1997; Waks & Frank, 1999; Zuckerman & Rhodes, 2000). The above researchers argue that staff became more aware of their work and more responsive to their duties and responsibilities, and that staff and management felt more confident in coping with the new situations due to the systematic and standardized mechanism of ISO 9000.

Finally, *continual improvement over years* has been recognized as an important benefit. More specifically, a few previous case studies indicate that an effective internal performance measurement and independent audit system, along with a corrective, preventive action procedure, help to solve organizational problems and lead to continuous improvement (Ayudhya, 2001; Stimson, 2003; Zuckerman & Rhodes, 2000). In addition, some ISO 9000 consulting firms (Core Business Solutions, 2003) assert that ISO 9000, a proven effective central management tool, brings with it a data-driven decision-making system and provides ongoing feedback as to how well schools and their staff are performing in terms of management.

Briefly, all of the above researchers and private ISO 9000 consulting companies agree that ISO 9000 provides a more scientific and systematic framework and structure for allegedly inefficient public schools and other educational institutions. More importantly, they claim that ISO 9000 successfully transplants effective business ethos and ideologies – such as customer satisfaction and efficiency – into educational organizations, together with considerable costs savings.

External Benefits: Productive Relationship with the Outside – Market and Customers

External benefits are related to the positive effects of ISO 9000 on the schools' relationship with the educational market and their customers, including parents, the local community, educational authorities, and local companies.

From a marketing perspective, some researchers suggest that ISO 9000-certified institutions earn a better reputation as reliable education providers and eventually enhance their credibility on the market (Peters, 1999; Singels, Ruel, & Van De Water, 2001; Van Den Berghe, 1997, 1998). Likewise, given its market orientation, ISO 9000 registration gives an education provider a more productive partnership with business and industry (Core Business Solutions, 2003; Zuckerman & Rhodes, 2000). In practice, Van Den Berghe (1997) reports that the new ISO 9000 quality system improves access to large companies – for instance, the big three automotive companies require all their suppliers to be registered in ISO 9000. In this regard, ISO 9000 may be most beneficial to vocational schools that want to send their graduates to companies through school-to-work programs (Bevans-Gonzales & Nair, 2004; Van Den Berghe, 1997; Zuckerman & Rhodes, 2000).

From an advertising perspective, ISO 9000-certified organizations are more likely to obtain recognition in terms of leadership and competitiveness by their peers and competitors (Van Den Berghe, 1997). Waks and Franks (1999) argue that ISO 9000 affords organizations a substantial advantage over their competitors by checking the organization's activities against an international standard requirement.

Lastly, in terms of public relations, a logo of ISO 9000 certification raises community trust and confidence of an organization itself and of its products – in this case, education and graduates. As cited in Zuckerman & Rhodes (2000), ISO 9000 certification enables taxpayers to be sure that schools use their money effectively. Likewise, an ISO 9000-certified institution is more likely to gain political backing – for instance, on April 26, 1999, the Pennsylvania General Assembly passed a House

Resolution that commends the School District of Lancaster on its achievement of ISO 9000 certification.

Better Student Achievement

As stated earlier, ISO 9000 concerns processes rather than products or services. In this sense, research efforts have been undertaken to identify the benefits to an organization's operation, whereas little study has been conducted on whether and to which degree having ISO 9000 certification is associated with educational outcomes of schools, especially in the K-12 school setting.

Most previous studies in particular have kept silent about whether and how a school districts' registration to ISO 9000 standards relates to raising student achievement of schools. Instead, they just posit that if the school system is running properly, there will, necessarily, be better educational results (Waks & Frank, 1999; B. Bradley, personal communication, January 25, 2005); in this context, the current study, in its effort to find empirical evidence on the association between ISO 9000 implementation and educational outcomes of schools, is significant both on a theoretical and a practical level.

Through which mechanisms, then, could the ISO 9000 system affect educational outcomes? The following list includes some key factors of ISO 9000 in education that researchers assume affect student achievement:

- Customer-oriented educational programs and recruitment of academic staff (Core Business Solutions, 2005; Lo & Sculli, 1996);

- Development and improvement of course content and curriculum design (Core Business Solutions, 2005; Lo & Sculli, 1996);
- Standardized teaching methods based on best practices (Ayudhya, 2001);
- Evaluation of teacher and student performance (Stimson, 2003; Waks & Frank, 1999); and
- A refocusing of staff energies on teaching and learning (The School District of Lancaster, 1999).

Costs of ISO 9000 in Education

In addition to various positive effects, some studies found negative results from the application of ISO 9000 to education. In most cases, problems are related to the reactions of staff to the new system.

First, the most frequently raised negative impact is the bureaucratization of an organization (Castle, 2000; Moreland & Clark, 1998; Seddon, 2001; Van Den Berghe, 1997). Interestingly enough, this finding confirms the notion that the theoretical foundations of ISO 9000 are the *Weberian theory of Rationalization* and the *Taylor's theory of Scientific Management*, both of which are likely to be coupled with bureaucracy by overemphasizing values such as efficiency, measurability, and predictability (Scott, 1998).

Second, Moreland and Clark (1998) and Bevans-Gonzales and Nair (2004) report that some staff felt the sense of exclusion and frustration. One could assume that this problem may be caused by the top-down approach of ISO 9000, along with tightened controls over teachers' professional work by standardized procedures.

Third, researchers agree that additional problems are the considerable and continuous paper work and the monetary costs to establish and to maintain the new system (Moreland & Clark, 1998; Van Den Berghe, 1997; Zuckerman & Rhodes, 2000). In fact, some staff feel that the extra paper work has nothing to do with educational activities and an academic support system (Moreland & Clark, 1998).

Fourth, the inability of educators to fully understand the new quality system is recognized as another big problem (Bevans-Gonzales & Nair, 2004; Moreland & Clark, 1998; Van Den Berghe, 1997; Zuckerman & Rhodes, 2000; USA Today, May 27, 1998). It manifests itself as resistance of the academic community to the new quality management paradigm.

Contradictory Notions Regarding ISO 9000 in Education

There has been very little research to examine the appropriateness of ISO 9000 for the school setting – more specifically, how schools' or school districts' registration to ISO 9000 standards relates to achieving educational goals. Nevertheless, the literature that examines the recent market-based education reforms as well as the reactions of schools to those reforms can provide some insights into this matter. The contradictory notions regarding ISO 9000 in education discussed in this section are based on three perspectives: the organization theory perspective, the pedagogical perspective, and the historical perspective.

From the organization theory perspective, Weick (1976) explains educational organizations as loosely coupled systems. According to Weick, lack of coordination, absence of regulations, and very slow feedback mechanisms are important characteristics of school organizations. Because of those internal mechanisms, school systems are very difficult to change (Weick, 1976). In addition, Scott (1998) claims that educational organizations are less likely to be managed by "technical" control mechanisms, but more likely to be managed by "structural and institutional" control. Given the very technical and outside-driven systematic approach of ISO 9000, one may speculate that ISO 9000 mechanisms are not readily adapted to school organizations.

Other researchers, who approach the issue from the pedagogical perspective, argue that chronic consumerism and standardization efforts in the American education reform movement, on which ISO 9000 is based, undermine real student learning. Thus, Labaree (2000) claims that educational consumerism makes schools more vulnerable to consumers' pressure, which may not increase educational value. Further, Meier maintains that standardization of schooling may "run the risk to squeeze out the schools and educators that seek to show alternative possibilities and explore other paths" (Meier, 2000, p.5). Similarly, "holding common standards for all pupils can only encourage a narrowing of educational experiences for most pupils" and "limit the development of many worthy talents" (Coffman, 1993, p.8).

Finally, the history of public school reform in America has shown how difficult it is for outside-driven reforms to succeed, especially when those reforms are intended to change the long-lasting traditions of schools. Historians of education assert that "grammar of schooling" is a product of history and remarkably durable and that the "typical and instrumental assumptions of educational reformers fail to give due weight to the resilience of schools as an institution" (Tyack & Cuban, 1995, p.134).

Summary

As discussed earlier in this chapter, the application of ISO 9000 to educational institutions is intimately related to the recent education reform movement in terms of methodology and ideology. Methodologically, the ISO 9000 mechanism has much in common with the widespread standard-based reform initiatives that emphasize standards and measurement (Friedman, 2004; Meier, 2000; Stimson, 2003). Ideologically, it is deeply influenced by educational consumerism and managerialism (Chan & Lai, 2002; Labaree, 2000; Moreland & Clark, 1998). As cited in the SRI, an ISO 9000 registrar headquartered in Pennsylvania which helps schools registered to ISO 9000 standards, Steve Franchak of the Pennsylvania Department of Education illuminates this aspect as follows: "The goal [of ISO 9000] is to answer the continual cry for educational reform and improvement in a manner that is data-oriented, objective, and requires schools to reach for performance excellence" (SRI, n.d., ¶.8).

As explained earlier, the ISO 9000 quality management system provides many benefits to the certified institutions. Much research confirms that ISO 9000 certification has caused organizations' cultural changes and an attitudinal shift in staff members toward business-oriented values – economy, efficiency, and effectiveness (Chan & Lai, 2002; Moreland & Clark, 1998; Peters, 1999; Russo, 1995; Stimson, 2003; Van Den Berghe, 1997; Zuckerman & Rhodes, 2000). In addition, clearer and more systematic procedures through ISO 9000 cause organizations to run in a systematic and reliable manner that ensures continuous improvement. Further, by becoming certified in ISO 9000, an organization gains considerable advantages in marketing, advertising and public relations.

However, little is known about the relationship between becoming certified to ISO 9000 standards and quality and equality of educational outcomes. In particular, if we consider the application of ISO 9000 to public schools as a school reform initiative, as many ISO 9000-certified school districts announced, the impact of ISO 9000 registration on these two fundamental goals for public schools should have been addressed in previous studies. In this context, this study was designed to find empirical evidence regarding the relationship between school districts' implementing the ISO 9000 quality management system and school performance in terms of student achievement and attitude toward schools.

Chapter 3

Methodology

The purpose of this study was to investigate the relationship between a school district's being registered to ISO 9000 standards – in other words its implementation of the ISO 9000 quality management system – and the performance (educational outcomes) of schools within that school district. Three indicators were used to measure school performance: average passing rates of students on the state-mandated tests, average passing rates of the economically disadvantaged students of a school on the state-mandated tests, and average student attendance rate, or, graduation rates at the high school level.

The current research was conducted using schools in the US that participated in ISO 9000 as of 2004. Detailed information of sample selection, measurement of the variables, data collection, and data analysis are included in this chapter.

Sample and Data

Sample

The sample was selected from 30 school districts including 8 school districts implementing ISO 9000. The sample consisted of 330 schools at the primary school level, 157 schools at the middle school level, and 112 schools at the high school level; among them, 101 primary schools, 62 middle schools, and 36 high schools were implementing ISO 9000 as of 2004 (see Table 3.2). Although ISO 9000 registration is generally granted by school district level, the ISO 9000 system is being implemented both at the school district and school levels.

Given the nature of this study as a non-experimental exploratory study with small samples, sampling was carefully conducted employing the concept of "the case-control study." Often being called a retrospective study, the case-control study has been extensively used in the social sciences – particular, in public health research to investigate factors that may cause a particular disease. Methodologically speaking, it compares individuals with a particular condition or disease (cases) with a group of persons who are free of that condition or disease (controls). According to one group of researchers, including Breslow & Day (1980), Kazdin (2003), and Schlesselman (1982), this case-control method is effective in exploratory studies with relatively rare and small samples, useful in drawing strong inferences with the nonprobability sample, and economically efficient by using existing data and thus not involving experimental research. Considering that the investigator is not able to experimentally control conditions in this study – e.g., school SES and ISO 9000 implementation as a policy – this technique is particularly useful. Meanwhile, supporting the use of inferential statistics with the nonprobability sample, Huck states that "researchers begin with the sample and then create an abstract population that is considered to include people like those included in the sample" (Huck, 2004, p.113).

A two stage purposive sampling technique was used to identify cases and controls. First, cases were identified as schools under the school districts that are implementing ISO 9000 at least for one school year. At the first stage, school districts with an ISO

9000 certification were selected. Then, information on schools in those school districts was collected. Because no official data base is available on ISO 9000-certified educational institutions, a search engine of an ISO 9000 certification-consulting company was alternatively used in order to identify school districts with an ISO 9000 certification. As a result, 8 school districts were selected from 7 different states. As shown in Table 3.1, the selected school districts vary in enrollment size, socio-economic status, location, and the length (year) of ISO 9000 implementation, reflecting little possibility of case selection bias.

Second, controls – a comparison group of schools under the non-ISO 9000 school districts – were chosen from the same 7 states from which cases were drawn. In selecting controls, the existing state systems that provide information on "similar" school districts were used, as in the case of Pennsylvania and Ohio. For the states which do not have such systems, controls were selected based on the following two criteria: 1) the percent of students in a district who receive free/reduced-priced lunches, and 2) student enrollment, which indicates district size. To obtain enough samples for adequate statistical power, a ratio of 1:3 was generally maintained between the number of ISO 9000 school districts and non-ISO 9000 school districts within each of the 7 states.

Finally, from this sampling, 30 school districts were selected from 7 different states in the US. All schools under those school districts were included in the sample – for school districts which have more than 50 schools at one school level, 15 through 20 schools were randomly selected at each school level and included in the sample.

Although all states in this study have administered state-wide mandatory tests to students in various grades, those tested grades were collapsed into three school levels –

primary, middle, and high school – and analysis was conducted on each of those three school levels. The detailed information on the sample may be found in Table 3.1 and 3.2.

Data

This research involved secondary data analysis. The 2003-2004 school year data were collected from various sources including official state and district report cards and the National Center for Educational Statistics (NCES) – the exception was North Carolina school districts for which the 2002-2003 data were used because the 2003-2004 data were not available. Specifically, state report cards that are part of the implementation of the No Child Left Behind Act (NCLB) contain information about the annual test results as well as other background information of each school and school district – such as, enrollment, the number of students who receive free/reduced-price lunches, attendance rates, graduation rates, and the number of teachers. The specific data sources may be found in appendix A.

Table **3-1**

ISO 9000 Status, Per-Pupil Expenditure, Socio-Economic Status (SES), and Enrollment of Sampled School Districts

State	School District	ISO 9000[a]	Per-pupil expenditure	SES[b]	Enrollment
PA	Allentown	-	6,941	71.0	16,964
	Altoona	Y (2002)	7,682	52.2	8,390
	Erie	-	8,465	72.6	12,690
	Lancaster[c]	Y (1999)	9,079	67.2	11,045
	Reading	-	6,639	75.3	16,515
	Scranton	-	9,277	60.8	8,940
OH	Evergreen	-	7,827	17.6	1,340
	West Liberty-Salem Local	-	7,454	10.4	1,160
	Black River Local	-	6,302	23.6	1,669
	Liberty Center	Y (1999)	6,705	15.7	1,197
WA	Longview	-	7,621	43.0	7,576
	Franklin Pierce	-	6,881	48.0	7,843
	Moses Lake	-	6,694	53.0	6,974
	Wenatchee	Y (2002)	6,602	44.0	7,505
TN	Montgomery	Y (2003)	5,170	39.7	24,924
	Rutherford	-	5,301	30.1	29,529
	Greeneville	-	7,775	35.6	2,676
	Sumner	-	5,740	28.0	24,002
NV	Clark	Y (2003)	5,774	35.6	270,529
	Lyon	-	7,021	39.4	7,678
	Nye	-	7,810	42.2	5,471
	Washoe	-	6,120	31.2	62,103
NC	Guilford	Y (2003)	6,943	45.8	66,971
	Gaston	-	5,977	44.0	31,288
	Cumberland	-	6,301	56.0	53,159
	Rockingham	-	6,336	47.0	14,799
GA	Dougherty	Y (2004)	8,056	69.1	16,844
	Newton	-	6,915	47.3	14,713
	Rockdale	-	7,251	40.5	14,266
	Bibb	-	7,256	68.4	25,276

[a] Y = ISO 9000 (certification year). [b] SES measured by percentage of students in a school district who receive free/reduced-priced lunches. [c] Lancaster school district eliminated ISO 9000 in 2004-2005 school year.

Table **3-2**

Number of Samples by ISO 9000 Status and School Level

School level	Registered	Non-registered	Total
District	8	22	30
Elementary	101	229	330
Middle	62	95	157
High	36	76	112
Total	199	400	599

Variables

Dependent Variables

Average passing rates of students of a school on the state-mandated math and reading tests (Math/Reading). This variable represents the percentage of students in a school who passed state standards on the 2003-2004 states' math and reading tests. A student's test results fall into one of four categories – below basic, basic, proficient, and advanced. Students whose scores fall into the proficient or advanced categories were considered as passing state standards. Despite the different state assessment systems with various standards, the use of percent-based measurement rather than raw scores makes possible the use of inferential statistics. Data for this variable was obtained from 2004 official state and district report cards.

Average passing rates of economically disadvantaged students of a school on the state-mandated math and reading tests (Math_Dis./Reading_Dis.) This variable represents the percentage of economically disadvantaged students in a school who passed state standards on the 2003-2004 states' math and reading tests. This variable was used to explore the relationship between having ISO 9000 and achieving educational equality. Although educational equality may be understood in various ways, in this study, it is assumed that when economically disadvantaged students gain higher test scores, greater educational equality is achieved. The term 'economically disadvantaged students' refers to students who receive free or reduced-priced lunches in a school.

Students' attendance rates of schools (in the case of high schools, graduation rates) (Attendance/Graduation). This variable represents the average daily attendance of students of a school. The average daily attendance was calculated by dividing the total number of days of attendance by the number of days taught in a year. Because the data on the student attendance rates was not available at the high school level, graduation rates of schools were used. Data for this variable was obtained from 2004 official state and district report cards.

Independent Variables

Based on previous educational studies that suggest school SES and school resources as the most powerful predictors of school performance (Coleman et al., 1966; Lee & Bryk, 1989; Lee & Smith, 1999; McNeal, 1997; Riordan, 1997; Rumberger & Thomas, 2000), three independent variables, in addition to ISO 9000 participation, were chosen from two different levels – the school and school district levels (see Figure 3.1). It should be noted that although state-level variables may influence school performance, this study does not include a state-level analysis, considering the relatively small samples of states that may lead to a significant loss of statistical power. Definition of independent variables may be found below.

School-level variables

Percentage of students in a school who receive free/reduced-priced lunches (%FreeLunch). This variable was used to measure the degree of school SES. According to the "National School Lunch Program," children from families with incomes at or below 130% of the poverty level are eligible for free lunches and those in families whose income is between 130% and 185% of the poverty level are eligible for reduced-price lunches (for more information, see the Pennsylvania Department of Education web site at http://www.pde.state.pa.us/food_nutrition). Data for this variable were collected from 2004 official state and district report cards. Many educational studies have shown a strong relationship between the school SES context – i.e., "the mean SES of the student body" (Rumberger& Palardy, 2005) – and school performance in terms of student achievement and drop-out rates (Coleman et al., 1966; Fowler & Walberg, 1991; Goldschmidt & Wang, 1999; Mayer, 1991; Lee & Bryk, 1989; Lee & Smith, 1999; PDE 2002; Rumberger, 1995; Wilson, 1959).

Student-teacher ratio of a school (Class Size). This variable reflects the size of classes in a school and was calculated by dividing the total number of students by the number of full-time classroom teachers in a school. Because the data on the 2004 student-teacher ratio were not available for some school districts, alternatively, the 2003 data were used. Data for this variable were obtained from the the data base of NCES.

While some researchers (Glass & Smith, 1978, 1979; Hanushek, 1989) argue that there is no significant relationship between class size and student achievement, many educators and researchers maintain that smaller class size has a positive effect on educational outcomes of schools (Finn & Achilles, 1999; McNeal 1997; National Education Association, n.d.; Molnar et al., 1999; Rumberger & Thomas, 2000).

School district-level variables

Annual per-pupil expenditure of school district (Exp). This variable was used to measure the SES context of a school district and reflects the school district leadership. Data for this variable were obtained from the data base of NCES.

ISO 9000 participation (ISO 9000). This variable was used to identify whether a school district became registered to ISO 9000 standards and thus is implementing the ISO 9000 quality management system. As stated earlier, each school district is implementing a different ISO 9000 system; for simplicity, however, this study coded this variable into two dummy variables (0 = school not having ISO 9000, 1= school having ISO 9000).

Data Analysis

Research Questions and Data Analysis

To determine the relationship between a school district's being registered to ISO 9000 standards and educational outcomes of schools within that district in terms of student achievement and school attendance/graduation rates (research questions 1, 2 & 3), both descriptive and inferential statistics were used. First, comparison was made between ISO 9000 participating schools and non-ISO 9000 participating schools on three outcome variables – average passing rates of students in a school on the state-mandated tests, average passing rates of economically disadvantaged students in a school on the state-mandated tests, and the student attendance rate/graduation rate of a school. Means and standard deviations of the dependent variables were calculated and compared by school level. Second, to measure the association between ISO 9000 participation of a school district and school performance, the study used the Hierarchical Linear Modeling (HLM) technique, taking into account the hierarchically nested data structure of this study discussed later.

Table **3-3**

Summary of the Research Questions, Variables, and Analysis Techniques

Research Questions	Dependent Variables	Independent Variables	Statistics
1. ISO 9000 participation and student achievement	o Average passing rates of students of a school on the state-mandated math and reading tests (Math/Reading)	o % of students in a school who receive free/reduced-priced lunche (%FreeLunch)	o Descriptive statistics to compare ISO 9000 schools with non-ISO 9000 schoools on depedent variables
2. ISO 9000 particiaption and academic achievement of economically diadvantaged students	o Average passing rates of economically disadvantaged students of a school on the state-mandated math and reading tests (Math_Dis./Reading_Dis.)	o School wide student-teacher ratio (Class size)	o HLM analysis to examine the relationship between dependent variables and independent variables
3. ISO 9000 particiaption and the student attendence rates/graduation rates	o Average student attendence rate/graduation rate of a school (Attendance/Graduation)	o Annual per-pupil expenditure of school district	
4. Whether the relationship between school SES and student achievement of school differs between ISO 9000 schools and non-ISO 9000 schools		o ISO 9000 participation	

To examine whether the relationship between school SES and student achievement of a school differs between ISO 9000-participating schools and non-ISO 9000-participating schools (Research question 4), the current study also used HLM to detect "cross-level interaction effects" (Luke, 2004; Raudenbush & Bryk, 2002; Hox, 2002), as is explained later. School SES and student achievement of a school were measured by the percentage of students in a school receiving free/reduced priced lunches and the average passing rates of students of a school on the state-mandated tests, respectively.

Statistical Analysis: Hierarchical Linear Modeling (HLM)

As stated before, this study involves a hierarchical data structure where schools as the unit of analysis are nested within school districts. From the data analysis point of view, the presence of a hierarchically nested data structure leads to the following statistical issues in this study. First, as schools tend to share certain characteristics of the school districts to which they belong, they are more likely to be homogeneous compared to the population as a whole; thus, the assumption of independence of the observations that most statistical analyses require is violated (Osborne, 2000; Raudenbush & Bryk, 2002, Hox, 2002). Second, while the predictor variable of interest, ISO 9000 participation, is measured at the school district level, the outcome variables are measured at the school level. Consequently, a question of the appropriate unit of analysis arises.

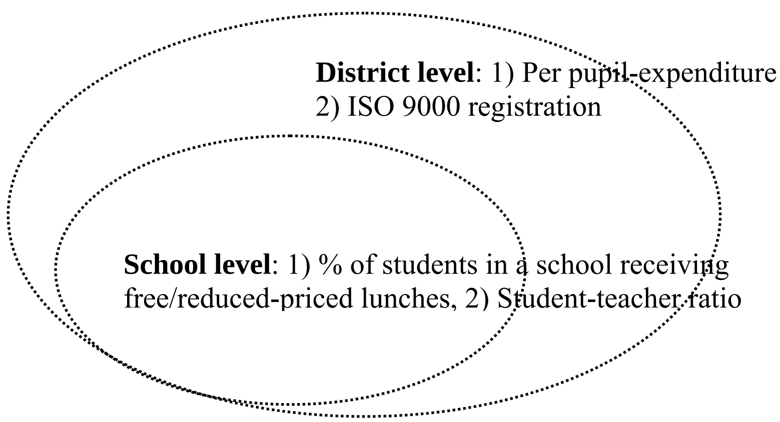

Figure **3-1** Independent variables within a nested data structure.

Two statistical techniques – disaggregation and aggregation – have been traditionally used to resolve these hierarchical data problems, but researchers (Raudenbush & Bryk, 2002; Goldstein, 1995; Osborne, 2000; Hox, 2002) have demonstrated that either method generates erroneous results. For instance, the school district data can be disaggregated by assigning the same value on the school district variables to each school, but this method, by ignoring the nested data structure, tends to produce "liberal or over-optimistic" results. Alternatively, the school data can be aggregated to the school district level by averaging, but this analysis may be done with small samples and lose a great amount of information at the school level. Finally, another problem is that either approach is not able to adequately capture the cross-level interaction effects, which are often called contextual effects, in organizational research (Luke, 2004; Hox, 2002).

Hierarchical Regression Equations

Given the hierarchical nature of data and associated problems, this study employed a Hierarchical Linear Modeling technique – "a hierarchical system of regression equations" (Hox, 2002, p.11). Two-level hierarchical linear models are formulated 1) to investigate the direct effects that indicate relations between predictors and the outcome variables both at the school and school district levels, and 2) to explore the cross-level interactions that suggest how variables at the school district level are associated with the relations between variables at the school level.

School-level model. In this model, the units of analysis are schools and the outcome, Y_{ij}, is predicted by two predictor variables – *%FreeLunch and Class size*.

$$Y_{ij} = \beta_{0j} + \beta_{1j}\,(\%FreeLunch)_{ij} + \beta_{2j}\,(Class\ Size)_{ij} + r_{ij}$$

where

Y_{ij} = outcomes for school *i* within school district *j*;
β_{0j} = the intercept;

β_{1j} and β_{2j} = slope coefficients that indicate the direction and strength of association between predictors and outcomes of school *ij;*
r_{ij} = the residual error term that indicate a unique effect associated with school *ij*. These residual school effects are assumed to be normally distributed with a mean of 0 and a variance σ_e^2.

It should be noted that the intercept (β_{0j}) and slopes coefficients (β_{1j} and β_{2j}) in this regression equation are assumed to vary randomly across school districts. The variation of regression coefficients indicates that the initial status and the effects of predictor variables on the outcome variables are different across school districts.

School district-level model. The school district-level model is created to explain the variation of the school level regression coefficients as following.

$$\beta_{0j} = \gamma_{00} + \gamma_{01} (ISO9000)_j + \gamma_{02} (Exp)_j + u_{0j}$$
$$\beta_{1j} = \gamma_{10} + \gamma_{11} (ISO9000)_j + \gamma_{12} (Exp)_j + u_{1j}$$
$$\beta_{2j} = \gamma_{20} + \gamma_{21} (ISO9000)_j + \gamma_{22} (Exp)_j + u_{2j}$$

Where
β_{0j}, β_{1j} and β_{2j} = regression coefficients of the school-level equation;
γ_{00}, γ_{10} and γ_{20} = the intercepts;
$\Gamma 01$, γ_{11}, γ_{21}, γ_{02}, γ_{12}, and γ_{22}, = slope coefficients that indicate the direction and strength of association between the school district-level predictors and the school-level regression coefficients, β_{0j}, β_{1j} and $\beta 2_j$;
u_{0j}, u_{1j}, and u_{2j} = the residual error terms that indicate a unique effect associated with school district *j*. All variations among school districts that are not explained by the two predictor variables are captured by these residual error terms. These residual errors are assumed to have a mean of zero, and the variances are specified as σ_{uo}^2, σ_{ui}^2, and σ_{u2}^2, respectively.

In these regression equations, two school district-level predictor variables – ISO 9000 participation represented by ISO 9000 and annual per-pupil expenditure of school district represented by Exp – are assumed to be associated with the regression coefficients in the school-level model. That is, the intercept and the two slopes at the school-level model are dependent on the predictor variables at the school district level. In the meantime, because this study does not include a state-level analysis, unlike the school-level model, regression coefficients at the school district level are not assumed to vary across school districts, suggesting that all coefficients apply to all school districts without variation.

Combined (Mixed) model. To explain both the individual direct effects and the cross-level interactions in one regression equation, a combined model was created by substitution into the school-level equation.

$$
\begin{aligned}
Y_{ak} = {} & \gamma_{00} + \gamma_{10}\,(\%FreeLunch)_{ij} + \gamma_{20}\,(Class\ Size)_{ij} + \gamma_{01}(Exp)_j \\
& + \gamma_{02}\,(ISO9000)_j + \gamma_{11}\,(Exp)_j(\%FreeLunch)_{in} + \gamma_{21}\,(Exp)_j(Class\ Size)_{ij} \\
& + \gamma_{12}\,(ISO9000)_j\,(\%FreeLunch)_{ij} + \gamma_{22}\,(ISO9000)_j\,(Class\ Size)_{ij} \\
& + u_{1j}\,(\%FreeLunch)_{ij} + u_{2j}\,(Class\ Size)_{ij} + u_{0j} + r_{ij}
\end{aligned}
$$

Additionally, in order for the value of the intercept to be meaningful and interpretable, the predictor variables are all grand mean centered. "Centering is simply the process of linear transforming a variable *X* by subtracting a meaningful constant, often some type of mean *X*" (Luke, 2004, p. 48) – in this case, the grand mean of each independent variable (for more information on centering, see Luke, 2004; Raudenbush & Bryk, 2002; Hox, 2002). Therefore, the intercept is the expected outcome for school *i* within school district j whose values on independent variables are equal to the grand mean.

Null model. The null model with no predictor variables below was used to examine the extent to which the predictive ability of the fitted model (conditional model) was improved by the inclusion of two school-level and two school district-level predictors. Methodologically, the school- and school district-level residual variances, σ_r^2 and σ_{u0}^2, of the null model with no predictor variables below were compared to those of the fitted conditional model.

$$Y_{ij} = \beta_{0j} + r_{ij}$$
$$\beta_{0j} = \gamma_{00} + u_{0j}$$
$$Y_{ij} = \gamma_{00} + r_{ij} + u_{0j}$$

Interpretation of Results

HLM analysis presents the statistical parameters including a) the fixed effects regression parameters (the gammas), which provide information about the direction and strength of the relationship between predictors and outcome variables and b) the random effects variance components, which present the residual variance at the school- and school district-levels.

Among the fixed effects regression parameters, this study specifically concerns a) γ_{02}, indicating the direction and strength of the relationship between ISO 9000 participation and outcome variables, and b) γ_{12}, indicating the extent and direction of the relationship between ISO 9000 participation and the effect of school SES – represented by %FreeLunch – on outcomes variables. The random effects variance components were used to examine the predictive ability of the fitted model. Specifically, the proportional reduction of prediction error (PRE) (Luke, 2004) was calculated by comparing the residual variances, σ_r^2 and σ_{u0}^2, between conditional and null models. The PREs at the school- and school district-level are represented by the following equations:

$$\text{PRE}_{\text{school}} = \frac{\sigma^2_{r(null)} - \sigma^2_{r(conditional)}}{\sigma^2_{r(null)}}$$

$$\text{PRE}_{\text{district}} = \frac{\sigma^2_{uo(null)} - \sigma^2_{uo(conditional)}}{\sigma^2_{uo(null)}}$$

Chapter 4

Findings

The purpose of this study was to examine the relationship between ISO 9000 participation and school performance. School performance was measured by three outcome variables: a) average passing rates of students on the state-mandated tests, b) average passing rates of economically disadvantaged students on the state-mandated tests, and c) average student attendance rates or, at the high school level, graduation rates. The study also examined whether the effect of school SES on student achievement of schools differs between ISO 9000 schools and non-ISO 9000 schools.

This chapter includes the data analysis results and interpretation. The findings are organized according to the research questions.

Research Question One

Q1: Is there any relationship between a school district's having the ISO 9000 quality management system and average passing rates of students of schools within that school district on the state-mandated test?

Descriptive Statistics

Table 4.1 shows means and standard deviations for dependent variables and independent variables by groups – ISO 9000 schools versus non-ISO 9000 schools. In general, non-ISO 9000 schools as a group outperformed ISO 9000 schools across math and reading at all three school levels – with the only exception being math in high schools.

In terms of school SES, ISO 9000 schools, on average, have a higher percentage of students receiving free/reduced-priced lunches compared with non-ISO 9000 schools across all school levels. The results, thus, are consistent with previous educational studies that suggest the high correlation between school SES and student achievement (Coleman et al., 1966; Lee & Bryk, 1989, PDE, 2002a).

Hierarchical Analysis

Table 4.2, 4.3, and 4.4 present the results of HLM analyses – i.e., point and interval estimates of effects of school- and school district-level independent variables on outcomes in elementary, middle, and high schools, respectively. In these tables, the reported statistical parameters include a) the fixed effects regression parameters (the gammas) in the upper panel, and b) the random effects in the bottom panel, which present the residual variance – the unaccounted effects, or error terms – at the school- and school district-levels.

Fixed effects. There was no relationship between a school district's being certified to ISO 9000 standards and average passing rates of students of schools within that school district on the state-mandated tests, after controlling for the percentage of students in a school receiving free/reduced priced lunches (%FreeLunch), student-teacher ratio (Class

Size), and average per-pupil expenditure of school district. Results were consistent both in math and reading across all school levels ($p < .05$) (see Table 4.2, 4.3, and 4.4).

Consistent with the previous studies, however, the percentage of students in a school receiving free/reduced priced lunches, represented by %FreeLunch, was significantly and negatively associated with the average passing rates of students on the state-mandated math and reading tests across all three school levels ($p < .05$). For instance, in elementary schools, 1% increase in the percentage of students in a school receiving free/reduced lunches was related to 0.29% decrease in the average passing rates of students of schools on the state-mandated math test ($t = -4.12$, $df = 26$, $p<.001$) (see Table 4.2).

Finally, neither school-wide student-teacher ratio nor annual per-pupil expenditure of school district was significantly related to the average passing rates of students of schools on the state-mandated tests across math and reading at all school levels ($p < .05$). Only the relationship between student-teacher ratio and the average reading passing rates of schools at the middle school level was statistically significant (γ_{20}= - 0.63, $t = -2.44$, $df = 27$. $p = .022$) (see Table 4.3).

Random effects. Both at the school and school district levels, the proportional reduction of prediction error was examined for the predictive ability of the fitted conditional model by comparing the residual variances, σ_r^2 and σ_{u0}^2, between the null model and the conditional model. Results suggest that, in general, the school district-level independent variables do not explain many variations between school districts while the school-level independent variables greatly explain variations in math and reading achievement between schools within school districts. That is, prediction errors at the school district-level were not greatly reduced by adding the school district-level predictors in the model. For instance, in elementary schools, 63% of the school-level variance in math achievement was explained by two school-level predictors – i.e., proportional reduction of prediction error for the school level = σ_r^2 (null) - σ_r^2 (conditional) / σ_r^2 (null) = (137.27 - 79.61) / 137.27 = 0.63. By contrast, only 6% of the school district-level variance was explained by two school district predictors – i.e., proportional reduction of prediction error for the school district level = (276.90 – 268.28) / 276.90 = 0.06 (see Table 4.2). Results were generally similar across math and reading across all three school levels. The findings are consistent with the results of the fixed effects analyses, suggesting that school district-level predictors are not associated with outcome variables.

Research Question Two

Q2: Is there any relationship between a school district's having the ISO 9000 quality management system and average passing rates of economically disadvantaged students of schools within that district on the state-mandated test?

Descriptive Statistics

As a group, economically disadvantaged students of non-ISO 9000 schools performed better than those of ISO 9000 schools both across math and reading across all three school levels. The only exception was math in high schools (see Table 4.1).

Hierarchical Analysis

Fixed effects. After controlling for the effect of %FreeLunch, Class Size, and Per-pupil expenditure, no relationship was found between a school district's being registered to ISO 9000 standards and academic achievement of economically disadvantaged students of schools within that school district on the state-mandated tests ($p < .05$). The results were the same both in math and reading across all school levels.

As in the case of students in general (research question 1), the percentage of students in a school receiving free/reduced priced lunches, represented by %FreeLunch, was significantly and negatively associated with the average passing rates of the disadvantaged students on the state-mandated tests across math and reading at all school levels ($p < .05$).

Random effects. As found in research question 1, the analysis of proportional reduction of prediction error shows that the fitted conditional model greatly explains the variances in outcomes between schools within a school district, but not between school districts. The findings suggest that although two school district-level predictors were entered into the model, potentially substantial un-modeled variability between school districts still exists.

Table 4.1

Summary of Descriptive Statistics for Dependent and Independent Variables by ISO 9000 Status and School Level

	Elementary				Middle				High			
	Non-ISO 9000 (*n* = 229)		ISO 9000 (*n* = 101)		Non-ISO 9000 (*n* = 95)		ISO 9000 (*n* = 62)		Non-ISO 9000 (*n* = 76)		ISO 9000 (*n* = 36)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Dependent variable												
Passing rates												
Math[a]	71.12	20.93	69.54	19.98	65.57	19.79	61.13	22.53	61.39	20.20	61.46	22.25
Reading	69.02	20.26	65.33	20.14	72.85	16.41	65.59	23.18	72.80	17.84	63.86	20.15
Math_Dis.[b]	65.42	21.44	63.56	21.31	56.45	20.81	51.39	23.47	48.50	23.09	56.60	23.20
Reading_Dis.	62.17	19.65	57.77	21.52	63.51	18.93	56.77	24.22	58.56	21.97	56.20	20.48
Attendance rates	95.01	1.09	95.35	0.72	93.90	1.77	93.88	1.76				
Graduation rates									77.87	13.99	78.55	19.96
Independent variable												
School-level												
% FreeLunch[c]	54.94	23.15	58.70	23.87	46.82	20.45	49.01	23.52	30.62	16.01	35.39	16.97
Student-teacher ratio	16.10	2.56	15.51	3.11	16.11	2.69	17.61	3.41	16.32	3.15	17.71	2.75
School district-level												
Per-pupil expenditure	6,996	925	7,001	1,254	6,996	925	7,001	1,254	6,996	925	7,001	1,254

[a] Average passing rates of students on the state-mandated math tests. [b] Average passing rates of economically disadvantaged students on the state-mandated math tests. [c] Percentage of students in a school who receive free/reduced-priced lunches

Table 4.2

Point and Interval Estimates (95% CI) of Effects of School- and School District-Level Variables on Elementary School Outcomes for Null and Conditional Models (n = 330)

	Math		Reading		Math_Dis.		Reading_Dis.		Attendance	
	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model
Fixed effect										
Intercept, γ_{00}	69.00* (62.71, 75.29)	68.74* (61.76, 75.72)	67.98* (61.86, 74.10)	66.74* (59.94, 73.54)	62.26* (55.97, 68.55)	63.00* (55.92, 70.08)	60.41* (54.20, 66.62)	60.58* (53.41, 67.75)	95.10* (94.77, 95.43)	94.93* (94.60, 95.26)
School-level										
% FreeLunch, γ_{10}		-0.29* (-0.43, -0.15)		-0.40* (-0.52, -0.28)		-0.21* (-0.35, -0.07)		-0.29* (-0.43, -0.15)		-0.02* (-0.03, -0.02)
Class Size, γ_{20}		0.04 (-0.65, 0.73)		-0.09 (-1.01, 0.83)		-0.54 (-1.36, 0.28)		-0.78 (-1.66, 0.10)		0.02 (-0.04, 0.08)
School district-level										
Per-pupil expenditure, γ_{01}		-0.00 (-0.01, 0.00)		-0.00 (-0.01, 0.00)		-0.00 (-0.01, 0.00)		-0.00 (-0.01, 0.00)		-0.00 (0.00, 0.00)
ISO 9000 participation, γ_{02}		1.08 (-12.52, 14.68)		2.59 (-11.15, 16.33)		-1.66 (-16.73, 13.41)		-1.37 (-16.38, 13.64)		0.56* (0.07, 1.05)
Interaction										
% FreeLunch × ISO 9000 participation, γ_{12}		-0.08 (-0.28, 0.12)		0.00 (-0.16, 0.16)		-0.05 (-0.25, 0.15)		-0.05 (-0.25, 0.15)		0.00 (-0.01, 0.01)
Random effect										
Variance component										
School district-level, u_{0j}	276.90*	268.28*	268.64*	263.65*	310.46*	288.51*	277.50*	288.01*	0.54*	0.33*
School-level, r_{ij}	137.27	79.61	148.69	69.98	156.35	124.78	142.64	102.53	0.59	0.42

Note. For brevity, this table includes only the coefficients that are related to the research questions. Complete output of HLM analysis may be found in Appendix B.

* $p < .05$.

Table 4.3

Point and Interval Estimates (95% CI) of Effects of School- and School District-Level Variables on Middle School Outcomes for Null and Conditional Models (n = 157)

	Math		Reading		Math_Dis.		Reading_Dis.		Attendance	
	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model
Fixed effect										
Intercept, γ_{00}	62.82* (56.06, 69.58)	61.93* (55.52, 68.34)	70.31* (64.53, 76.09)	70.15* (64.56, 75.74)	53.62* (46.23, 61.01)	51.64* (45.74, 57.54)	60.60* (53.94, 67.26)	59.43* (52.84, 66.02)	93.88* (93.27, 94.49)	93.65* (93.22, 94.08)
School-level										
% FreeLunch, γ_{10}		-0.47* (-0.67, -0.27)		-0.35* (-0.53, -0.17)		-0.27* (-0.45, -0.09)		-0.21* (-0.41, -0.01)		-0.05* (-0.07, -0.03)
Class Size, γ_{20}		-0.39 (-1.31, 0.53)		-0.63* (-1.14, -0.12)		-1.46* (-2.68, -0.24)		-0.39 (-1.41, 0.63)		-0.12 (-0.30, 0.06)
School district-level										
Per-pupil expenditure, γ_{01}		-0.00 (-0.01, 0.00)		-0.00 (-0.01, 0.00)		-0.00 (-0.01, 0.00)		-0.00 (-0.01, 0.00)		-0.00 (0.00, 0.00)
ISO 9000 participation, γ_{02}		0.13 (-17.22, 17.48)		-0.84 (-16.07, 14.39)		2.43 (-16.76, 21.62)		2.42 (-15.00, 19.84)		0.68[a] (0.01, 1.35)
Interaction										
% FreeLunch × ISO 9000 participation, γ_{12}		-0.03 (-0.23, 0.17)		-0.06 (-0.26, 0.14)		-0.05 (-0.25, 0.15)		-0.10 (-0.30, 0.10)		0.01 (-0.17, 0.19)
Random effect										
Variance component										
School district-level, u_{0j}	322.76*	302.71*	235.51*	237.41*	398.88*	310.04*	329.38*	324.24*	1.65*	0.36*
School-level, r_{ij}	135.55	50.68	103.99	34.37	123.29	94.33	77.79	51.65	2.03	1.04

Note. For brevity, this table includes only the coefficients that are related to the research questions. Complete output of HLM analysis may be found in Appendix B.

[a] $p = .063$

* $p < .05$.

Table 4.3

Point and Interval Estimates (95% CI) of Effects of School- and School District-Level Variables on High School Outcomes for Null and Conditional Models (n = 112)

	Math		Reading		Math_Dis.		Reading_Dis.		Graduation	
	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model	Null model	Conditional model
Fixed effect										
Intercept, γ_{00}	59.05*	59.73*	71.45*	72.74*	46.92*	48.09*	59.02*	60.78*	76.02*	77.76*
	(51.09, 67.01)	(52.69, 66.77)	(64.45, 78.45)	(65.86, 79,62)	(38.61, 55.23)	(40.76, 55.42)	(51.12, 66.92)	(52.27, 69.29)	(71.22, 80.82)	(72.96, 82.56)
School-level										
% FreeLunch, γ_{10}		-0.95*		-0.65*		-0.77*		-0.46*		-0.53*
		(-1.13, -0.77)		(-0.83, -0.47)		(-1.06, -0.48)		(0-0.66, -0.26)		(-0.73, -0.33)
Class Size, γ_{20}		-0.57		-0.08		-0.81		-0.84		-0.94
		(-1.71, 0.57)		(-0.96, 0.80)		(-2.59, 0.97)		(-1.88, 0.20)		(-1.98, 0.10)
School district-level										
Per-pupil expenditure, γ_{01}		-0.00		-0.00		-0.00		-0.00		0.00
		(-0.01, 0.00)		(-0.01, 0.00)		(-0.01, 0.00)		(-0.01, 0.01)		(0.00, 0.01)
ISO 9000 participation, γ_{02}		1.60		-3.78		3.45		-2.74		-4.46
		(-14.61, 17.81)		(-18.44, 10.88)		(-11.76, 18.66)		(-18.24, 12.76)		(22.47, 13,55)
Interaction										
% FreeLunch × ISO 9000 participation, γ_{12}		0.30[a]		0.41*		0.37		0.36*		-0.09
		(-0.01, 0.61)		(0.17, 0.65)		(-0.22, 0.96)		(0.07, 0.65)		(-0.52, 0.34)
Random effect										
Variance component										
School district-level, u_{0j}	426.08*	303.93*	338.46*	275.71*	447.68*	274.16*	439.43*	392.49*	160.77*	231.53*
School-level, r_{ij}	150.63	48.50	95.88	33.11	194.23	119.54	96.71	72.15	111.70	21.47

Note. For brevity, this table includes only the coefficients that are related to the research questions. Complete output of HLM analysis may be found in Appendix B.

[a] $p = .076$

* $p < .05$.

Research Question Three

Q3: Is there any relationship between a school district's having the ISO 9000 quality management system and the student attendance rates of schools within that district, or, in the case of high schools, the graduation rates?

Descriptive Statistics

At the elementary school level, the student attendance rates of ISO 9000 schools was 0.34 higher compared with non-ISO 9000 schools (see Table 4.1). At the middle school level, however, the result was opposite – however, the difference between the two groups was only 0.02. At the high level, because the data on the student attendance rates in high schools was not available, the average graduation rates of schools were compared. As a group, ISO 9000 schools have a 0.68 higher graduation rate compared with non-ISO 9000 schools.

Hierarchical Analysis

Fixed effects. A significant and positive relationship was found between a school district's being registered to ISO 9000 standards and the student attendance rates of schools within that school district in elementary schools. ISO 9000 participation was associated with a 0.56% increase in the student attendance rates of schools after controlling for the effects of other predictor variables (p = .038) (see Table 4.2). In middle schools, the estimated effect of ISO 9000 participation, γ_{02}, was of borderline significance (p = .063). School SES, represented by %FreeLunch, was significantly and negatively related to the student attendance rates of schools both in elementary and middle schools.

At the high school level, however, no relationship was found between ISO 9000 participation and the average graduation rates of schools (p < .05).
However, %FreeLunch was significantly and negatively associated with average graduation rates of schools (see Table 4.4).

Random effects. Unlike the other cases, a substantial explanatory power of two school district-level predictors was detected. Specifically, in elementary schools, 39% of the school district-level variance in the student attendance rates of schools was explained by the inclusion of two school district-level predictor variables in the model – i.e., proportional reduction of prediction error at the school district-level = (0.54 – 0.33) / 0.54 = 0.39. In middle schools, 78% of the variance between school districts was explained by the inclusion of two school district-level predictors – i.e., proportional reduction of prediction error at the school district-level = (1.65 – 0.36) / 1.65 = 0.78. These results support the findings from the fixed effects suggesting that there is a significant relationship between ISO 9000 participation and the student attendance rates of schools.

In high schools, however, proportional reduction of prediction error at the school district-level was negative – i.e., proportional reduction of prediction error at the school district-level = (160.77 – 231.5) / 160.77 = - 0.44. This finding is also consistent with the estimation of fixed effects suggesting that the school district-level predictor variables are not associated with the graduation rates of schools at the high school level.

Research Question Four

Q4: Does the relationship between school SES and student achievement of a school differ between ISO 9000-participating schools and non-ISO 9000-participating schools?

Hierarchical Analysis

Both at the elementary and middle school levels, there was no difference in the effect of school SES on student achievement of a school between ISO 9000 schools and non-ISO 9000 schools – % FreeLunch and the average passing rates of students of a school on the state-mandated tests were used as indicators of school SES and student achievement of a school, respectively (see Table 4.2 and 4.3). In high schools, however, the effect of school SES on student achievement of a school gets stronger in ISO 9000 school districts – for math, the effect, γ_{12}, was marginally significant (p = .076) and for reading, the effect, γ_{12}, was significant (p = .003) (see Table 4.4). Put differently, schools with lower SES do worse in ISO 9000 school districts compared with non-ISO 9000 school districts. Figure 4.1 illustrates this positive interaction – the figure is not drawn to scale, but reflects the general pattern of interaction between ISO 9000 participation and school SES (% FreeLunch) on student achievement of a school (average passing rates of students of a school on the state-mandated tests).

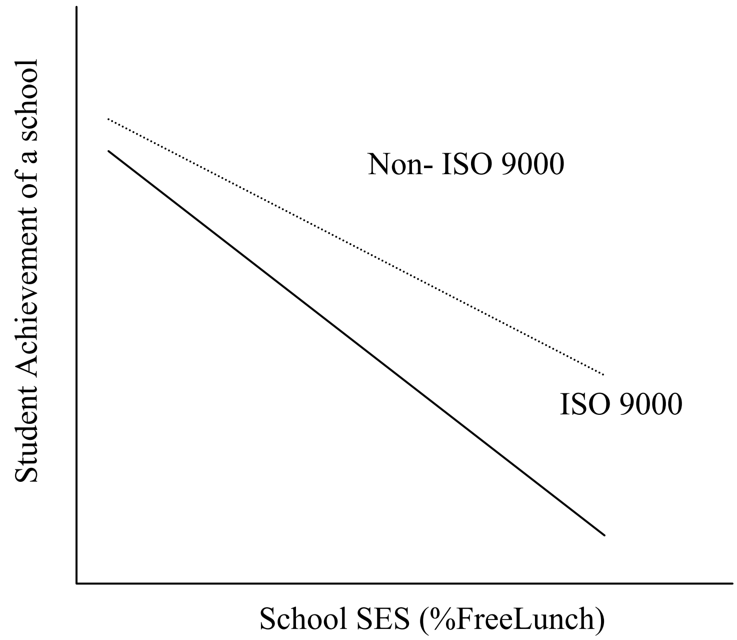

Figure **4-1** Interaction between ISO 9000 participation and school SES (%FreeLunch) on student achievement of a school (average passing rates of students on the state-mandated tests) at the high level.

Chapter 5

Summary of Findings, Discussion, Policy Implications, and Recommendations for Future Research

The focus of this study was to determine the relationship between the implementation of the ISO 9000 quality management system and school performance, which was measured by the overall student achievement of a school on the state-wide standardized tests and the student attendance rates of a school or graduation rates in high schools. In addition, the study examined whether the implementation of the ISO 9000 standardized education system mitigates the effect of school SES on the overall student achievement of a school.

Chapters one through four presented a historical background and summary of the problem, significance of the study, research questions, a review of related literature and previous studies, and a description of the methodology of the study and the findings. This chapter provides a summary of findings, discussion and implications, and recommendations for future study.

Summary of Findings

Research Question One: ISO 9000 and Student Achievement of Schools

No relationship was found between a school district’s being registered to ISO 9000 standards and the average passing rates of students of schools within that school district on the state-mandated test, after controlling for the percentage of students in a school receiving free/reduced-priced lunches, student-teacher ratio, and annual per pupil expenditure of school district. The results were consistent across math and reading achievement across all school levels. The finding of this study, hence, does not support the argument that ISO 9000 certification is related to student learning – i.e., the quality of education.

Research Question Two: ISO 9000 and Achievement of the Disadvantaged Students

No relationship was found between a school district's being certified to ISO 9000 standards and the average passing rates of economically disadvantaged students of schools within that school district on the state-mandated tests, when controlling for the percentage of students in a school receiving free/reduced-priced lunches, student-teacher ratio, and annual per-pupil expenditure of school district. The results were the same across math and reading across all school levels. This finding, thus, nullifies the argument that ISO 9000 registration is related to educational achievement of the disadvantaged student – i.e., the equality of education

Research Question Three: ISO 9000 and Student Attendance (Graduation)

A school district's being registered to ISO 9000 standard was significantly and positively related to the student attendance rates of schools within that school district both in elementary and middle schools. In elementary schools, the estimated effect of

ISO 9000 participation on the student attendance rates of schools, γ_{02}, was 0.56, indicating that ISO 9000 schools, on average, have a 0.56 % higher student attendance rate compared with non-ISO 9000 schools (*p* = .038). In middle schools, the estimated effect was 0.68 (*p* = .63). The results, thus, support the argument that implementing the ISO 9000 quality management system is related to improving the student attendance rates – thus, the quality of education – at least in elementary and middle schools.

Because the data on the student attendance rates was not available at the high school level, the relationship of ISO 9000 participation with graduation rates of schools was examined. After controlling for the effects of the percentage of students in a school receiving free/reduced priced lunches, student-teacher ratio, and annual per-pupil expenditure of school district, no relationship was found between a school district's being registered to ISO 9000 standards and the graduation rates of schools within that school district.

Research Question Four: ISO 9000 and the Effects of School SES on Student Achievement of a School

In elementary and middle schools, there was no difference in the effect of school SES on the overall student achievement of a school between ISO 9000-particpating schools and non-ISO 9000-participating schools. This means that ISO 9000 registration neither increases nor decreases the school SES effects on the student achievement of schools. In high schools, however, the study found that schools with higher SES do better in the ISO 9000 setting across math and reading. The finding, therefore, does not support the argument that ISO 9000 registration is related to achieving educational equality by mitigating the effect of school SES on student learning.

Discussion

Given the nature of ISO 9000 that emphasizes processes and consistency of products and service, very limited studies have been done examining what educational outcomes ISO 9000 in fact brings to schools. Due to the limited research available for comparison with the current study, the findings of the study are discussed in a more general and broader context, in which the implementation of the ISO 9000 quality management system in education is viewed as a public school reform initiative. Discussion is made on the appropriateness of ISO 9000 techniques in improving education quality and equality.

The first important finding of this study is that, in contrast to the claims or hopes of the ISO 9000 advocates, ISO 9000 certification does not lead to higher student achievement of schools – across students in general and economically disadvantaged students in particular. From this finding, one can draw a conclusion that the application of the ISO 9000 standardized education system does not in fact change teachers' classroom activities, a key determinant of student learning. Then, why? Answers may be found from the institutional and cultural theory perspectives.

First, from the institutional theory perspective (Powell & DiMaggio, 1991), the study results suggest that standardization, a core mechanism of ISO 9000, may be fundamentally incompatible with long-established norms of the public schools. That is, considering the institutional features of education such as value-orientation, diversity, complexity, and unpredictability (National Research Council, 2002), procedural standardization of teaching and learning may be more difficult and less appropriate than expected. One may argue that the ISO 9000 quality management system attempts to standardize the changing and dynamic world of the classroom.

Secondly, the study results can be explained using the cultural theory perspective that emphasizes the importance of organizational culture in adopting a new system relying on ethos of another social sector. Cultural theorists in various fields (Hofstede, 1980; Schein, 2004; Scott, 1998; Weick, 1976) argue that different culture groups are likely to have different cultural and value systems. This proposition could, undoubtedly, be applied to two different social sectors in a society: in this case, education versus business. As evidenced by the literature review, ISO 9000 must have captured the attention of business-minded education reformers and administrators as a means to reform public schools, while also succeeding in shifting their mentality toward the new educational context: consumerism and managerialism (Chan & Lai, 2002; Moreland & Clark, 1998; Thornhouser, 2005). However, from the findings of this study, one may assume that ISO 9000 might fail to change the practices of teachers in classrooms, which determines the quality of education. A principal of an ISO 9000 certified school supports this idea, saying, “[S]ome of the teachers will publicly comply [to the externally mandated reform initiatives], but when their classroom door closes they may continue in their usual practices” (N. Donovan, personal communication, June 22, 2003).

The second important finding is that, after adopting ISO 9000, school SES continues to have a powerful influence on student achievement of schools. In high schools, the negative relationship between the percentage of free lunch students and student achievement of a school was found to be stronger in ISO 9000 schools. This finding is fully consistent with theory and the previous studies demonstrating that the SES context of a school is the significant and consistent predictor of school performance (Fowler & Walberg, 1991; Henderson & Berla, 1994; Lee & Bryk, 1989; Toutkoushian & Curtis, 2005; Wilson, 1959). It, thus, may be argued that the ISO 9000 quality management system could not help foster more equitable educational results among schools in various socio-economic conditions, especially by mitigating the school SES effect.

Then, do the above findings mean that ISO 9000 participation has no benefits in terms of student learning? Regarding this question, it should be noted that the implementation of the ISO 9000 quality management system is significantly related to the student attendance rates of elementary and middle schools. Considering the nature of student attendance, which is easy to administratively observe, quantify, and be reported into data on a daily basis, it is reasonable to say that a systematic and standardized approach of ISO 9000 can influence student attendance. As is discussed later, this finding provides an important clue to how ISO 9000 can contribute to making public schools better.

Policy Implications

The findings of this study provide profound theoretical and practical implications for researchers, policy makers, business leaders, and educators who attempt to introduce the ISO 9000 system to classrooms. First, the study found that ISO 9000 participation does not lead to higher student achievement. Therefore, for those who intend to apply ISO 9000 techniques as a quick-fix solution to enhance student achievement, the study results suggest that procedural standardization approaches of ISO 9000 may not work as well for classroom instruction and student learning as it does in manufacturing companies. This is clearly supported by the fact that some school districts have already given up their ISO 9000 registration after only a short period of implementation.

However, the study also found that although ISO 9000 registration may not improve student learning, it could promote student attendance. Despite the seemingly minimal effect (γ_{02} = 0.56 for elementary schools, γ_{02} = 0.68 for middle schools), it may produce very meaningful outcomes, considering the size of the whole population – i.e., the elementary and middle school students in the U.S. More importantly, given the high correlation between student attendance and achievement that has been suggested by previous studies (Johnston, 2000; Minneapolis public schools, n.d.), this finding suggests that ISO 9000 participation could contribute to promoting student achievement of a school without interfering with teachers' classroom activities. Specifically, ISO 9000 may influence school performance by helping schools become organized and thus function well in the area of essential school operations, such as student and teacher attendance, which have been taken for granted but without which schools may not achieve their goals including improved student learning. Further, this way of helping schools may be important in that ISO 9000 could influence school performance without intimidating other important values such as teachers' professional autonomy and creativity in classrooms. Nonetheless, considering the considerable financial and human costs in implementing the ISO 9000 quality management system in schools (D. Burkhardt, personal communication, January 25, 2005; R. Utz, personal communication, January 26, 2005), whether or not to employ the ISO 9000 quality management system among other alternatives depends on the school district policymakers' practical judgment..

From a cultural theory perspective, it should also be noted that, in order to transplant a business practice to classrooms, it is essential to help teachers understand and become thoroughly assimilated to it. Due to a long-established mindset and culture, teachers may perceive ISO 9000 differently from outside reformers who want to "reinvent schools" in a business-like manner (Moreland & Clark, 1998; Tyack & Cuban, 1995). Policymakers and education reformers should understand the institutional characteristics of real schools, especially when they intend to change the traditional legacy of the schools.

Finally, ISO 9000 registration was found to fail to decrease the effect of school SES on student achievement of a school. As researchers (Coleman, 1996, Lee & Bryk, 1989; Riordan, 1997) argue, in order to foster more equitable educational outcomes among schools in different situations, it may be necessary to develop policy measures that directly deal with the problem of unequal school conditions.

Recommendations for Future Research

Because of the limited nonprobability sample, the generalizability of the study's results is uncertain. This study is but one step in the effort to explore the relationship between schools' ISO 9000 participation and quality and equality of education.

Subsequent research could include a larger population and more representative sample. Further, future study could compare educational outcomes of various samples in different conditions such as school type – private versus public schools or the general public schools versus vocational schools. The way of implementing the ISO 9000 quality management system could be an important independent variable as well.

Secondly, some ISO 9000 schools studied in this study have been implementing the ISO 9000 quality management system for only one or two years. Considering the effects of the new system that may occur over a long period, future study should be conducted longitudinally to determine the relationship between ISO 9000 participation and educational outcomes of schools.

Thirdly, this study used the average passing rates of students on the state-mandated standardized tests to measure educational outcomes of schools. Given that ISO 9000 may affect school performance in various ways – i.e., student behavioral tendencies, monetary efficiency and gains, and improvement of reputation of schools or school district – future research could examine other important outcome measures to identify the influence of ISO 9000 on results of schooling.

Finally, for a better understanding of why ISO 9000 has little impact on educational outcomes of schools, future research could be conducted to examine whether or not and how ISO 9000 influences teachers' behavior and practices in real classroom teaching.

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Appendix A

Data Sources

Data source	URL
National data set	
National Center for Education Statistics (NCES)	http://nces.ed.gov/
Greatschools.net	http://www.greatschools.net/
State data set	
Pennsylvania Department of Education	http://www.pde.state.pa.us/
State, District and School Report Cards	http://www.pde.state.pa.us/pas/cwp/view.asp?a=3&Q=95497&k12Nav=
Ohio Department of Education	http://www.ode.state.oh.us/
Interactive Local Report Card	http://ilrc.ode.state.oh.us/
Washington Office of Superintendent of Public Instruction	http://www.k12.wa.us/
Washington State Report Card	http://reportcard.ospi.k12.wa.us/
Tennessee Department of Education	http://www.tennessee.gov/education/
Report Card 2005	http://www.k-12.state.tn.us/rptcrd05/
Nevada Department of Education	http://www.doe.nv.gov/index.html
Nevada Annual Reports of Accountability	http://www.nevadareportcard.com/
North Carolina Department of Instruction	http://www.ncpublicschools.org/
NC School Report Cards	http://www.ncschoolreportcard.org/src/
Georgia Department of Education	http://public.doe.k12.ga.us/
Annual Education Accountability Report Cards	http://reportcard2005.gaosa.org/

Appendix B

Raw Data

Table B1

School- and School District-level Dependent and Independent Variables for Elementary Schools

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
1	PA	Allentown city	Central	16	16	15	15	92	79	16	0	6,941
2	PA	Allentown city	Francis	39	41	35	38	90	81	20	0	6,941
3	PA	Allentown city	Hiram W Dodd	75	69	70	64	95	60	17	0	6,941
4	PA	Allentown city	Jackson	54	48	48	43	94	73	15	0	6,941
5	PA	Allentown city	Jefferson	46	47	42	38	94	80	15	0	6,941
6	PA	Allentown city	Lehigh Park	100	90	100	88	96	36	18	0	6,941
7	PA	Allentown city	Mckinley	33	18	31	19	94	82	18	0	6,941
8	PA	Allentown city	Mosser	43	34	40	34	94	75	16	0	6,941
9	PA	Allentown city	Muhlenberg	87	85	85	81	95	31	17	0	6,941
10	PA	Allentown city	Ritter	78	61	71	48	96	46	19	0	6,941
11	PA	Allentown city	Roosevelt	53	29	50	22	94	75	18	0	6,941
12	PA	Allentown city	Sheridan	40	34	38	33	95	88	18	0	6,941
13	PA	Allentown city	Trexler MS	36	50	33	49	92	65	18	0	6,941
14	PA	Allentown city	Union Terrace	57	56	53	50	94	56	18	0	6,941
15	PA	Allentown city	Washington	41	30	40	29	93	89	18	0	6,941
16	PA	Altoona area	Baker	73	81	.	.	97	31	17	1	7,682
17	PA	Altoona area	Irving	82	73	80	75	97	42	17	1	7,682
18	PA	Altoona area	Junita	72	75	64	64	96	55	16	1	7,682
19	PA	Altoona area	Junita Gap	82	82	76	68	96	38	17	1	7,682
20	PA	Altoona area	Logan	62	58	52	52	96	40	19	1	7,682
21	PA	Altoona area	Mowrie A Ebner	59	53	37	33	96	44	19	1	7,682
22	PA	Altoona area	Penn-Lincoln	76	75	74	72	96	78	15	1	7,682
23	PA	Altoona area	Pleasant Valley	90	78	85	63	97	42	19	1	7,682
24	PA	Altoona area	Washington-Jefferson	66	54	60	47	96	72	17	1	7,682

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
25	PA	Altoona area	Wright	59	55	37	35	95	69	15	1	7,682
26	PA	Erie city	Burton	74	69	72	67	95	95	15	0	8,465
27	PA	Erie city	Cleveland	76	71	72	66	96	56	17	0	8,465
28	PA	Erie city	Connell	53	50	42	38	96	69	18	0	8,465
29	PA	Erie city	Diehl	67	64	63	60	95	78	15	0	8,465
30	PA	Erie city	Edison	55	60	51	55	94	75	15	0	8,465
31	PA	Erie city	Emerson-Gridley	41	37	40	38	93	75	16	0	8,465
32	PA	Erie city	Glenwood	76	68	77	65	94	69	15	0	8,465
33	PA	Erie city	Harding	67	67	59	61	95	67	18	0	8,465
34	PA	Erie city	Irving	46	55	42	49	94	71	17	0	8,465
35	PA	Erie city	Jefferson	44	57	32	53	95	59	14	0	8,465
36	PA	Erie city	Lincoln	71	74	66	68	96	67	18	0	8,465
37	PA	Erie city	Mckinley	49	51	46	49	92	89	15	0	8,465
38	PA	Erie city	Perry	64	63	59	59	95	68	15	0	8,465
39	PA	Erie city	Pfeiffer-Burleigh	70	55	74	54	92	87	15	0	8,465
40	PA	Erie city	Wayne	28	37	27	37	90	87	16	0	8,465
41	PA	Lancaster	Burrowes	47	43	46	34	94	64	13	1	9,079
42	PA	Lancaster	Carter Macrae	21	30	21	29	93	96	11	1	9,079
43	PA	Lancaster	Elizabeth R Martin	72	64	69	62	96	42	17	1	9,079
44	PA	Lancaster	Fulton	58	52	57	48	94	87	16	1	9,079
45	PA	Lancaster	George Washington	49	60	48	61	93	88	14	1	9,079
46	PA	Lancaster	Hamilton	43	42	33	34	95	66	21	1	9,079
47	PA	Lancaster	James Buchanan	70	60	76	56	96	41	15	1	9,079
48	PA	Lancaster	King	64	38	68	40	95	99	14	1	9,079

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
49	PA	Lancaster	Lafayette	46	49	42	48	95	73	16	1	9,079
50	PA	Lancaster	Price	45	42	47	40	95	82	14	1	9,079
51	PA	Lancaster	Ross	53	45	50	32	95	74	15	1	9,079
52	PA	Lancaster	Thomas Wharton	59	61	42	47	96	60	15	1	9,079
53	PA	Lancaster	Wickersham	43	37	40	34	95	72	15	1	9,079
54	PA	Reading	10th & Penn	49	40	46	36	94	90	16	0	6,639
55	PA	Reading	Amanda E Stout	32	25	32	23	94	84	22	0	6,639
56	PA	Reading	Glenside	42	39	41	37	93	70	18	0	6,639
57	PA	Reading	Lauers Park	51	45	51	45	95	90	17	0	6,639
58	PA	Reading	Millmont	92	83	94	88	95	39	15	0	6,639
59	PA	Reading	Northwest	38	22	38	22	93	78	19	0	6,639
60	PA	Reading	Riverside	47	41	41	35	94	68	19	0	6,639
61	PA	Reading	16th & Haak	47	33	50	31	94	61	19	0	6,639
62	PA	Reading	10th & Green	40	30	39	29	93	79	20	0	6,639
63	PA	Reading	13th & Green	41	46	38	42	94	73	17	0	6,639
64	PA	Reading	13th & Union	45	42	38	36	94	45	18	0	6,639
65	PA	Reading	Thomas H Ford	44	42	42	40	93	89	17	0	6,639
66	PA	Reading	12th & Marion	36	38	29	33	95	74	18	0	6,639
67	PA	Reading	Tyson-Schoener	33	24	32	23	93	77	16	0	6,639
68	PA	Scranton	Charles Sumner #18	71	82	86	79	91	43	15	0	9,277
69	PA	Scranton	Frances Willard #32	74	64	59	47	95	50	15	0	9,277
70	PA	Scranton	George Bancroft #34	68	66	65	62	91	82	11	0	9,277
71	PA	Scranton	John Adams #4	73	63	74	63	95	86	12	0	9,277
72	PA	Scranton	John F. Kennedy #7	86	66	89	53	95	52	17	0	9,277

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
73	PA	Scranton	John G Whittier #2	57	59	43	39	95	49	18	0	9,277
74	PA	Scranton	John J. Audubon #42	33	38	30	35	94	77	12	0	9,277
75	PA	Scranton	John Marhall #41	72	80	32	46	97	23	15	0	9,277
76	PA	Scranton	Lincoln-Jackson #14	55	42	53	33	95	67	13	0	9,277
77	PA	Scranton	Mcnicholas Plaza	57	70	61	69	94	80	13	0	9,277
78	PA	Scranton	Neil Armstrong #40	54	64	43	55	94	48	15	0	9,277
79	PA	Scranton	Robert Morris #27	83	77	81	62	95	31	18	0	9,277
80	PA	Scranton	William Prescott #38	60	65	46	42	96	58	15	0	9,277
81	OH	Evergreen	Fulton	71	78	60	60	96	16	18	0	7,827
82	OH	Evergreen	Lyons	67	67	.	.	96	13	14	0	7,827
83	OH	West Liberty-Salem Local	West Liberty-Salem	67	78	54	69	96	9	14	0	7,454
84	OH	Liberty Center	Liberty Center Elementar	66	81	41	59	96	54	20	1	6,705
85	WA	Longview	Columbia Heights	48	76	18	59	.	34	17	0	7,621
86	WA	Longview	Columbia Valley Garden	52	70	33	61	.	21	19	0	7,621
87	WA	Longview	Kessler	45	62	40	60	.	75	18	0	7,621
88	WA	Longview	Mint Valley	45	61	41	57	.	56	17	0	7,621
89	WA	Longview	Northlake	44	68	32	55	.	54	17	0	7,621
90	WA	Longview	Olympic	59	70	48	59	.	65	17	0	7,621
91	WA	Longview	Robert Gray	49	77	41	52	.	28	21	0	7,621
92	WA	Longview	Saint Helens	26	40	22	35	.	81	19	0	7,621
93	WA	Franklin Pierce	Brookdale	68	78	51	69	.	48	21	0	6,881
94	WA	Franklin Pierce	Central Avenue	55	60	48	44	.	44	20	0	6,881
95	WA	Franklin Pierce	Christensen	50	67	46	66	.	69	19	0	6,881
96	WA	Franklin Pierce	Collins	52	68	44	57	.	33	20	0	6,881

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
97	WA	Franklin Pierce	Elmhurst	53	67	36	58	.	41	21	0	6,881
98	WA	Franklin Pierce	Harvard	57	46	38	44	.	63	20	0	6,881
99	WA	Franklin Pierce	James Sales	48	70	49	70	.	59	17	0	6,881
100	WA	Franklin Pierce	Midland	55	70	46	60	.	51	20	0	6,881
101	WA	Moses Lake	Garden Heights	82	100	75	100	.	40	19	0	6,694
102	WA	Moses Lake	Knolls Vista	61	72	64	73	.	65	20	0	6,694
103	WA	Moses Lake	Lakeview terrace	85	89	80	90	.	62	20	0	6,694
104	WA	Moses Lake	Larson Heights	72	75	74	80	.	88	18	0	6,694
105	WA	Moses Lake	Longview	58	69	44	66	.	52	19	0	6,694
106	WA	Moses Lake	Discover	68	83	64	82	.	42	18	0	6,694
107	WA	Moses Lake	North	55	88	52	87	.	82	16	0	6,694
108	WA	Moses Lake	Peninsula	43	57	43	48	.	65	19	0	6,694
109	WA	Wenatchee	Abraham Lincoln	63	71	45	53	.	67	18	1	6,602
110	WA	Wenatchee	Columbia	38	54	31	44	.	84	17	1	6,602
111	WA	Wenatchee	John Newbery	56	62	25	21	.	40	22	1	6,602
112	WA	Wenatchee	Lewis And Clark	66	74	61	70	.	73	16	1	6,602
113	WA	Wenatchee	Mission View	45	59	39	51	.	67	18	1	6,602
114	WA	Wenatchee	Sunnyslope	86	86	.	.	.	16	18	1	6,602
115	WA	Wenatchee	Washington	77	71	51	54	.	35	20	1	6,602
116	TN	Clarksville-Mongomery	Barksdale	92	94	89	94	96	41	13	1	5,170
117	TN	Clarksville-Mongomery	Burt	91	95	80	87	96	48	13	1	5,170
118	TN	Clarksville-Mongomery	Byrns L Darden	80	83	77	82	95	80	15	1	5,170
119	TN	Clarksville-Mongomery	Cumberland hights	89	93	83	85	96	46	14	1	5,170
120	TN	Clarksville-Mongomery	Glenellen	92	93	91	90	96	40	17	1	5,170

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
121	TN	Clarksville-Mongomery	Kenwood	95	96	94	94	96	55	14	1	5,170
122	TN	Clarksville-Mongomery	Liberty	87	88	81	83	95	64	13	1	5,170
123	TN	Clarksville-Mongomery	Minglewood	84	88	83	86	96	57	12	1	5,170
124	TN	Clarksville-Mongomery	Moore	80	81	76	77	95	73	9	1	5,170
125	TN	Clarksville-Mongomery	Norman Smith	87	91	83	88	95	69	11	1	5,170
126	TN	Clarksville-Mongomery	Northeast	91	91	85	83	96	27	13	1	5,170
127	TN	Clarksville-Mongomery	Sango	96	97	93	97	97	12	15	1	5,170
128	TN	Clarksville-Mongomery	St Bethlehem	92	89	87	81	95	53	14	1	5,170
129	TN	Clarksville-Mongomery	Woodlawn	92	94	89	88	95	33	14	1	5,170
130	TN	Rutherford	Barfield	98	95	90	93	96	20	14	0	5,301
131	TN	Rutherford	Blackman	90	90	73	77	96	23	17	0	5,301
132	TN	Rutherford	Buchanan	90	92	78	81	96	24	15	0	5,301
133	TN	Rutherford	Cedar Grove	93	94	85	87	95	32	17	0	5,301
134	TN	Rutherford	Christiana	85	85	74	69	95	35	12	0	5,301
135	TN	Rutherford	David Youree	91	88	86	83	95	69	11	0	5,301
136	TN	Rutherford	Lascassas	94	92	92	89	96	20	14	0	5,301
137	TN	Rutherford	Rockspring	92	92	88	90	95	36	15	0	5,301
138	TN	Rutherford	Rockvale	93	93	81	92	95	23	12	0	5,301
139	TN	Rutherford	Roy Waldron	84	86	73	78	94	42	16	0	5,301
140	TN	Rutherford	Stewartsboro	89	87	83	83	95	43	13	0	5,301
141	TN	Rutherford	Walter Hill	85	91	70	90	96	47	10	0	5,301
142	TN	Rutherford	Wilson	90	91	80	83	96	26	15	0	5,301
143	TN	Greeneville	C Hai Henard	88	73	90	86	95	47	12	0	7,775
144	TN	Greeneville	Eastview	98	89	98	92	95	22	12	0	7,775

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
145	TN	Greeneville	Tusculum View	98	96	94	79	96	30	12	0	7,775
146	TN	Sumner	Benny Bills	85	85	77	77	95	59	17	0	5,740
147	TN	Sumner	Clyde Riggs	92	89	85	82	95	43	13	0	5,740
148	TN	Sumner	Guild	89	89	81	81	95	58	14	0	5,740
149	TN	Sumner	Howard	87	87	75	76	95	55	12	0	5,740
150	TN	Sumner	Lakeside	91	92	95	77	96	16	11	0	5,740
151	TN	Sumner	Madison creek	93	94	86	91	96	20	12	0	5,740
152	TN	Sumner	Millersville	86	83	81	81	95	46	10	0	5,740
153	TN	Sumner	Union	95	99	95	.	96	11	10	0	5,740
154	TN	Sumner	Walton Ferry	91	95	74	89	97	22	15	0	5,740
155	TN	Sumner	Watt Hardson	85	88	67	73	96	34	14	0	5,740
156	TN	Sumner	Wessington Place	87	91	84	88	95	34	13	0	5,740
157	TN	Sumner	Westmoreland	91	94	86	86	95	42	12	0	5,740
158	TN	Sumner	Williams	91	91	83	79	96	20	14	0	5,740
159	NV	Clark	Adams	58	37	70	13	95	40	14	1	5,774
160	NV	Clark	Beckley	28	27	27	26	95	67	17	1	5,774
161	NV	Clark	Christensen	55	50	54	31	95	30	17	1	5,774
162	NV	Clark	Dearing	34	28	29	23	94	69	17	1	5,774
163	NV	Clark	Edwards	32	24	29	18	94	65	17	1	5,774
164	NV	Clark	Garehime	64	65	44	44	95	15	17	1	5,774
165	NV	Clark	Hancock	45	47	34	38	95	55	15	1	5,774
166	NV	Clark	Kesterson	56	57	38	42	96	21	17	1	5,774
167	NV	Clark	Lake	29	18	29	14	94	72	16	1	5,774
168	NV	Clark	Mackey	58	55	53	47	96	41	13	1	5,774

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
169	NV	Clark	May	68	52	57	50	95	21	19	1	5,774
170	NV	Clark	Moore	42	24	43	26	94	77	15	1	5,774
171	NV	Clark	Perkins	48	48	30	30	94	65	12	1	5,774
172	NV	Clark	Rogers	66	61	56	49	96	18	18	1	5,774
173	NV	Clark	Snyder	44	31	39	20	95	68	16	1	5,774
174	NV	Clark	Tobler	52	49	49	38	95	35	15	1	5,774
175	NV	Clark	Virgin Valley	66	51	49	28	96	54	16	1	5,774
176	NV	Clark	Watson	40	37	35	29	96	39	20	1	5,774
177	NV	Clark	Wolfe Eva	42	38	27	30	96	34	16	1	5,774
178	NV	Clark	Wynn	25	26	22	25	93	69	17	1	5,774
179	NV	Lyon	Cottonwood	57	57	41	48	95	30	16	0	7,021
180	NV	Lyon	Silver Stage Middle	27	24	15	12	92	59	16	0	7,021
181	NV	Lyon	Sutro	49	39	44	26	94	36	17	0	7,021
182	NV	Lyon	Yerington Middle	45	37	46	32	95	52	14	0	7,021
183	NV	Nye	Amargosa Valley	58	21	59	18	94	91	11	0	7,810
184	NV	Nye	Hafen	40	48	29	40	92	35	19	0	7,810
185	NV	Nye	Mt Charleston	70	56	66	51	93	46	19	0	7,810
186	NV	Nye	Silver Rim	33	19	.	.	93	26	15	0	7,810
187	NV	Washoe	Alice L Smith	61	46	54	28	95	45	17	0	6,120
188	NV	Washoe	Bennett	36	41	37	39	95	65	18	0	6,120
189	NV	Washoe	Desert Heights	31	34	26	26	95	60	15	0	6,120
190	NV	Washoe	Donner Springs	53	49	31	29	95	42	18	0	6,120
191	NV	Washoe	Gomes	50	54	50	50	96	24	20	0	6,120
192	NV	Washoe	Hidden Valley	67	69	52	52	96	25	15	0	6,120

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
193	NV	Washoe	Hunter Lake	78	69	71	57	96	36	20	0	6,120
194	NV	Washoe	Kate M Smith	35	22	33	18	95	77	15	0	6,120
195	NV	Washoe	Lincoln Park	53	37	52	37	96	72	15	0	6,120
196	NV	Washoe	Mathews	36	26	31	22	96	76	16	0	6,120
197	NV	Washoe	Mitchell	48	38	48	32	96	67	16	0	6,120
198	NV	Washoe	Peavine	60	81	39	54	96	19	19	0	6,120
199	NV	Washoe	Van Gorder	70	62	.	.	96	3	20	0	6,120
200	NV	Washoe	Warner	60	33	52	21	95	56	18	0	6,120
201	NV	Washoe	Winnemucca	65	69	52	44	96	21	19	0	6,120
202	NC	Guilford County	Bessemer	84	70	85	69	95	89	15	1	6,943
203	NC	Guilford County	Bluford	99	80	100	81	97	56	15	1	6,943
204	NC	Guilford County	Claxton	99	91	92	85	96	17	14	1	6,943
205	NC	Guilford County	Fairview	92	69	91	65	95	94	12	1	6,943
206	NC	Guilford County	Florence	95	85	85	77	96	13	16	1	6,943
207	NC	Guilford County	General Greene	90	75	70	48	96	24	14	1	6,943
208	NC	Guilford County	Jefferson	96	92	89	78	96	33	18	1	6,943
209	NC	Guilford County	Jesse Wharton	91	85	73	63	95	35	20	1	6,943
210	NC	Guilford County	John Van Lindley	85	82	74	70	95	71	13	1	6,943
211	NC	Guilford County	Johnson Street	84	58	74	69	95	99	8	1	6,943
212	NC	Guilford County	Morehead	92	84	85	73	96	59	11	1	6,943
213	NC	Guilford County	Oak View	91	84	83	72	96	50	9	1	6,943
214	NC	Guilford County	Parkview Village	78	66	75	60	95	77	12	1	6,943
215	NC	Guilford County	Rankin	83	57	82	54	96	85	13	1	6,943
216	NC	Guilford County	Southern	93	80	86	62	95	38	13	1	6,943

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
217	NC	Guilford County	Southwest	97	91	82	73	96	13	15	1	6,943
218	NC	Guilford County	Sternberger	89	80	71	58	96	43	12	1	6,943
219	NC	Guilford County	Vandalia	89	69	86	62	95	75	10	1	6,943
220	NC	Guilford County	W M Hampton	85	74	85	72	95	99	8	1	6,943
221	NC	Guilford County	Washington	81	57	79	55	95	98	8	1	6,943
222	NC	Gaston County	Arlington	100	83	100	82	95	80	17	0	5,977
223	NC	Gaston County	Brookside	95	82	93	79	95	47	17	0	5,977
224	NC	Gaston County	Carr	93	77	93	76	96	62	16	0	5,977
225	NC	Gaston County	Costner	91	81	82	64	96	40	20	0	5,977
226	NC	Gaston County	Gardner Park	96	81	95	74	96	39	17	0	5,977
227	NC	Gaston County	Ida Rankin	98	91	95	85	96	34	20	0	5,977
228	NC	Gaston County	Kiser	95	77	92	67	95	34	18	0	5,977
229	NC	Gaston County	Lowell	99	90	93	67	95	27	18	0	5,977
230	NC	Gaston County	New Hope	98	95	100	100	96	19	19	0	5,977
231	NC	Gaston County	Pine Wood	97	80	88	69	95	32	18	0	5,977
232	NC	Gaston County	Pleasant Ridge	80	68	79	64	96	76	15	0	5,977
233	NC	Gaston County	Robinson	97	88	91	73	97	10	18	0	5,977
234	NC	Gaston County	Sherwood	94	87	88	79	96	44	17	0	5,977
235	NC	Gaston County	Tyon	94	83	91	76	95	51	19	0	5,977
236	NC	Gaston County	W A Bess	96	88	86	72	96	22	20	0	5,977
237	NC	Gaston County	Woodhill	83	70	81	68	94	86	9	0	5,977
238	NC	Gaston County	Belmont central	97	90	90	75	96	15	20	0	5,977
239	NC	Gaston County	Rhyne	90	75	90	74	95	82	11	0	5,977
240	NC	Gaston County	North Belmont	95	72	93	68	95	51	15	0	5,977

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
241	NC	Gaston County	J B Page	93	81	89	74	96	61	16	0	5,977
242	NC	Cumberland County	Alger B Wilkins	90	73	87	67	95	88	12	0	6,301
243	NC	Cumberland County	Armstrong	86	78	87	73	95	53	14	0	6,301
244	NC	Cumberland County	Beaver Dam	94	83	83	67	95	40	11	0	6,301
245	NC	Cumberland County	Benjamin J	94	90	94	91	96	55	17	0	6,301
246	NC	Cumberland County	College Lake	83	74	78	70	97	57	14	0	6,301
247	NC	Cumberland County	Cumberland Mills	88	74	83	70	95	66	15	0	6,301
248	NC	Cumberland County	Cumberland Road	85	60	83	54	95	88	13	0	6,301
249	NC	Cumberland County	Eastover	98	89	95	78	96	43	15	0	6,301
250	NC	Cumberland County	Education V Baldwin	90	90	83	83	95	47	16	0	6,301
251	NC	Cumberland County	E E Miller	91	75	87	67	96	50	14	0	6,301
252	NC	Cumberland County	Gray's Creek	92	79	87	69	95	59	14	0	6,301
253	NC	Cumberland County	Howrad Hall	94	89	86	75	95	40	17	0	6,301
254	NC	Cumberland County	J W Coon	91	67	90	63	95	81	9	0	6,301
255	NC	Cumberland County	Long Hill	99	97	94	84	96	32	15	0	6,301
256	NC	Cumberland County	Sunnyside	95	94	66	61	95	81	15	0	6,301
257	NC	Cumberland County	Vanstory Hills	94	81	90	73	96	28	16	0	6,301
258	NC	Cumberland County	Ponderosa	94	92	89	81	97	57	14	0	6,301
259	NC	Cumberland County	Rockfish	100	95	100	92	95	49	17	0	6,301
260	NC	Cumberland County	Young Howard	87	57	83	50	94	98	11	0	6,301
261	NC	Cumberland County	Westarea	85	85	66	64	96	78	15	0	6,301
262	NC	Rockingham County	Bethany	95	81	91	77	95	30	14	0	6,336
263	NC	Rockingham County	Central	95	87	87	80	96	41	15	0	6,336
264	NC	Rockingham County	Douglass	93	80	82	61	96	39	14	0	6,336

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
265	NC	Rockingham County	Draper	93	78	92	76	94	67	11	0	6,336
266	NC	Rockingham County	Lincoln	88	79	84	70	95	55	14	0	6,336
267	NC	Rockingham County	New Vision	92	80	84	68	96	44	16	0	6,336
268	NC	Rockingham County	Monroeton	98	83	91	55	97	29	14	0	6,336
269	NC	Rockingham County	Stoneville	98	84	95	76	95	61	13	0	6,336
270	NC	Rockingham County	Moss	83	71	85	79	96	75	14	0	6,336
271	NC	Rockingham County	Leaksvliee-Spray	87	70	82	61	95	68	14	0	6,336
272	NC	Rockingham County	Wentworth	93	82	83	70	96	37	14	0	6,336
273	GA	Doherty	Alice Coachman	80	70	80	70	.	81	20	1	8,056
274	GA	Doherty	Jackson Heights	80	67	80	67	.	92	18	1	8,056
275	GA	Doherty	Lake Park	93	97	93	97	.	23	17	1	8,056
276	GA	Doherty	Lamar Reese	69	72	69	72	.	85	19	1	8,056
277	GA	Doherty	Lincoln Magnet	99	99	99	99	.	47	20	1	8,056
278	GA	Doherty	Magnolia	72	66	72	66	.	75	18	1	8,056
279	GA	Doherty	M.L. King	53	54	53	54	.	86	16	1	8,056
280	GA	Doherty	Mock Road	54	52	54	52	.	83	13	1	8,056
281	GA	Doherty	Morningside	71	65	71	65	.	79	20	1	8,056
282	GA	Doherty	Northside	67	67	67	67	.	83	19	1	8,056
283	GA	Doherty	Radium Springs	83	88	83	88	.	72	16	1	8,056
284	GA	Doherty	Sherwood	72	68	72	68	.	59	18	1	8,056
285	GA	Doherty	Sylvandale	60	56	60	56	.	94	15	1	8,056
286	GA	Doherty	Sylvester Road	65	66	65	66	.	87	22	1	8,056
287	GA	Doherty	Turner	60	58	60	58	.	90	20	1	8,056
288	GA	Doherty	West Town	66	66	66	66	.	85	18	1	8,056

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
289	GA	Newton	East Newton	83	77	73	63	.	34	17	0	6,915
290	GA	Newton	Oak Hill	84	85	81	79	.	39	17	0	6,915
291	GA	Newton	Fairview	79	81	72	74	.	54	18	0	6,915
292	GA	Newton	Middle ridge	67	70	65	66	.	64	16	0	6,915
293	GA	Newton	West Newton	73	72	72	72	.	56	18	0	6,915
294	GA	Newton	Ficquett	74	81	64	74	.	56	14	0	6,915
295	GA	Newton	Livingston	68	85	68	78	.	43	17	0	6,915
296	GA	Newton	Palmer Ston	77	77	66	65	.	48	15	0	6,915
297	GA	Newton	Mansfield	75	79	55	55	.	28	18	0	6,915
298	GA	Newton	Heard-Mixon	80	81	71	76	.	54	16	0	6,915
299	GA	Newton	Porterdale	72	68	53	51	.	61	16	0	6,915
300	GA	Rockdale	Peek's chapel	81	88	80	86	.	53	18	0	7,251
301	GA	Rockdale	Honey Creek	89	91	82	82	.	32	17	0	7,251
302	GA	Rockdale	Barksdale	90	91	79	78	.	28	19	0	7,251
303	GA	Rockdale	Sims	84	89	69	81	.	45	17	0	7,251
304	GA	Rockdale	Shoal Creek	84	89	74	86	.	45	17	0	7,251
305	GA	Rockdale	Lorraine	91	96	93	86	.	17	16	0	7,251
306	GA	Rockdale	hightower Trail	84	83	79	79	.	50	16	0	7,251
307	GA	Rockdale	Flat Shoal	79	85	66	79	.	58	14	0	7,251
308	GA	Rockdale	Pine Street	78	77	82	75	.	73	15	0	7,251
309	GA	Rockdale	Hicks	76	81	72	79	.	75	16	0	7,251
310	GA	Rockdale	House	79	76	76	72	.	76	16	0	7,251
311	GA	Bibb	Alexander II Magnet	89	91	78	89	.	38	17	0	7,256
312	GA	Bibb	Barden	65	60	67	60	.	94	17	0	7,256

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
313	GA	Bibb	Bernd	80	60	59	58	.	89	19	0	7,256
314	GA	Bibb	Brookdale	51	61	49	61	.	98	16	0	7,256
315	GA	Bibb	Bruce	31	41	31	42	.	99	18	0	7,256
316	GA	Bibb	Burdell	66	55	65	50	.	99	19	0	7,256
317	GA	Bibb	Burghard	52	63	52	60	.	99	17	0	7,256
318	GA	Bibb	Burke	68	72	66	71	.	99	19	0	7,256
319	GA	Bibb	Carter	83	87	67	64	.	46	18	0	7,256
320	GA	Bibb	Hamilton	47	45	48	47	.	98	15	0	7,256
321	GA	Bibb	Heard	69	72	62	49	.	39	17	0	7,256
322	GA	Bibb	Lane	93	88	90	81	.	54	15	0	7,256
323	GA	Bibb	Morgan	45	62	41	59	.	92	17	0	7,256
324	GA	Bibb	Porter	81	77	61	57	.	39	17	0	7,256
325	GA	Bibb	Rice	72	78	70	77	.	90	18	0	7,256
326	GA	Bibb	Riley	60	55	60	55	.	94	18	0	7,256
327	GA	Bibb	Springdale	91	93	85	85	.	26	18	0	7,256
328	GA	Bibb	Taylor at Tinsley	67	74	66	68	.	57	12	0	7,256
329	GA	Bibb	Union	64	77	65	80	.	94	17	0	7,256
330	GA	Bibb	Williams	49	46	51	48	.	97	16	0	7,256

[a] Average passing rates of students on the state-mandated math test. [b] Average passing rates of economically disadvantaged students on the state-mandated math test. [c] Percentage of students who receive free/reduced-priced lunches. [d] 0 = non-registered, 1 = registered. [e] Annual per-pupil expenditure of school district.

Table B2

School- and School District-level Dependent and Independent Variables for Middle Schools

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
1	PA	Allentown city	Francis D Raub	51	50	47	46	90	81	20	0	6,941
2	PA	Allentown city	Harrison-Morton	34	44	27	37	93	71	18	0	6,941
3	PA	Allentown city	South Moutain	28	43	22	35	91	65	18	0	6,941
4	PA	Allentown city	Trexler	28	43	19	31	92	65	18	0	6,941
5	PA	Altoona area	D S Keith	61	73	52	64	95	44	17	1	7,682
6	PA	Altoona area	Theodore Roosevelt	57	67	41	51	95	43	16	1	7,682
7	PA	Erie city	Connell	81	69	81	67	96	69	18	0	8,465
8	PA	Erie city	Harding	47	73	38	67	95	67	18	0	8,465
9	PA	Erie city	Roosevelt	59	70	54	66	92	71	16	0	8,465
10	PA	Erie city	Wayne	35	44	32	40	90	87	16	0	8,465
11	PA	Erie city	Wilson	37	50	34	45	93	81	18	0	8,465
12	PA	Lancaster	Hand	27	31	25	28	90	81	16	1	9,079
13	PA	Lancaster	Lincoln	40	49	35	44	90	73	13	1	9,079
14	PA	Lancaster	Reynolds	30	42	26	36	88	82	20	1	9,079
15	PA	Lancaster	Wheatland	32	44	19	29	91	52	8	1	9,079
16	PA	Reading	Northeast	46	54	41	43	93	68	16	0	6,639
17	PA	Reading	Northwest	38	46	35	43	92	75	17	0	6,639
18	PA	Reading	Southern	30	43	29	42	91	81	17	0	6,639
19	PA	Reading	Southwest	26	37	24	37	90	81	16	0	6,639
20	PA	Scranton	Northeast Intrmd	42	62	31	49	.	44	15	0	9,277
21	PA	Scranton	South Scranton Intrm	70	64	58	50	94	60	11	0	9,277
22	PA	Scranton	West Scranton Intrdm	63	71	46	55	93	42	15	0	9,277
23	OH	Evergreen	Evergreen	65	56	46	36	95	25	23	0	7,827

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
24	OH	West Liberty-Salem Loca	West Liberty-Salem	73	75	69	46	95	11	17	0	7,454
25	OH	Black River Local	Black River Education Ce	73	67	70	60	95	30	8	0	6,302
26	OH	Liberty Center	Liberty Center	83	74	91	82	96	17	18	1	6,705
27	WA	Longview	Cascade	42	66	23	49	.	39	21	0	7,621
28	WA	Longview	Monticello	33	55	22	42	.	53	21	0	7,621
29	WA	Franklin Pierce	Morris Ford	42	61	31	56	.	47	21	0	6,881
30	WA	Franklin Pierce	Perry G Keithley	27	44	19	37	.	59	18	0	6,881
31	WA	Moses Lake	Chief Moses	49	74	36	63	.	54	21	0	6,694
32	WA	Moses Lake	Froniter	40	44	31	33	.	62	21	0	6,694
33	WA	Wenatchee	Foothills	56	70	25	43	.	30	21	1	6,602
34	WA	Wenatchee	Orchard	35	52	15	34	.	58	18	1	6,602
35	WA	Wenatchee	Pioneer	32	57	16	41	.	49	20	1	6,602
36	TN	Clarksville-Mongomery	Kenwood	85	88	78	84	95	57	15	1	5,170
37	TN	Clarksville-Mongomery	Montgomery Central	89	90	81	75	94	37	18	1	5,170
38	TN	Clarksville-Mongomery	New Providence	85	89	78	81	94	48	16	1	5,170
39	TN	Clarksville-Mongomery	Northeast	90	92	87	89	95	31	16	1	5,170
40	TN	Clarksville-Mongomery	Rossview	91	92	83	84	95	31	13	1	5,170
41	TN	Rutherford	Blackman	94	92	87	76	95	20	15	0	5,301
42	TN	Rutherford	Central	77	82	66	73	93	58	12	0	5,301
43	TN	Rutherford	Rock Spring	93	95	91	93	95	34	16	0	5,301
44	TN	Rutherford	Siegel	93	96	78	89	95	16	16	0	5,301
45	TN	Greeneville	Greenville	91	92	80	84	96	36	13	0	7,775
46	TN	Sumner	Ellis	98	98	92	94	96	7	14	0	5,740

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
47	TN	Sumner	Hawkins	92	95	82	89	95	20	14	0	5,740
48	TN	Sumner	Hunter	91	95	75	89	95	16	15	0	5,740
49	TN	Sumner	Ortland	83	89	68	79	94	40	15	0	5,740
50	TN	Sumner	Rucker Steward	87	87	74	75	94	50	14	0	5,740
51	TN	Sumner	Shafer	83	88	79	82	94	53	12	0	5,740
52	TN	Sumner	Whitehouse	92	94	84	80	94	22	14	0	5,740
53	NV	Clark	Becker	59	71	33	45	94	20	20	1	5,774
54	NV	Clark	Brinley	36	38	36	36	91	56	20	1	5,774
55	NV	Clark	Burkholder	49	43	28	29	94	24	21	1	5,774
56	NV	Clark	Cashman	27	24	25	21	93	71	19	1	5,774
57	NV	Clark	Cram	36	42	18	27	95	32	23	1	5,774
58	NV	Clark	Fremont	22	21	16	18	93	68	20	1	5,774
59	NV	Clark	Garside	37	38	31	34	92	57	21	1	5,774
60	NV	Clark	Greenspun	61	63	49	51	95	10	21	1	5,774
61	NV	Clark	Harney	46	38	30	25	94	49	22	1	5,774
62	NV	Clark	Hyde Park	72	69	53	44	95	32	23	1	5,774
63	NV	Clark	Johnson	41	47	25	29	94	32	20	1	5,774
64	NV	Clark	Knudson Jr High	42	46	34	38	95	51	18	1	5,774
65	NV	Clark	Lawrence	57	52	48	41	95	23	21	1	5,774
66	NV	Clark	Lied	51	52	41	43	95	16	20	1	5,774
67	NV	Clark	Martin	20	19	19	17	93	84	17	1	5,774
68	NV	Clark	Miller	66	71	40	57	96	8	23	1	5,774
69	NV	Clark	Monaco	21	19	20	17	91	79	20	1	5,774

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
70	NV	Clark	Orr	27	23	26	22	93	80	18	1	5,774
71	NV	Clark	Rogich	67	66	51	51	95	11	22	1	5,774
72	NV	Clark	Sawyer	50	51	42	42	94	34	22	1	5,774
73	NV	Clark	Sedway	34	36	25	27	93	62	22	1	5,774
74	NV	Clark	Swainston	41	39	26	24	94	45	21	1	5,774
75	NV	Clark	White	65	55	53	35	94	26	22	1	5,774
76	NV	Lyon	Dayton Intermediate	48	54	23	39	95	35	16	0	7,021
77	NV	Lyon	Fernley Intermediate	62	63	56	60	94	39	18	0	7,021
78	NV	Lyon	Silver Stage	51	59	53	58	92	59	16	0	7,021
79	NV	Lyon	Smith Valley	43	73	.	.	94	30	10	0	7,021
80	NV	Lyon	Yerington Intermed	66	71	52	54	95	52	14	0	7,021
81	NV	Nye	Amargosa Valley	31	69	.	.	99	59	11	0	7,810
82	NV	Nye	Beatty	36	43	.	.	99	27	13	0	7,810
83	NV	Nye	Clarke	42	53	32	44	90	50	19	0	7,810
84	NV	Nye	Round Mountain	64	64	.	.	98	17	12	0	7,810
85	NV	Nye	Tonopah	67	73	.	.	92	36	11	0	7,810
86	NV	Washoe	Billinghurst	70	65	48	39	95	21	21	0	6,120
87	NV	Washoe	Clayton	57	58	40	40	94	39	17	0	6,120
88	NV	Washoe	Damonte Ranch	65	66	28	31	95	21	19	0	6,120
89	NV	Washoe	Dilworth	46	52	39	35	95	46	16	0	6,120
90	NV	Washoe	Incline	76	83	.	.	95	15	12	0	6,120
91	NV	Washoe	Mendive	73	77	58	54	96	12	20	0	6,120
92	NV	Washoe	Pine	66	73	28	46	95	28	20	0	6,120

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
93	NV	Washoe	Sparks	57	60	27	32	95	23	18	0	6,120
94	NV	Washoe	Swope	75	78	34	35	95	17	19	0	6,120
95	NV	Washoe	Traner	37	43	36	40	93	72	14	0	6,120
96	NV	Washoe	Vaughn	45	52	32	42	95	56	17	0	6,120
97	NC	Guilford County	Allen Jay	82	84	77	79	96	50	17	1	6,943
98	NC	Guilford County	Allen	73	85	65	81	95	66	18	1	6,943
99	NC	Guilford County	Aycock	69	82	54	69	95	64	17	1	6,943
100	NC	Guilford County	Eastern	78	83	66	75	93	57	15	1	6,943
101	NC	Guilford County	Ferndale	72	63	72	64	92	67	11	1	6,943
102	NC	Guilford County	Guilford	90	88	75	72	95	40	13	1	6,943
103	NC	Guilford County	Jackson	68	71	63	69	92	85	12	1	6,943
104	NC	Guilford County	Jamestown	87	89	68	73	95	40	20	1	6,943
105	NC	Guilford County	Kernodle	96	96	86	91	97	12	18	1	6,943
106	NC	Guilford County	Kiser	77	86	46	67	94	55	18	1	6,943
107	NC	Guilford County	Laurin Welborn	72	82	62	75	93	76	17	1	6,943
108	NC	Guilford County	Mendenhall	88	89	77	74	95	32	14	1	6,943
109	NC	Guilford County	Northeast Guilford	74	88	61	80	95	41	12	1	6,943
110	NC	Guilford County	Northwest Guilford	97	98	89	96	96	11	11	1	6,943
111	NC	Guilford County	Otis L Hairston Sr	70	78	66	74	95	81	21	1	6,943
112	NC	Guilford County	Southeast Guilford	88	93	74	83	95	24	14	1	6,943
113	NC	Guilford County	Southwest Guilford	87	92	68	76	96	20	14	1	6,943
114	NC	Guilford County	Penn Griffin	73	87	67	85	94	78	18	1	6,943
115	NC	Gaston County	Belmont	90	75	93	81	94	28	17	0	5,977

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
116	NC	Gaston County	Bessemer City	78	85	71	82	92	49	16	0	5,977
117	NC	Gaston County	Cramerton	91	95	77	87	95	11	17	0	5,977
118	NC	Gaston County	Holbrook	86	84	76	70	94	42	18	0	5,977
119	NC	Gaston County	John Chavis	88	86	76	73	93	39	16	0	5,977
120	NC	Gaston County	Mount Holly	90	88	87	85	94	29	17	0	5,977
121	NC	Gaston County	Southwest	74	80	61	66	92	49	18	0	5,977
122	NC	Gaston County	Stanley	87	90	79	77	93	28	16	0	5,977
123	NC	Gaston County	W P Grier	71	79	59	68	94	52	15	0	5,977
124	NC	Gaston County	William C Friday	77	77	67	66	93	45	17	0	5,977
125	NC	Gaston County	York Chester	67	74	65	73	90	73	13	0	5,977
126	NC	Cumberland County	Douglas	72	81	70	76	95	66	14	0	6,301
127	NC	Cumberland County	Gray's creek	81	84	70	70	94	46	15	0	6,301
128	NC	Cumberland County	Hope Mills	85	90	76	84	94	45	15	0	6,301
129	NC	Cumberland County	John Griffin	92	93	82	87	95	33	16	0	6,301
130	NC	Cumberland County	Mac Williams	87	88	79	81	94	48	15	0	6,301
131	NC	Cumberland County	R Max Abbott	87	88	80	79	94	44	15	0	6,301
132	NC	Cumberland County	South View	75	81	65	74	93	57	16	0	6,301
134	NC	Cumberland County	Spring Lake	62	76	60	75	94	73	14	0	6,301
135	NC	Cumberland County	Westover	73	82	67	78	95	57	15	0	6,301
136	NC	Rockingham County	Western Rockingham	84	79	77	67	94	45	16	0	6,336
137	NC	Rockingham County	J.E. Holmes	74	83	62	72	94	47	14	0	6,336
138	NC	Rockingham County	Reidsville	70	80	60	69	94	63	14	0	6,336
139	NC	Rockingham County	Rockingham county	87	93	74	87	95	22	15	0	6,336

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Attendance	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
140	GA	Doherty	Albany	54	70	54	70	.	91	14	1	8,056
141	GA	Doherty	Dougherty	62	81	62	81	.	87	17	1	8,056
142	GA	Doherty	Merry Acres	77	84	77	84	.	67	16	1	8,056
143	GA	Doherty	Radium Springs	74	84	74	84	.	79	15	1	8,056
144	GA	Doherty	Robert A. Cross	99	100	99	100	.	37	19	1	8,056
145	GA	Doherty	Southside	66	81	66	81	.	77	15	1	8,056
146	GA	Newton	Veterans Memorial	59	85	48	83	.	49	17	0	6,915
147	GA	Newton	Clements	61	86	60	84	.	63	17	0	6,915
148	GA	Newton	Cousins	71	85	61	80	.	54	14	0	6,915
149	GA	Newton	Indian Creek	66	88	46	75	.	42	16	0	6,915
150	GA	Rockdale	Conyers	74	86	65	82	.	55	15	0	7,251
151	GA	Rockdale	Memorial	86	96	77	92	.	36	17	0	7,251
152	GA	Rockdale	Edwards	80	89	58	76	.	36	17	0	7,251
153	GA	Bibb	Appling	49	78	45	76	.	89	19	0	7,256
154	GA	Bibb	McEvoy	65	76	65	75	.	92	18	0	7,256
155	GA	Bibb	Miller	71	84	65	75	.	70	16	0	7,256
156	GA	Bibb	Rutland	72	77	52	65	.	60	21	0	7,256
157	GA	Bibb	Weaver	73	82	87	92	.	75	17	0	7,256

[a] Average passing rates of students on the state-mandated math test. [b] Average passing rates of economically disadvantaged students on the state-mandated math test. [c] Percentage of students who receive free/reduced-priced lunches. [d] 0 = non-registered, 1 = registered. [e] Annual per-pupil expenditure of school district.

Table B3

School- and School District-level Dependent and Independent Variables for High Schools

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Graduation	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
1	PA	Allentown city	Louis E Dieruff	21.90	40.80	12.20	27.60	66.50	50.10	20.30	0.00	6941.00
2	PA	Allentown city	William Allen	22.30	38.80	13.80	27.70	56.10	45.00	23.10	0.00	6941.00
3	PA	Altoona area	Altoona Area	52.80	65.40	33.20	46.20	84.50	31.80	17.10	1.00	7682.00
4	PA	Erie city	Central	39.90	61.60	37.20	58.60	77.80	57.90	12.10	0.00	8465.00
5	PA	Erie city	East	27.40	46.00	24.30	41.60	81.00	73.70	15.90	0.00	8465.00
6	PA	Erie city	Strong Vincent	32.30	59.80	28.70	58.60	78.70	65.80	16.10	0.00	8465.00
7	PA	Lancaster	McCaskey	26.10	38.90	10.20	21.20	62.70	70.10	22.90	1.00	9079.00
8	PA	Reading	Reading	15.20	28.70	8.60	18.50	63.80	44.40	19.00	0.00	6639.00
9	PA	Scranton	Scranton	44.10	60.70	36.40	47.50	81.00	25.50	15.70	0.00	9277.00
10	PA	Scranton	West Scranton	47.10	57.60	17.10	34.30	84.60	27.00	12.20	0.00	9277.00
11	OH	Evergreen	Evergreen	89.80	98.10	83.30	94.10	95.60	15.40	19.40	0.00	7827.00
12	OH	West Liberty-Salem	West Liberty-Salem	93.80	97.50	80.00	90.00	96.90	11.40	17.20	0.00	7454.00
13	OH	Black River Local	Black River	82.20	92.40	79.20	75.00	93.90	17.90	21.20	0.00	6302.00
14	OH	Liberty Center	Liberty Center	90.40	98.60	54.50	72.70	95.90	9.60	21.50	1.00	6705.00
15	WA	Longview	Mark Morris	51.60	69.90	26.90	46.20	56.70	24.30	24.30	0.00	7627.00
16	WA	Longview	R. A. Long	36.90	58.40	21.20	38.00	45.60	38.00	23.10	0.00	7627.00
17	WA	Franklin Pierce	Franklin-Pierce	36.30	60.00	24.40	51.20	74.00	38.00	20.10	0.00	6881.00
18	WA	Franklin Pierce	Washington	24.00	47.00	17.90	34.50	78.00	39.60	19.00	0.00	6881.00
19	WA	Moses Lake	Moses Lake	41.70	60.10	30.80	49.00	68.00	35.30	23.60	0.00	6694.00
20	WA	Wenatchee	Wenatchee	44.90	64.80	20.80	41.70	80.50	29.00	22.40	1.00	6602.00
21	WA	Wenatchee	Westside	18.90	43.20	22.20	38.90	15.20	38.60	17.40	1.00	6602.00
22	TN	Clarksville-Mongomery	Clarkville	93.00	94.00	85.00	78.00	74.80	27.20	16.20	1.00	5170.00
23	TN	Clarksville-Mongomery	Kenwood	97.00	93.00	95.00	89.00	74.10	45.30	17.20	1.00	5170.00
24	TN	Clarksville-Mongomery	Montgomery Central	91.00	90.00	95.00	85.00	77.40	24.90	14.90	1.00	5170.00

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Graduation	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
25	TN	Clarksville-Mongomery	Northeast	84.00	95.00	73.00	89.00	82.30	27.70	17.00	1.00	5170.00
26	TN	Clarksville-Mongomery	Northwest	86.00	90.00	78.00	84.00	68.10	34.60	15.30	1.00	5170.00
27	TN	Clarksville-Mongomery	Rossview	90.00	91.00	78.00	76.00	79.30	20.40	15.40	1.00	5170.00
28	TN	Rutherford	Blackman	93.00	98.00	86.00	91.00	87.20	12.90	16.80	0.00	5301.00
29	TN	Rutherford	LaVergne	80.00	94.00	69.00	93.00	81.10	24.40	15.80	0.00	5301.00
30	TN	Rutherford	Oakland	85.00	95.00	87.00	90.00	83.80	31.80	14.80	0.00	5301.00
31	TN	Rutherford	Riverside	90.00	96.00	78.00	93.00	84.60	18.70	12.90	0.00	5301.00
32	TN	Rutherford	Smyrna	90.00	97.00	86.00	91.00	86.70	26.80	14.80	0.00	5301.00
33	TN	Sumner	Gallantin	81.00	91.00	78.00	80.00	77.10	31.80	13.40	0.00	5740.00
34	TN	Sumner	Handersonville	88.00	97.00	95.00	93.00	93.00	7.00	14.70	0.00	5740.00
35	TN	Sumner	Station Camp	95.00	97.00	65.00	94.00	93.30	19.80	9.10	0.00	5740.00
36	TN	Sumner	Westmoreland	89.00	92.00	75.00	92.00	88.90	25.20	12.20	0.00	5740.00
37	NV	Clark	Clark High	44.10	62.10	.	.	66.80	26.20	20.70	1.00	5774.00
38	NV	Clark	Desert Pines	26.80	53.30	23.90	50.70	62.00	38.40	20.00	1.00	5774.00
39	NV	Clark	Moapa Valley	52.40	74.40	46.20	53.80	91.70	20.90	14.80	1.00	5774.00
40	NV	Clark	Rancho	35.30	53.60	.	.	56.60	26.60	21.10	1.00	5774.00
41	NV	Clark	Valley	34.00	52.00	36.40	50.90	65.70	40.30	20.20	1.00	5774.00
42	NV	Clark	Virgin Valley	53.60	71.00	44.70	59.60	73.20	34.70	15.60	1.00	5774.00
43	NV	Clark	Western	18.30	48.60	8.20	51.00	46.40	30.90	20.70	1.00	5774.00
44	NV	Lyon	Dayton	50.00	77.70	42.50	60.00	85.40	24.00	15.70	0.00	7021.00
45	NV	Lyon	Fernley	49.70	73.60	40.00	65.00	83.10	27.40	14.20	0.00	7021.00
46	NV	Lyon	Smith Valley	69.60	95.70	.	.	90.90	18.80	10.40	0.00	7021.00
47	NV	Lyon	Yerington	57.80	86.70	.	.	78.00	34.30	15.10	0.00	7021.00
48	NV	Nye	Beatty	40.70	77.80	31.30	62.50	45.20	49.20	13.10	0.00	7810.00

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Graduation	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
49	NV	Nye	Round Mountain	65.50	86.20	.	.	83.90	18.20	11.60	0.00	7810.00
50	NV	Nye	Tonopah	61.90	73.80	.	.	83.00	28.90	10.60	0.00	7810.00
51	NV	Washoe	Galena	69.80	86.00	22.20	48.90	86.60	8.30	21.10	0.00	6120.00
52	NV	Washoe	Hug	24.30	51.50	23.20	48.40	51.70	42.80	15.30	0.00	6120.00
53	NV	Washoe	Incline	52.50	77.80	.	.	72.10	3.10	13.10	0.00	6120.00
54	NV	Washoe	Mc Queen	62.50	82.50	15.80	47.40	92.70	4.20	20.60	0.00	6120.00
55	NV	Washoe	North Valleys	51.30	74.70	34.00	54.00	84.20	15.80	20.00	0.00	6120.00
56	NV	Washoe	Reed	59.90	81.70	26.90	46.20	85.20	4.80	19.70	0.00	6120.00
57	NV	Washoe	Reno	72.30	84.70	41.30	50.00	87.20	6.00	20.70	0.00	6120.00
58	NV	Washoe	Spanish Springs	57.00	82.70	34.00	63.80	87.10	9.90	19.80	0.00	6120.00
59	NV	Washoe	Sparks	32.10	62.70	18.60	45.10	75.10	24.10	16.10	0.00	6120.00
60	NV	Washoe	Wooster	51.90	64.30	34.80	43.90	75.50	17.40	17.00	0.00	6120.00
61	NC	Guilford County	Ben L Smith	39.00	39.00	33.00	30.00	93.20	63.00	23.60	1.00	6943.00
62	NC	Guilford County	Dudley	45.00	31.00	44.00	35.00	96.70	54.00	16.90	1.00	6943.00
63	NC	Guilford County	Eastern Guilford	59.00	40.00	55.00	36.00	96.80	46.00	14.70	1.00	6943.00
64	NC	Guilford County	Grimsley	81.00	57.00	78.00	50.00	98.50	21.00	16.30	1.00	6943.00
65	NC	Guilford County	High Point Central	60.00	47.00	52.00	37.00	95.40	64.00	19.40	1.00	6943.00
66	NC	Guilford County	Lucy Ragsdale	72.00	46.00	63.00	37.00	98.70	23.00	16.70	1.00	6943.00
67	NC	Guilford County	Northeast Guilford	66.00	44.00	58.00	41.00	95.90	27.00	14.50	1.00	6943.00
68	NC	Guilford County	Northwest Guilford	88.00	60.00	86.00	38.00	99.20	5.00	16.90	1.00	6943.00
69	NC	Guilford County	Page	71.00	45.00	69.00	43.00	94.70	31.00	17.30	1.00	6943.00
70	NC	Guilford County	Southeast Guilford	72.00	67.00	67.00	57.00	98.00	13.00	14.60	1.00	6943.00
71	NC	Guilford County	Southern Guilford	62.00	53.00	63.00	49.00	97.10	36.00	13.60	1.00	6943.00
72	NC	Guilford County	Southwest Guilford	71.00	58.00	72.00	58.00	98.50	15.00	15.90	1.00	6943.00

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Graduation	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
73	NC	Guilford County	Western Guilford	82.00	64.00	77.00	48.00	97.20	20.00	21.60	1.00	6943.00
74	NC	Guilford County	T Wingate Andrews	49.00	34.00	46.00	29.00		47.00	17.30	1.00	6943.00
75	NC	Gaston County	Ashbrook	64.00	60.00	39.00	33.00		26.00	16.20	0.00	5977.00
76	NC	Gaston County	Bessemer City	58.00	56.00	46.00	29.00		26.00	14.80	0.00	5977.00
77	NC	Gaston County	Cherryville Senoir	69.00	56.00	55.00	33.00		27.00	14.20	0.00	5977.00
78	NC	Gaston County	Eastgaston	70.00	63.00	52.00	34.00		19.00	17.10	0.00	5977.00
79	NC	Gaston County	Forestview	77.00	70.00	51.00	44.00		15.00	16.60	0.00	5977.00
80	NC	Gaston County	Highland school of tech	95.00	87.00	96.00	73.00		18.00	11.90	0.00	5977.00
81	NC	Gaston County	Hunter Huss	48.00	43.00	36.00	32.00		44.00	15.20	0.00	5977.00
82	NC	Gaston County	North Gaston	59.00	53.00	36.00	30.00		28.00	16.20	0.00	5977.00
83	NC	Gaston County	South point	66.00	59.00	55.00	32.00		20.00	16.00	0.00	5977.00
84	NC	Cumberland County	Cape Fear	65.00	63.00	48.00	52.00		37.00	14.90	0.00	6301.00
85	NC	Cumberland County	Douglas Byrd	56.00	57.00	56.00	54.00		48.00	13.40	0.00	6301.00
86	NC	Cumberland County	EE Smith	42.00	44.00	37.00	40.00		48.00	15.80	0.00	6301.00
87	NC	Cumberland County	Jack Briit	72.00	71.00	56.00	50.00		26.00	14.90	0.00	6301.00
88	NC	Cumberland County	Massey Hill Classical	87.00	87.00	95.00	89.00		16.00	11.60	0.00	6301.00
89	NC	Cumberland County	Pine Forest	50.00	53.00	42.00	51.00		37.00	14.50	0.00	6301.00
90	NC	Cumberland County	Reid Ross Classical	72.00	83.00	82.00	82.00		37.00	17.20	0.00	6301.00
91	NC	Cumberland County	Seventy-First	54.00	61.00	44.00	52.00		35.00	16.30	0.00	6301.00
92	NC	Cumberland County	South View	59.00	59.00	46.00	47.00		38.00	15.70	0.00	6301.00
93	NC	Cumberland County	Terry Sanford	74.00	69.00	43.00	36.00		28.00	15.10	0.00	6301.00
94	NC	Cumberland County	Westover	60.00	54.00	53.00	48.00		45.00	14.30	0.00	6301.00
95	NC	Rockingham County	Rockingham county	72.00	70.00	53.00	36.00	94.20	21.00	16.00	0.00	6336.00
96	NC	Rockingham County	John Motley Morehead	66.00	61.00	59.00	49.00	94.60	29.00	16.40	0.00	6336.00

ID	State	District	School	Math[a]	Reading	Math_Dis.[b]	Reading_Dis.	Graduation	% FreeLunch[c]	Class Size	ISO 9000[d]	PPE[e]
97	NC	Rockingham County	D.L. McMichael	71.00	67.00	63.00	53.00	95.60	24.00	15.30	0.00	6336.00
98	NC	Rockingham County	Reidsville	44.00	46.00	20.00	32.00	96.10	47.00	14.90	0.00	6336.00
99	GA	Doherty	Albany	58.00	79.00	58.00	79.00	53.80	52.00	14.20	1.00	8056.00
100	GA	Doherty	Dougherty	63.00	86.00	63.00	86.00	44.80	67.30	18.30	1.00	8056.00
101	GA	Doherty	Monroe	61.00	82.00	61.00	82.00	62.10	68.40	15.90	1.00	8056.00
102	GA	Doherty	westover	75.00	88.00	75.00	88.00	71.30	44.10	19.40	1.00	8056.00
103	GA	Newton	Newton	77.00	90.00	61.00	83.00	57.00	39.70	19.00	0.00	6915.00
104	GA	Newton	Eastside	67.00	85.00	50.00	76.00	61.20	36.20	16.60	0.00	6915.00
105	GA	Rockdale	Heritage	89.00	96.00	67.00	81.00	88.10	22.80	16.60	0.00	7251.00
106	GA	Rockdale	Salem	80.00	92.00	59.00	90.00	76.10	24.70	17.00	0.00	7251.00
107	GA	Rockdale	Rockdale county	82.00	90.00	78.00	81.00	69.40	38.30	15.50	0.00	7251.00
108	GA	Bibb	Central	75.00	93.00	62.00	84.00	67.30	45.90	17.60	0.00	7256.00
109	GA	Bibb	Northeast	46.00	86.00	40.00	82.00	49.40	76.00	19.00	0.00	7256.00
110	GA	Bibb	Rutland	52.00	80.00	26.00	60.00	71.10	43.70	16.30	0.00	7256.00
111	GA	Bibb	Southwest	41.00	80.00	41.00	76.00	51.60	75.50	19.60	0.00	7256.00
112	GA	Bibb	Westside	80.00	94.00	71.00	89.00	68.10	40.50	17.70	0.00	7256.00

[a] Average passing rates of students on the state-mandated math test. [b] Average passing rates of economically disadvantaged students on the state-mandated math test. [c] Percentage of students who receive free/reduced-priced lunches. [d] 0 = non-registered, 1 = registered. [e] Annual per-pupil expenditure of school district.

Appendix C

Complete Output of HLM Analysis

Elementary_Math_Null Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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-------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        17 October 2005, Monday
 Time:        22:59:26
-------------------------------------------------------------------------------

 SPECIFICATIONS FOR THIS HLM2 RUN

  Problem Title: no title

  The data source for this run  = el_math_reading_1018
  The command file for this run = I:\Final data
set\Elementary\el_math_reading_model 1.hlm
  Output file name              = I:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 330
  The maximum number of level-2 units = 29
  The maximum number of iterations = 10000
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                         Weight
                         Variable
            Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     MATH

  The model specified for the fixed effects was:
 ---------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00


 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
              INTRCPT1

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + R
Level-2 Model
          B0 = G00 + U0
```

```
Iterations stopped due to small change in likelihood function
******* ITERATION 4 *******

 Sigma_squared =    137.26894

 Tau
 INTRCPT1,B0    276.90053


Tau (as correlations)
 INTRCPT1,B0  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.927
 ----------------------------------------------------

The value of the likelihood function at iteration 4 = -1.320027E+003
 The outcome variable is     MATH

 Final estimation of fixed effects:
 ----------------------------------------------------------------------------
                                      Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          69.002689   3.208452    21.507        28    0.000
 ----------------------------------------------------------------------------

 The outcome variable is     MATH

 Final estimation of fixed effects
 (with robust standard errors)
 ----------------------------------------------------------------------------
                                      Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          69.002689   3.152413    21.889        28    0.000
 ----------------------------------------------------------------------------



 Final estimation of variance components:
 -----------------------------------------------------------------------------
 Random Effect           Standard      Variance     df    Chi-square  P-value
                         Deviation     Component
 -----------------------------------------------------------------------------
 INTRCPT1,       U0       16.64033     276.90053    28     724.91279    0.000
  level-1,       R        11.71618     137.26894
 -----------------------------------------------------------------------------

 Statistics for current covariance components model
 --------------------------------------------------
 Deviance                       = 2640.053442
 Number of estimated parameters = 2
```

Elementary_Math_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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 -----------------------------------------------------------------------------
-
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        16 November 2005, Wednesday
 Time:        22:58:45
 -----------------------------------------------------------------------------
-


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = el_mathreading_1116
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 330
  The maximum number of level-2 units = 29
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                         Weight
                         Variable
           Weighting?    Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     MATH

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00
$                              EXP, G01
                           ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                              EXP, G11
                           ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                              EXP, G21
                           ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)
```

```
         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 817 *******

 Sigma_squared =     79.60869

 Tau
 INTRCPT1,B0    268.27984       1.66430       9.59398
      SES,B1      1.66430       0.05541       0.08547
     SIZE,B2      9.59398       0.08547       0.36913


Tau (as correlations)
 INTRCPT1,B0  1.000  0.432  0.964
      SES,B1  0.432  1.000  0.598
     SIZE,B2  0.964  0.598  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.917
       SES, B1                        0.634
      SIZE, B2                        0.134
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 25 of 29
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 817 = -1.269253E+003
```

The outcome variable is MATH

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	68.738369	3.756222	18.300	26	0.000
EXP, G01	-0.004129	0.003176	-1.300	26	0.205
ISO9000, G02	1.081290	7.302712	0.148	26	0.884
For SES slope, B1					
INTRCPT2, G10	-0.290639	0.067657	-4.296	26	0.000
EXP, G11	0.000016	0.000055	0.295	26	0.770
ISO9000, G12	-0.081164	0.127531	-0.636	26	0.530
For SIZE slope, B2					
INTRCPT2, G20	0.039109	0.399676	0.098	26	0.923
EXP, G21	0.000539	0.000291	1.854	26	0.075
ISO9000, G22	-0.417762	0.644670	-0.648	26	0.522

The outcome variable is MATH

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	68.738369	3.556900	19.325	26	0.000
EXP, G01	-0.004129	0.002475	-1.668	26	0.107
ISO9000, G02	1.081290	6.934763	0.156	26	0.878
For SES slope, B1					
INTRCPT2, G10	-0.290639	0.070507	-4.122	26	0.000
EXP, G11	0.000016	0.000034	0.467	26	0.644
ISO9000, G12	-0.081164	0.099353	-0.817	26	0.422
For SIZE slope, B2					
INTRCPT2, G20	0.039109	0.352653	0.111	26	0.913
EXP, G21	0.000539	0.000208	2.588	26	0.016
ISO9000, G22	-0.417762	0.537638	-0.777	26	0.444

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	16.37925	268.27984	22	582.61933	0.000
SES slope,	U1	0.23538	0.05541	22	88.82598	0.000
SIZE slope,	U2	0.60756	0.36913	22	27.29486	0.200
level-1,	R	8.92237	79.60869			

Note: The chi-square statistics reported above are based on only 25 of 29 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 2538.505271
Number of estimated parameters = 7

Elementary_Reading_Null Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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 -----------------------------------------------------------------------------
-
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        17 October 2005, Monday
 Time:        23: 2: 1
 -----------------------------------------------------------------------------
-

 SPECIFICATIONS FOR THIS HLM2 RUN

  Problem Title: no title
  The data source for this run  = el_math_reading_1018
  The command file for this run = I:\Final data set\Elementary\el_reading_model
1.hlm
  Output file name              = I:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 330
  The maximum number of level-2 units = 29
  The maximum number of iterations = 10000
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     READ

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
              INTRCPT1

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + R

Level-2 Model
          B0 = G00 + U0
```

```
Iterations stopped due to small change in likelihood function
******* ITERATION 4 *******

 Sigma_squared =    148.68670

 Tau
 INTRCPT1,B0    268.64385


Tau (as correlations)
 INTRCPT1,B0  1.000
```

Random level-1 coefficient	Reliability estimate
INTRCPT1, B0	0.920

The value of the likelihood function at iteration 4 = -1.331745E+003

The outcome variable is   READ

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	67.981526	3.172151	21.431	28	0.000

The outcome variable is   READ

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	67.981526	3.116725	21.812	28	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	16.39036	268.64385	28	607.08108	0.000
level-1,	R	12.19372	148.68670			

Statistics for current covariance components model

```
Deviance                       = 2663.490836
Number of estimated parameters = 2
```

Elementary_Reading_Conditional Model

```
Program:                      HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                      Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                    Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

www.ssicentral.com
 ------------------------------------------------------------------------------
-
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        16 November 2005, Wednesday
 Time:        22:56: 6
 ------------------------------------------------------------------------------
-


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = el_mathreading_1116
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 330
  The maximum number of level-2 units = 29
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 ----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     READ

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
         INTRCPT1, B0      INTRCPT2, G00
$                               EXP, G01
                            ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                               EXP, G11
                            ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                               EXP, G21
                            ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 21 *******

 Sigma_squared =     69.97631

 Tau
 INTRCPT1,B0    263.65454       1.84681       7.27294
      SES,B1      1.84681       0.04079       0.15906
     SIZE,B2      7.27294       0.15906       1.60916


Tau (as correlations)
 INTRCPT1,B0  1.000  0.563  0.353
      SES,B1  0.563  1.000  0.621
     SIZE,B2  0.353  0.621  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.924
       SES, B1                        0.597
      SIZE, B2                        0.397
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 25 of 29
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 21 = -1.251521E+003
```

The outcome variable is READ

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	66.737688	3.727815	17.903	26	0.000
EXP, G01	-0.004144	0.003148	-1.316	26	0.200
ISO9000, G02	2.586694	7.279478	0.355	26	0.725
For SES slope, B1					
INTRCPT2, G10	-0.398163	0.060527	-6.578	26	0.000
EXP, G11	-0.000021	0.000049	-0.436	26	0.666
ISO9000, G12	0.002822	0.112183	0.025	26	0.980
For SIZE slope, B2					
INTRCPT2, G20	-0.087234	0.469146	-0.186	26	0.854
EXP, G21	0.000177	0.000352	0.503	26	0.619
ISO9000, G22	-0.452664	0.840242	-0.539	26	0.594

The outcome variable is READ

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	66.737688	3.472107	19.221	26	0.000
EXP, G01	-0.004144	0.002614	-1.585	26	0.125
ISO9000, G02	2.586694	7.008826	0.369	26	0.715
For SES slope, B1					
INTRCPT2, G10	-0.398163	0.064628	-6.161	26	0.000
EXP, G11	-0.000021	0.000033	-0.641	26	0.527
ISO9000, G12	0.002822	0.084616	0.033	26	0.974
For SIZE slope, B2					
INTRCPT2, G20	-0.087234	0.473445	-0.184	26	0.856
EXP, G21	0.000177	0.000256	0.691	26	0.495
ISO9000, G22	-0.452664	0.712065	-0.636	26	0.530

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	16.23744	263.65454	22	738.03263	0.000
SES slope,	U1	0.20197	0.04079	22	74.32107	0.000
SIZE slope,	U2	1.26853	1.60916	22	47.41044	0.002
level-1,	R	8.36518	69.97631			

Note: The chi-square statistics reported above are based on only 25 of 29 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 2503.042023
Number of estimated parameters = 7

Elementary_Math_Dis_Null Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

www.ssicentral.com
 ------------------------------------------------------------------------------
-
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        17 October 2005, Monday
 Time:        23:24:18
 ------------------------------------------------------------------------------
-

 SPECIFICATIONS FOR THIS HLM2 RUN

  Problem Title: no title
  The data source for this run  = el_math_reading_Dis_1018.mdm
  The command file for this run = I:\Final data
set\Elementary\el_math_dis_model 1.hlm
  Output file name              = I:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 324
  The maximum number of level-2 units = 29
  The maximum number of iterations = 10000
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                         Weight
                         Variable
           Weighting?    Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is MATH_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
              INTRCPT1

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + R

Level-2 Model
          B0 = G00 + U0
```

```
Iterations stopped due to small change in likelihood function
******* ITERATION 3 *******

 Sigma_squared =    156.35176

 Tau
 INTRCPT1,B0    310.45706


Tau (as correlations)
 INTRCPT1,B0  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.920
 ----------------------------------------------------

The value of the likelihood function at iteration 3 = -1.316987E+003

 The outcome variable is MATH_DIS

 Final estimation of fixed effects:
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          62.262779   3.410823    18.254        28    0.000
 ----------------------------------------------------------------------------

 The outcome variable is MATH_DIS

 Final estimation of fixed effects
 (with robust standard errors)
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          62.262779   3.351215    18.579        28    0.000
 ----------------------------------------------------------------------------


 Final estimation of variance components:
 -----------------------------------------------------------------------------
 Random Effect           Standard      Variance     df    Chi-square  P-value
                         Deviation     Component
 -----------------------------------------------------------------------------
 INTRCPT1,       U0       17.61979     310.45706    28     663.39015    0.000
  level-1,       R        12.50407     156.35176
 -----------------------------------------------------------------------------

 Statistics for current covariance components model
 --------------------------------------------------
 Deviance                       = 2633.974158
 Number of estimated parameters = 2
```

Elementary_Math_Dis_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

www.ssicentral.com
 ------------------------------------------------------------------------------
-
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        16 November 2005, Wednesday
 Time:        22:58:45
 ------------------------------------------------------------------------------
-


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = el_mathreading_1116
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 330
  The maximum number of level-2 units = 29
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                         Weight
                         Variable
           Weighting?    Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     MATH

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00
$                              EXP, G01
                          ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                              EXP, G11
                          ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                              EXP, G21
                          ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 817 *******

 Sigma_squared =     79.60869

 Tau
 INTRCPT1,B0    268.27984       1.66430       9.59398
      SES,B1      1.66430       0.05541       0.08547
     SIZE,B2      9.59398       0.08547       0.36913


Tau (as correlations)
 INTRCPT1,B0  1.000  0.432  0.964
      SES,B1  0.432  1.000  0.598
     SIZE,B2  0.964  0.598  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.917
       SES, B1                        0.634
      SIZE, B2                        0.134
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 25 of 29
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 817 = -1.269253E+003
```

The outcome variable is MATH

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	68.738369	3.756222	18.300	26	0.000
EXP, G01	-0.004129	0.003176	-1.300	26	0.205
ISO9000, G02	1.081290	7.302712	0.148	26	0.884
For SES slope, B1					
INTRCPT2, G10	-0.290639	0.067657	-4.296	26	0.000
EXP, G11	0.000016	0.000055	0.295	26	0.770
ISO9000, G12	-0.081164	0.127531	-0.636	26	0.530
For SIZE slope, B2					
INTRCPT2, G20	0.039109	0.399676	0.098	26	0.923
EXP, G21	0.000539	0.000291	1.854	26	0.075
ISO9000, G22	-0.417762	0.644670	-0.648	26	0.522

The outcome variable is MATH

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	68.738369	3.556900	19.325	26	0.000
EXP, G01	-0.004129	0.002475	-1.668	26	0.107
ISO9000, G02	1.081290	6.934763	0.156	26	0.878
For SES slope, B1					
INTRCPT2, G10	-0.290639	0.070507	-4.122	26	0.000
EXP, G11	0.000016	0.000034	0.467	26	0.644
ISO9000, G12	-0.081164	0.099353	-0.817	26	0.422
For SIZE slope, B2					
INTRCPT2, G20	0.039109	0.352653	0.111	26	0.913
EXP, G21	0.000539	0.000208	2.588	26	0.016
ISO9000, G22	-0.417762	0.537638	-0.777	26	0.444

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	16.37925	268.27984	22	582.61933	0.000
SES slope,	U1	0.23538	0.05541	22	88.82598	0.000
SIZE slope,	U2	0.60756	0.36913	22	27.29486	0.200
level-1,	R	8.92237	79.60869			

Note: The chi-square statistics reported above are based on only 25 of 29 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 2538.505271
Number of estimated parameters = 7

Elementary_Reading_Dis_Null Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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 ------------------------------------------------------------------------------
-
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        17 October 2005, Monday
 Time:        23:25:27
 ------------------------------------------------------------------------------
-

 SPECIFICATIONS FOR THIS HLM2 RUN

  Problem Title: no title
  The data source for this run  = el_math_reading_Dis_1018.mdm
  The command file for this run = I:\Final data
set\Elementary\el_reading_dis_model 1.hlm
  Output file name              = I:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 324
  The maximum number of level-2 units = 29
  The maximum number of iterations = 10000
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                         Weight
                         Variable
           Weighting?    Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is READ_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                     Level-2
   Coefficients                Predictors
 ----------------------      ---------------
         INTRCPT1, B0      INTRCPT2, G00


 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1

 Summary of the model specified (in equation format)
 ---------------------------------------------------
Level-1 Model

          Y = B0 + R

Level-2 Model
          B0 = G00 + U0
```

```
Iterations stopped due to small change in likelihood function
******* ITERATION 4 *******

 Sigma_squared =    142.63907

 Tau
 INTRCPT1,B0    277.49814


Tau (as correlations)
 INTRCPT1,B0  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.919
 ----------------------------------------------------

The value of the likelihood function at iteration 4 = -1.301900E+003

 The outcome variable is READ_DIS

 Final estimation of fixed effects:
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          60.411625   3.227002    18.721        28    0.000
 ----------------------------------------------------------------------------

 The outcome variable is READ_DIS

 Final estimation of fixed effects
 (with robust standard errors)
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          60.411625   3.170641    19.053        28    0.000
 ----------------------------------------------------------------------------



 Final estimation of variance components:
 -----------------------------------------------------------------------------
 Random Effect           Standard      Variance     df    Chi-square  P-value
                         Deviation     Component
 -----------------------------------------------------------------------------
 INTRCPT1,       U0       16.65828     277.49814    28     638.57365    0.000
  level-1,       R        11.94316     142.63907
 -----------------------------------------------------------------------------


 Statistics for current covariance components model
 --------------------------------------------------
 Deviance                       = 2603.799932
 Number of estimated parameters = 2
```

Elementary_Reading_Dis_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         16 November 2005, Wednesday
 Time:         23: 7: 7
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116.mdm
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 324
  The maximum number of level-2 units = 29
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is READ_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
         INTRCPT1, B0      INTRCPT2, G00
$                               EXP, G01
                            ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                               EXP, G11
                            ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                               EXP, G21
                            ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)
```

```
         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 489 *******

 Sigma_squared =    102.53072

 Tau
 INTRCPT1,B0    288.01263       2.26689       9.40969
      SES,B1      2.26689       0.04665      -0.02994
     SIZE,B2      9.40969      -0.02994       0.83010


Tau (as correlations)
 INTRCPT1,B0  1.000  0.618  0.609
      SES,B1  0.618  1.000 -0.152
     SIZE,B2  0.609 -0.152  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.888
       SES, B1                        0.509
      SIZE, B2                        0.195
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 25 of 29
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 489 = -1.282278E+003
```

The outcome variable is READ_DIS

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	60.579871	3.907266	15.504	26	0.000
EXP, G01	-0.004012	0.003302	-1.215	26	0.236
ISO9000, G02	-1.365703	7.611909	-0.179	26	0.859
For SES slope, B1					
INTRCPT2, G10	-0.285733	0.068074	-4.197	26	0.000
EXP, G11	-0.000022	0.000055	-0.398	26	0.694
ISO9000, G12	0.049533	0.125928	0.393	26	0.697
For SIZE slope, B2					
INTRCPT2, G20	-0.778521	0.482170	-1.615	26	0.118
EXP, G21	-0.000075	0.000351	-0.214	26	0.833
ISO9000, G22	0.318889	0.793670	0.402	26	0.691

The outcome variable is READ_DIS

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	60.579871	3.655169	16.574	26	0.000
EXP, G01	-0.004012	0.002712	-1.479	26	0.151
ISO9000, G02	-1.365703	7.662575	-0.178	26	0.860
For SES slope, B1					
INTRCPT2, G10	-0.285733	0.070453	-4.056	26	0.001
EXP, G11	-0.000022	0.000034	-0.630	26	0.534
ISO9000, G12	0.049533	0.102909	0.481	26	0.634
For SIZE slope, B2					
INTRCPT2, G20	-0.778521	0.445577	-1.747	26	0.092
EXP, G21	-0.000075	0.000170	-0.441	26	0.662
ISO9000, G22	0.318889	0.731306	0.436	26	0.666

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	16.97093	288.01263	22	500.57583	0.000
SES slope,	U1	0.21598	0.04665	22	56.35197	0.000
SIZE slope,	U2	0.91110	0.83010	22	32.36330	0.071
level-1,	R	10.12575	102.53072			

Note: The chi-square statistics reported above are based on only 25 of 29 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 2564.556009
Number of estimated parameters = 7

Elementary_Attendance_Null Model

```
Program:                      HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                      Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                    Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         18 October 2005, Tuesday
 Time:          0: 6:31
-------------------------------------------------------------------------------

 SPECIFICATIONS FOR THIS HLM2 RUN

  Problem Title: no title
  The data source for this run  = el_attend_1018
  The command file for this run = I:\Final data set\Elementary\el_attend_model
1.hlm
  Output file name              = I:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 236
  The maximum number of level-2 units = 21
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is   ATTEND

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00


 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
              INTRCPT1

 Summary of the model specified (in equation format)
 ---------------------------------------------------
Level-1 Model

          Y = B0 + R

Level-2 Model
          B0 = G00 + U0

Iterations stopped due to small change in likelihood function

******* ITERATION 6 *******

 Sigma_squared =      0.58982

 Tau
 INTRCPT1,B0      0.53915


Tau (as correlations)
 INTRCPT1,B0  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.849
 ----------------------------------------------------

The value of the likelihood function at iteration 6 = -2.952236E+002

 The outcome variable is   ATTEND

 Final estimation of fixed effects:
 ----------------------------------------------------------------------------
                                      Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          95.102651   0.173933   546.776        20    0.000
 ----------------------------------------------------------------------------

 The outcome variable is   ATTEND

 Final estimation of fixed effects
 (with robust standard errors)
 ----------------------------------------------------------------------------
                                      Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          95.102651   0.169620   560.680        20    0.000
 ----------------------------------------------------------------------------



 Final estimation of variance components:
 -----------------------------------------------------------------------------
 Random Effect           Standard      Variance     df    Chi-square  P-value
                         Deviation     Component
 -----------------------------------------------------------------------------
 INTRCPT1,       U0        0.73427       0.53915    20     181.91097    0.000
  level-1,       R         0.76800       0.58982
 -----------------------------------------------------------------------------


 Statistics for current covariance components model
 --------------------------------------------------
 Deviance                       = 590.447191
 Number of estimated parameters = 2
```

Elementary_Attendance_Conditional Model

```
Program:                      HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                      Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                    Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         16 November 2005, Wednesday
 Time:         23:12:26
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Elementary\hlm2.txt
  The maximum number of level-1 units = 236
  The maximum number of level-2 units = 21
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 ----------------------
                        Weight
                        Variable
            Weighting?  Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is   ATTEND

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                     Level-2
   Coefficients                Predictors
 ----------------------   ---------------
         INTRCPT1, B0      INTRCPT2, G00
$                               EXP, G01
                           ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                               EXP, G11
                           ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                               EXP, G21
                           ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function

******* ITERATION 1534 *******

 Sigma_squared =      0.41587

 Tau
 INTRCPT1,B0      0.32891       0.00109       0.05434
      SES,B1      0.00109       0.00006      -0.00013
     SIZE,B2      0.05434      -0.00013       0.01068


Tau (as correlations)
 INTRCPT1,B0  1.000  0.245  0.917
      SES,B1  0.245  1.000 -0.161
     SIZE,B2  0.917 -0.161  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.779
       SES, B1                        0.302
      SIZE, B2                        0.445
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 17 of 21
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1534 = -2.998192E+002
```

The outcome variable is ATTEND

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	94.928817	0.168306	564.024	18	0.000
EXP, G01	-0.000062	0.000121	-0.509	18	0.617
ISO9000, G02	0.557185	0.320384	1.739	18	0.099
For SES slope, B1					
INTRCPT2, G10	-0.021743	0.003750	-5.798	18	0.000
EXP, G11	-0.000002	0.000003	-0.882	18	0.390
ISO9000, G12	0.000535	0.006888	0.078	18	0.939
For SIZE slope, B2					
INTRCPT2, G20	-0.017005	0.040618	-0.419	18	0.680
EXP, G21	0.000006	0.000029	0.195	18	0.848
ISO9000, G22	0.033665	0.070512	0.477	18	0.638

The outcome variable is ATTEND

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	94.928817	0.170838	555.666	18	0.000
EXP, G01	-0.000062	0.000083	-0.743	18	0.467
ISO9000, G02	0.557185	0.249301	2.235	18	0.038
For SES slope, B1					
INTRCPT2, G10	-0.021743	0.003396	-6.403	18	0.000
EXP, G11	-0.000002	0.000002	-1.319	18	0.204
ISO9000, G12	0.000535	0.004965	0.108	18	0.916
For SIZE slope, B2					
INTRCPT2, G20	-0.017005	0.034922	-0.487	18	0.632
EXP, G21	0.000006	0.000018	0.309	18	0.761
ISO9000, G22	0.033665	0.044547	0.756	18	0.460

The robust standard errors are appropriate for datasets having a moderate to large number of level 2 units. These data do not meet this criterion.

Final estimation of variance components:

Random Effect	Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1, U0	0.57350	0.32891	14	101.99470	0.000
SES slope, U1	0.00776	0.00006	14	21.97379	0.079
SIZE slope, U2	0.10335	0.01068	14	20.96685	0.102
level-1, R	0.64488	0.41587			

Note: The chi-square statistics reported above are based on only 17 of 21 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 599.638396
Number of estimated parameters = 7

Middle_Math_Null Model

Program: HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

www.ssicentral.com

Module: HLM2.EXE (6.02.25138.2)
Date: 18 October 2005, Tuesday
Time: 0:18:37

SPECIFICATIONS FOR THIS HLM2 RUN
Problem Title: no title
The data source for this run = middle_math_reading_1018.mdm
The command file for this run = I:\Final data set\Middle\middle_math_model
1.hlm
Output file name = I:\Final data set\Middle\hlm2.txt
The maximum number of level-1 units = 157
The maximum number of level-2 units = 30
The maximum number of iterations = 100
Method of estimation: restricted maximum likelihood

Weighting Specification

	Weighting?	Weight Variable Name	Normalized?
Level 1	no		
Level 2	no		
Precision	no		

The outcome variable is MATH

The model specified for the fixed effects was:

Level-1 Coefficients	Level-2 Predictors
INTRCPT1, B0	INTRCPT2, G00

The model specified for the covariance components was:

Sigma squared (constant across level-2 units)

Tau dimensions
INTRCPT1

Summary of the model specified (in equation format)

Level-1 Model

Y = B0 + R

Level-2 Model
B0 = G00 + U0

Iterations stopped due to small change in likelihood function

******* ITERATION 5 *******

Sigma_squared = 135.54839

Tau
INTRCPT1,B0 322.75808

Tau (as correlations)
INTRCPT1,B0 1.000

Random level-1 coefficient	Reliability estimate
INTRCPT1, B0	0.874

The value of the likelihood function at iteration 5 = -6.402314E+002

The outcome variable is MATH

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	62.819785	3.508301	17.906	29	0.000

The outcome variable is MATH

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	62.819785	3.448740	18.215	29	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	17.96547	322.75808	29	379.40759	0.000
level-1,	R	11.64253	135.54839			

Statistics for current covariance components model

Deviance = 1280.462818
Number of estimated parameters = 2

Middle_Math_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         16 November 2005, Wednesday
 Time:         23:16:34
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Middle\hlm2.txt
  The maximum number of level-1 units = 157
  The maximum number of level-2 units = 30
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     MATH

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
         INTRCPT1, B0      INTRCPT2, G00
$                               EXP, G01
                            ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                               EXP, G11
                            ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                               EXP, G21
                            ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
```

```
               INTRCPT1
                    SES slope
                   SIZE slope

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1377 *******

 Sigma_squared =     50.67500

 Tau
 INTRCPT1,B0    302.70577      -0.26226      -8.14456
      SES,B1     -0.26226       0.03285       0.12557
     SIZE,B2     -8.14456       0.12557       0.65837


Tau (as correlations)
 INTRCPT1,B0  1.000 -0.083 -0.577
      SES,B1 -0.083  1.000  0.854
     SIZE,B2 -0.577  0.854  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.685
       SES, B1                        0.288
      SIZE, B2                        0.137
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 21 of 30
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1377 = -5.989184E+002
```

The outcome variable is MATH

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	61.928882	3.894438	15.902	27	0.000
EXP, G01	-0.004087	0.003402	-1.201	27	0.240
ISO9000, G02	0.134498	7.780270	0.017	27	0.986
For SES slope, B1					
INTRCPT2, G10	-0.472386	0.082029	-5.759	27	0.000
EXP, G11	0.000003	0.000063	0.055	27	0.957
ISO9000, G12	-0.029897	0.133661	-0.224	27	0.825
For SIZE slope, B2					
INTRCPT2, G20	-0.390503	0.510344	-0.765	27	0.451
EXP, G21	-0.000214	0.000368	-0.581	27	0.565
ISO9000, G22	0.852746	0.846167	1.008	27	0.323

The outcome variable is MATH

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	61.928882	3.268594	18.947	27	0.000
EXP, G01	-0.004087	0.003049	-1.341	27	0.191
ISO9000, G02	0.134498	8.845740	0.015	27	0.988
For SES slope, B1					
INTRCPT2, G10	-0.472386	0.091120	-5.184	27	0.000
EXP, G11	0.000003	0.000057	0.060	27	0.953
ISO9000, G12	-0.029897	0.104609	-0.286	27	0.777
For SIZE slope, B2					
INTRCPT2, G20	-0.390503	0.472372	-0.827	27	0.416
EXP, G21	-0.000214	0.000329	-0.652	27	0.520
ISO9000, G22	0.852746	0.513575	1.660	27	0.108

Final estimation of variance components:

Random Effect	Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1, U0	17.39844	302.70577	18	313.42351	0.000
SES slope, U1	0.18124	0.03285	18	30.63370	0.031
SIZE slope, U2	0.81140	0.65837	18	13.50615	>.500
level-1, R	7.11864	50.67500			

Note: The chi-square statistics reported above are based on only 21 of 30 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 1197.836867
Number of estimated parameters = 7

Middle_Reading_Null Model

```
Program:                      HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                      Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                    Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        18 October 2005, Tuesday
 Time:         0:28:14
-------------------------------------------------------------------------------

 SPECIFICATIONS FOR THIS HLM2 RUN
  Problem Title: no title
  The data source for this run  = middle_math_reading_1018.mdm
  The command file for this run = I:\Final data set\Middle\middle_reading_model
1.hlm
  Output file name              = I:\Final data set\Middle\hlm2.txt
  The maximum number of level-1 units = 157
  The maximum number of level-2 units = 30
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 ----------------------
                         Weight
                         Variable
            Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     READ

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ---------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00


 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
              INTRCPT1

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + R

Level-2 Model
          B0 = G00 + U0

Iterations stopped due to small change in likelihood function
```

```
******* ITERATION 6 *******

 Sigma_squared =    103.98849

 Tau
 INTRCPT1,B0    235.51184


Tau (as correlations)
 INTRCPT1,B0  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.869
 ----------------------------------------------------

The value of the likelihood function at iteration 6 = -6.189248E+002

 The outcome variable is     READ

 Final estimation of fixed effects:
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          70.306902   3.005836    23.390        29    0.000
 ----------------------------------------------------------------------------

 The outcome variable is     READ

 Final estimation of fixed effects
 (with robust standard errors)
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          70.306902   2.954769    23.794        29    0.000
 ----------------------------------------------------------------------------



 Final estimation of variance components:
 -----------------------------------------------------------------------------
 Random Effect           Standard      Variance     df    Chi-square  P-value
                         Deviation     Component
 -----------------------------------------------------------------------------
 INTRCPT1,       U0       15.34639     235.51184    29     449.82338    0.000
  level-1,       R        10.19747     103.98849
 -----------------------------------------------------------------------------


 Statistics for current covariance components model
 --------------------------------------------------
 Deviance                       = 1237.849670
 Number of estimated parameters = 2
```

Middle_Reading_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         16 November 2005, Wednesday
 Time:         23:19:14
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Middle\hlm2.txt
  The maximum number of level-1 units = 157
  The maximum number of level-2 units = 30
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     READ

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00
$                              EXP, G01
                           ISO9000, G02
 %      SES slope, B1     INTRCPT2, G10
$                              EXP, G11
                           ISO9000, G12
 %     SIZE slope, B2     INTRCPT2, G20
$                              EXP, G21
                           ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1463 *******

 Sigma_squared =     34.36542

 Tau
 INTRCPT1,B0    237.41041       0.94471       3.41579
      SES,B1      0.94471       0.04617      -0.08040
     SIZE,B2      3.41579      -0.08040       0.26035


Tau (as correlations)
 INTRCPT1,B0  1.000  0.285  0.434
      SES,B1  0.285  1.000 -0.733
     SIZE,B2  0.434 -0.733  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.702
       SES, B1                        0.395
      SIZE, B2                        0.094
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 21 of 30
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1463 = -5.749345E+002
```

The outcome variable is READ

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	70.151771	3.442556	20.378	27	0.000
EXP, G01	-0.001842	0.003016	-0.611	27	0.546
ISO9000, G02	-0.844762	6.915122	-0.122	27	0.904
For SES slope, B1					
INTRCPT2, G10	-0.349979	0.078979	-4.431	27	0.000
EXP, G11	0.000022	0.000063	0.351	27	0.728
ISO9000, G12	-0.055725	0.136937	-0.407	27	0.687
For SIZE slope, B2					
INTRCPT2, G20	-0.630764	0.390691	-1.614	27	0.118
EXP, G21	0.000198	0.000254	0.780	27	0.442
ISO9000, G22	1.334729	0.591384	2.257	27	0.032

The outcome variable is READ

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	70.151771	2.849522	24.619	27	0.000
EXP, G01	-0.001842	0.002792	-0.660	27	0.515
ISO9000, G02	-0.844762	7.768235	-0.109	27	0.915
For SES slope, B1					
INTRCPT2, G10	-0.349979	0.092935	-3.766	27	0.001
EXP, G11	0.000022	0.000065	0.343	27	0.734
ISO9000, G12	-0.055725	0.102021	-0.546	27	0.589
For SIZE slope, B2					
INTRCPT2, G20	-0.630764	0.258937	-2.436	27	0.022
EXP, G21	0.000198	0.000153	1.291	27	0.208
ISO9000, G22	1.334729	0.270712	4.930	27	0.000

Final estimation of variance components:

Random Effect	Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1, U0	15.40813	237.41041	18	392.50276	0.000
SES slope, U1	0.21487	0.04617	18	49.52454	0.000
SIZE slope, U2	0.51025	0.26035	18	13.19078	>.500
level-1, R	5.86220	34.36542			

Note: The chi-square statistics reported above are based on only 21 of 30 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 1149.868910
Number of estimated parameters = 7

Middle_Math_Dis_Null Model

Program: HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

www.ssicentral.com

Module: HLM2.EXE (6.02.25138.2)
Date: 18 October 2005, Tuesday
Time: 0:32:44

SPECIFICATIONS FOR THIS HLM2 RUN
Problem Title: no title
The data source for this run = middle_math_reading_dis_1018.mdm
The command file for this run = I:\Final data set\Middle\middle_math_dis_model 1.hlm
Output file name = I:\Final data set\Middle\hlm2.txt
The maximum number of level-1 units = 151
The maximum number of level-2 units = 30
The maximum number of iterations = 100
Method of estimation: restricted maximum likelihood

Weighting Specification

	Weighting?	Weight Variable Name	Normalized?
Level 1	no		
Level 2	no		
Precision	no		

The outcome variable is MATH_DIS

The model specified for the fixed effects was:

Level-1 Coefficients	Level-2 Predictors
INTRCPT1, B0	INTRCPT2, G00

The model specified for the covariance components was:

Sigma squared (constant across level-2 units)

Tau dimensions
INTRCPT1

Summary of the model specified (in equation format)

Level-1 Model

Y = B0 + R

Level-2 Model
B0 = G00 + U0

Iterations stopped due to small change in likelihood function

******* ITERATION 4 *******

Sigma_squared = 123.28918

Tau
INTRCPT1,B0 398.87694

Tau (as correlations)
INTRCPT1,B0 1.000

Random level-1 coefficient	Reliability estimate
INTRCPT1, B0	0.896

The value of the likelihood function at iteration 4 = -6.129795E+002

The outcome variable is MATH_DIS

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	53.623540	3.852326	13.920	29	0.000

The outcome variable is MATH_DIS

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	53.623540	3.786797	14.161	29	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	19.97190	398.87694	29	469.24169	0.000
level-1,	R	11.10357	123.28918			

Statistics for current covariance components model

Deviance = 1225.959020
Number of estimated parameters = 2

Middle_Math_Dis_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        16 November 2005, Wednesday
 Time:        23:24:26
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116_dis
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Middle\hlm2.txt
  The maximum number of level-1 units = 151
  The maximum number of level-2 units = 30
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                       Weight
                       Variable
           Weighting?  Name        Normalized?
 Level 1       no
 Level 2       no
 Precision     no

  The outcome variable is MATH_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00
$                              EXP, G01
                           ISO9000, G02
 %      SES slope, B1     INTRCPT2, G10
$                              EXP, G11
                           ISO9000, G12
 %     SIZE slope, B2     INTRCPT2, G20
$                              EXP, G21
                           ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1387 *******

 Sigma_squared =     94.32687

 Tau
 INTRCPT1,B0    310.04047      -1.48726      -0.46091
      SES,B1     -1.48726       0.01079      -0.01431
     SIZE,B2     -0.46091      -0.01431       0.09439


Tau (as correlations)
 INTRCPT1,B0  1.000 -0.813 -0.085
      SES,B1 -0.813  1.000 -0.448
     SIZE,B2 -0.085 -0.448  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.582
       SES, B1                        0.095
      SIZE, B2                        0.013
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 20 of 30
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1387 = -6.098521E+002
```

The outcome variable is MATH_DIS

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	51.635492	3.990090	12.941	27	0.000
EXP, G01	-0.004171	0.003542	-1.177	27	0.250
ISO9000, G02	2.436533	7.954365	0.306	27	0.762
For SES slope, B1					
INTRCPT2, G10	-0.261737	0.098044	-2.670	27	0.013
EXP, G11	0.000097	0.000065	1.500	27	0.145
ISO9000, G12	-0.050498	0.121116	-0.417	27	0.680
For SIZE slope, B2					
INTRCPT2, G20	-1.456585	0.761628	-1.912	27	0.066
EXP, G21	0.000245	0.000400	0.614	27	0.544
ISO9000, G22	1.629648	1.029859	1.582	27	0.125

The outcome variable is MATH_DIS

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	51.635492	3.006098	17.177	27	0.000
EXP, G01	-0.004171	0.003337	-1.250	27	0.222
ISO9000, G02	2.436533	9.792774	0.249	27	0.805
For SES slope, B1					
INTRCPT2, G10	-0.261737	0.093425	-2.802	27	0.010
EXP, G11	0.000097	0.000066	1.468	27	0.154
ISO9000, G12	-0.050498	0.096596	-0.523	27	0.605
For SIZE slope, B2					
INTRCPT2, G20	-1.456585	0.623721	-2.335	27	0.027
EXP, G21	0.000245	0.000302	0.811	27	0.425
ISO9000, G22	1.629648	0.741873	2.197	27	0.037

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	17.60797	310.04047	17	159.34434	0.000
SES slope,	U1	0.10389	0.01079	17	23.52295	0.133
SIZE slope,	U2	0.30723	0.09439	17	16.52261	>.500
level-1,	R	9.71220	94.32687			

Note: The chi-square statistics reported above are based on only 20 of 30 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance	= 1219.704292
Number of estimated parameters	= 7

Middle_Reading_Dis_Null Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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-------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        18 October 2005, Tuesday
 Time:         0:58:38
-------------------------------------------------------------------------------

 SPECIFICATIONS FOR THIS HLM2 RUN
  Problem Title: no title
  The data source for this run  = I:\Final data
set\Middle\middle_math_reading_dis_1018.mdm
  The command file for this run = I:\Final data
set\Middle\middle_reading_dis_model 1.hlm
  Output file name              = I:\Final data set\Middle\hlm2.txt
  The maximum number of level-1 units = 151
  The maximum number of level-2 units = 30
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is READ_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
              INTRCPT1

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + R

Level-2 Model
          B0 = G00 + U0

Iterations stopped due to small change in likelihood function
```

```
******* ITERATION 4 *******

 Sigma_squared =     77.79098

 Tau
 INTRCPT1,B0    329.37583


Tau (as correlations)
 INTRCPT1,B0  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.918
 ----------------------------------------------------

The value of the likelihood function at iteration 4 = -5.819794E+002

 The outcome variable is READ_DIS

 Final estimation of fixed effects:
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          60.595295   3.459020    17.518        29    0.000
 ----------------------------------------------------------------------------

 The outcome variable is READ_DIS

 Final estimation of fixed effects
 (with robust standard errors)
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          60.595295   3.400869    17.818        29    0.000
 ----------------------------------------------------------------------------



 Final estimation of variance components:
 -----------------------------------------------------------------------------
 Random Effect           Standard      Variance     df    Chi-square  P-value
                         Deviation     Component
 -----------------------------------------------------------------------------
 INTRCPT1,       U0       18.14871     329.37583    29     765.43231    0.000
  level-1,       R         8.81992      77.79098
 -----------------------------------------------------------------------------


 Statistics for current covariance components model
 --------------------------------------------------
 Deviance                       = 1163.958785
 Number of estimated parameters = 2
```

Middle_Reading_Dis_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        16 November 2005, Wednesday
 Time:        23:27:46
------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116_dis
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Middle\hlm2.txt
  The maximum number of level-1 units = 151
  The maximum number of level-2 units = 30
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 ----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is READ_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                     Level-2
   Coefficients                Predictors
 ----------------------      ---------------
         INTRCPT1, B0      INTRCPT2, G00
$                               EXP, G01
                            ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                               EXP, G11
                            ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                               EXP, G21
                            ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1431 *******

 Sigma_squared =     51.65235

 Tau
 INTRCPT1,B0    324.24187      -0.01328       0.38527
      SES,B1     -0.01328       0.01358       0.04234
     SIZE,B2      0.38527       0.04234       0.13955


Tau (as correlations)
 INTRCPT1,B0  1.000 -0.006  0.057
      SES,B1 -0.006  1.000  0.972
     SIZE,B2  0.057  0.972  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.667
       SES, B1                        0.162
      SIZE, B2                        0.030
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 20 of 30
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1431 = -5.762846E+002
```

The outcome variable is READ_DIS

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	59.425844	4.002112	14.849	27	0.000
EXP, G01	-0.002957	0.003521	-0.840	27	0.409
ISO9000, G02	2.416149	7.996633	0.302	27	0.765
For SES slope, B1					
INTRCPT2, G10	-0.208695	0.082865	-2.518	27	0.018
EXP, G11	0.000029	0.000057	0.510	27	0.614
ISO9000, G12	-0.095967	0.113143	-0.848	27	0.404
For SIZE slope, B2					
INTRCPT2, G20	-0.386934	0.619389	-0.625	27	0.537
EXP, G21	0.000444	0.000333	1.333	27	0.194
ISO9000, G22	0.574554	0.854236	0.673	27	0.507

The outcome variable is READ_DIS

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	59.425844	3.356758	17.703	27	0.000
EXP, G01	-0.002957	0.003151	-0.938	27	0.357
ISO9000, G02	2.416149	8.894225	0.272	27	0.788
For SES slope, B1					
INTRCPT2, G10	-0.208695	0.098264	-2.124	27	0.043
EXP, G11	0.000029	0.000055	0.528	27	0.601
ISO9000, G12	-0.095967	0.101793	-0.943	27	0.355
For SIZE slope, B2					
INTRCPT2, G20	-0.386934	0.526340	-0.735	27	0.469
EXP, G21	0.000444	0.000201	2.210	27	0.036
ISO9000, G22	0.574554	0.596431	0.963	27	0.344

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	18.00672	324.24187	17	281.84780	0.000
SES slope,	U1	0.11654	0.01358	17	32.23351	0.014
SIZE slope,	U2	0.37356	0.13955	17	16.80069	>.500
level-1,	R	7.18696	51.65235			

Note: The chi-square statistics reported above are based on only 20 of 30 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 1152.569241
Number of estimated parameters = 7

Middle_Attendance_Null Model

Program: HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

www.ssicentral.com

Module: HLM2.EXE (6.02.25138.2)
Date: 18 October 2005, Tuesday
Time: 1: 6:49

SPECIFICATIONS FOR THIS HLM2 RUN

Problem Title: no title
The data source for this run = middle_attend_1018.mdm
The command file for this run = I:\Final data set\Middle\middle_attend_model1.hlm
Output file name = I:\Final data set\Middle\hlm2.txt
The maximum number of level-1 units = 129
The maximum number of level-2 units = 22
The maximum number of iterations = 100
Method of estimation: restricted maximum likelihood

Weighting Specification

	Weighting?	Weight Variable Name	Normalized?
Level 1	no		
Level 2	no		
Precision	no		

The outcome variable is ATTEND

The model specified for the fixed effects was:

Level-1 Coefficients	Level-2 Predictors
INTRCPT1, B0	INTRCPT2, G00

The model specified for the covariance components was:

Sigma squared (constant across level-2 units)

Tau dimensions
INTRCPT1

Summary of the model specified (in equation format)

Level-1 Model

Y = B0 + R

Level-2 Model
B0 = G00 + U0

Iterations stopped due to small change in likelihood function
******* ITERATION 6 *******

Sigma_squared = 2.02589

Tau
INTRCPT1,B0 1.65022

Tau (as correlations)
INTRCPT1,B0 1.000

Random level-1 coefficient	Reliability estimate
INTRCPT1, B0	0.725

The value of the likelihood function at iteration 6 = -2.448378E+002

The outcome variable is ATTEND

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	93.881696	0.321724	291.808	21	0.000

The outcome variable is ATTEND

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	93.881696	0.313899	299.082	21	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	1.28461	1.65022	21	90.30088	0.000
level-1,	R	1.42334	2.02589			

Statistics for current covariance components model

Deviance = 489.675659
Number of estimated parameters = 2

Middle_Attendance_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         16 November 2005, Wednesday
 Time:         23:32:46
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116_atten
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\Middle\hlm2.txt
  The maximum number of level-1 units = 129
  The maximum number of level-2 units = 22
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
            Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is   ATTEND

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                   Level-2
   Coefficients              Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00
$                              EXP, G01
                           ISO9000, G02
 %      SES slope, B1     INTRCPT2, G10
$                              EXP, G11
                           ISO9000, G12
 %     SIZE slope, B2     INTRCPT2, G20
$                              EXP, G21
                           ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1828 *******

 Sigma_squared =      1.03886

 Tau
 INTRCPT1,B0      0.35725       0.00727       0.08606
      SES,B1      0.00727       0.00029      -0.00070
     SIZE,B2      0.08606      -0.00070       0.06378


Tau (as correlations)
 INTRCPT1,B0  1.000  0.717  0.570
      SES,B1  0.717  1.000 -0.162
     SIZE,B2  0.570 -0.162  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.344
       SES, B1                        0.230
      SIZE, B2                        0.387
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 15 of 22
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1828 = -2.399348E+002
```

The outcome variable is ATTEND

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	93.651301	0.245498	381.475	19	0.000
EXP, G01	-0.000035	0.000193	-0.181	19	0.859
ISO9000, G02	0.675977	0.431382	1.567	19	0.133
For SES slope, B1					
INTRCPT2, G10	-0.050991	0.009551	-5.339	19	0.000
EXP, G11	-0.000013	0.000007	-1.767	19	0.093
ISO9000, G12	-0.011964	0.015533	-0.770	19	0.451
For SIZE slope, B2					
INTRCPT2, G20	-0.123327	0.091249	-1.352	19	0.193
EXP, G21	0.000025	0.000067	0.373	19	0.713
ISO9000, G22	0.184316	0.175567	1.050	19	0.307

The outcome variable is ATTEND

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	93.651301	0.217843	429.903	19	0.000
EXP, G01	-0.000035	0.000203	-0.172	19	0.866
ISO9000, G02	0.675977	0.342948	1.971	19	0.063
For SES slope, B1					
INTRCPT2, G10	-0.050991	0.006900	-7.390	19	0.000
EXP, G11	-0.000013	0.000006	-2.069	19	0.052
ISO9000, G12	-0.011964	0.009892	-1.209	19	0.242
For SIZE slope, B2					
INTRCPT2, G20	-0.123327	0.089524	-1.378	19	0.184
EXP, G21	0.000025	0.000060	0.414	19	0.683
ISO9000, G22	0.184316	0.105766	1.743	19	0.097

The robust standard errors are appropriate for datasets having a moderate to large number of level 2 units. These data do not meet this criterion.

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	0.59770	0.35725	12	20.58518	0.056
SES slope,	U1	0.01697	0.00029	12	10.86904	>.500
SIZE slope,	U2	0.25254	0.06378	12	33.19743	0.001
level-1,	R	1.01925	1.03886			

Note: The chi-square statistics reported above are based on only 15 of 22 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 479.869616
Number of estimated parameters = 7

High_Math_Null Model

Program: HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

www.ssicentral.com

Module: HLM2.EXE (6.02.25138.2)
Date: 18 October 2005, Tuesday
Time: 1:17:54

SPECIFICATIONS FOR THIS HLM2 RUN

```
 Problem Title: no title
 The data source for this run  = High_math_reading_1018.mdm
 The command file for this run = I:\Final data set\High\high_math_model 1.hlm
 Output file name              = I:\Final data set\High\hlm2.txt
 The maximum number of level-1 units = 112
 The maximum number of level-2 units = 29
 The maximum number of iterations = 100
 Method of estimation: restricted maximum likelihood
```

Weighting Specification

	Weighting?	Weight Variable Name	Normalized?
Level 1	no		
Level 2	no		
Precision	no		

The outcome variable is MATH

The model specified for the fixed effects was:

Level-1 Coefficients	Level-2 Predictors
INTRCPT1, B0	INTRCPT2, G00

The model specified for the covariance components was:

```
        Sigma squared (constant across level-2 units)

        Tau dimensions
              INTRCPT1
```

Summary of the model specified (in equation format)

Level-1 Model

```
          Y = B0 + R
```

Level-2 Model

```
          B0 = G00 + U0
```

Iterations stopped due to small change in likelihood function

******* ITERATION 6 *******

Sigma_squared = 150.62587

Tau
INTRCPT1,B0 426.08171

Tau (as correlations)
INTRCPT1,B0 1.000

Random level-1 coefficient	Reliability estimate
INTRCPT1, B0	0.862

The value of the likelihood function at iteration 6 = -4.680405E+002

The outcome variable is MATH

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	59.050513	4.127891	14.305	28	0.000

The outcome variable is MATH

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	59.050513	4.055484	14.561	28	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	20.64175	426.08171	28	240.47041	0.000
level-1,	R	12.27297	150.62587			

Statistics for current covariance components model

Deviance = 936.081043
Number of estimated parameters = 2

High_Math_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         16 November 2005, Wednesday
 Time:         23:42:45
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\High\hlm2.txt
  The maximum number of level-1 units = 112
  The maximum number of level-2 units = 29
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                       Weight
                       Variable
           Weighting?  Name        Normalized?
 Level 1       no
 Level 2       no
 Precision     no

  The outcome variable is     MATH

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00
$                              EXP, G01
                           ISO9000, G02
 %      SES slope, B1     INTRCPT2, G10
$                              EXP, G11
                           ISO9000, G12
 %     SIZE slope, B2     INTRCPT2, G20
$                              EXP, G21
                           ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1566 *******

 Sigma_squared =     48.49939

 Tau
 INTRCPT1,B0    303.93272       3.59246       0.78158
      SES,B1      3.59246       0.05425       0.17012
     SIZE,B2      0.78158       0.17012       2.31360


Tau (as correlations)
 INTRCPT1,B0  1.000  0.885  0.029
      SES,B1  0.885  1.000  0.480
     SIZE,B2  0.029  0.480  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.779
       SES, B1                        0.284
      SIZE, B2                        0.335
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 15 of 29
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1566 = -4.362320E+002
```

The outcome variable is MATH

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	59.732568	4.090813	14.602	26	0.000
EXP, G01	-0.001974	0.003558	-0.555	26	0.583
ISO9000, G02	1.602860	8.070151	0.199	26	0.844
For SES slope, B1					
INTRCPT2, G10	-0.957233	0.116996	-8.182	26	0.000
EXP, G11	-0.000125	0.000105	-1.187	26	0.246
ISO9000, G12	0.300860	0.183245	1.642	26	0.112
For SIZE slope, B2					
INTRCPT2, G20	-0.567874	0.657241	-0.864	26	0.396
EXP, G21	0.000879	0.000551	1.594	26	0.123
ISO9000, G22	1.244452	1.141256	1.090	26	0.286

The outcome variable is MATH

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	59.732568	3.585574	16.659	26	0.000
EXP, G01	-0.001974	0.003214	-0.614	26	0.544
ISO9000, G02	1.602860	8.267838	0.194	26	0.848
For SES slope, B1					
INTRCPT2, G10	-0.957233	0.085640	-11.177	26	0.000
EXP, G11	-0.000125	0.000093	-1.350	26	0.189
ISO9000, G12	0.300860	0.163070	1.845	26	0.076
For SIZE slope, B2					
INTRCPT2, G20	-0.567874	0.577922	-0.983	26	0.335
EXP, G21	0.000879	0.000456	1.928	26	0.064
ISO9000, G22	1.244452	1.068988	1.164	26	0.255

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	17.43367	303.93272	12	155.41025	0.000
SES slope,	U1	0.23291	0.05425	12	15.83535	0.198
SIZE slope,	U2	1.52105	2.31360	12	36.74441	0.000
level-1,	R	6.96415	48.49939			

Note: The chi-square statistics reported above are based on only 15 of 29 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 872.464088
Number of estimated parameters = 7

High_Reading_Null Model

Program: HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2000

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Module: HLM2.EXE (6.02.25138.2)
Date: 18 October 2005, Tuesday
Time: 1:28:11

SPECIFICATIONS FOR THIS HLM2 RUN
Problem Title: no title
The data source for this run = High_math_reading_1018.mdm
The command file for this run = I:\Final data set\High\high_reading_model
1.hlm
Output file name = I:\Final data set\High\hlm2.txt
The maximum number of level-1 units = 112
The maximum number of level-2 units = 29
The maximum number of iterations = 100
Method of estimation: restricted maximum likelihood

Weighting Specification

	Weighting?	Weight Variable Name	Normalized?
Level 1	no		
Level 2	no		
Precision	no		

The outcome variable is READ

The model specified for the fixed effects was:

Level-1 Coefficients	Level-2 Predictors
INTRCPT1, B0	INTRCPT2, G00

The model specified for the covariance components was:

Sigma squared (constant across level-2 units)

Tau dimensions
INTRCPT1

Summary of the model specified (in equation format)

Level-1 Model

Y = B0 + R

Level-2 Model
B0 = G00 + U0

Iterations stopped due to small change in likelihood function
******* ITERATION 6 *******

Sigma_squared = 95.88398

Tau
INTRCPT1,B0 338.45957

Tau (as correlations)
INTRCPT1,B0 1.000

Random level-1 coefficient	Reliability estimate
INTRCPT1, B0	0.885

The value of the likelihood function at iteration 6 = -4.456821E+002

The outcome variable is READ

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	71.447325	3.630963	19.677	28	0.000

The outcome variable is READ

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	71.447325	3.567415	20.028	28	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	18.39727	338.45957	28	338.23671	0.000
level-1,	R	9.79204	95.88398			

Statistics for current covariance components model

Deviance = 891.364159
Number of estimated parameters = 2

High_Reading_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         16 November 2005, Wednesday
 Time:         23:51:12
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\High\hlm2.txt
  The maximum number of level-1 units = 112
  The maximum number of level-2 units = 29
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 ----------------------
                        Weight
                        Variable
            Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     READ

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00
$                              EXP, G01
                           ISO9000, G02
 %      SES slope, B1     INTRCPT2, G10
$                              EXP, G11
                           ISO9000, G12
 %     SIZE slope, B2     INTRCPT2, G20
$                              EXP, G21
                           ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

        Sigma squared (constant across level-2 units)

        Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1693 *******

 Sigma_squared =     33.11450

 Tau
 INTRCPT1,B0    275.70777       4.43264       8.78230
      SES,B1      4.43264       0.07332       0.20113
     SIZE,B2      8.78230       0.20113       2.22593


Tau (as correlations)
 INTRCPT1,B0  1.000  0.986  0.355
      SES,B1  0.986  1.000  0.498
     SIZE,B2  0.355  0.498  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.809
       SES, B1                        0.406
      SIZE, B2                        0.390
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 15 of 29
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1693 = -4.207644E+002
```

The outcome variable is READ

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	72.741130	3.830927	18.988	26	0.000
EXP, G01	-0.001495	0.003308	-0.452	26	0.654
ISO9000, G02	-3.777585	7.562573	-0.500	26	0.621
For SES slope, B1					
INTRCPT2, G10	-0.653907	0.108680	-6.017	26	0.000
EXP, G11	0.000004	0.000097	0.046	26	0.964
ISO9000, G12	0.405197	0.172705	2.346	26	0.027
For SIZE slope, B2					
INTRCPT2, G20	-0.083072	0.574790	-0.145	26	0.887
EXP, G21	0.000655	0.000486	1.348	26	0.190
ISO9000, G22	0.998646	1.012761	0.986	26	0.334

The outcome variable is READ

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	72.741130	3.512973	20.706	26	0.000
EXP, G01	-0.001495	0.002938	-0.509	26	0.615
ISO9000, G02	-3.777585	7.481730	-0.505	26	0.617
For SES slope, B1					
INTRCPT2, G10	-0.653907	0.085788	-7.622	26	0.000
EXP, G11	0.000004	0.000058	0.077	26	0.939
ISO9000, G12	0.405197	0.122808	3.299	26	0.003
For SIZE slope, B2					
INTRCPT2, G20	-0.083072	0.452515	-0.184	26	0.856
EXP, G21	0.000655	0.000368	1.783	26	0.086
ISO9000, G22	0.998646	1.021823	0.977	26	0.338

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	16.60445	275.70777	12	352.67325	0.000
SES slope,	U1	0.27078	0.07332	12	26.00007	0.011
SIZE slope,	U2	1.49196	2.22593	12	36.30325	0.000
level-1,	R	5.75452	33.11450			

Note: The chi-square statistics reported above are based on only 15 of 29 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 841.528724
Number of estimated parameters = 7

High_Math_Dis_Null Model

Program: HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors: Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher: Scientific Software International, Inc. (c) 2000

techsupport@ssicentral.com

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Module: HLM2.EXE (6.02.25138.2)
Date: 18 October 2005, Tuesday
Time: 1:32: 5

SPECIFICATIONS FOR THIS HLM2 RUN

Problem Title: no title
The data source for this run = high_math_reading_dis_1018.mdm
The command file for this run = I:\Final data set\High\high_math_reading_dis_model 1.hlm
Output file name = I:\Final data set\High\hlm2.txt
The maximum number of level-1 units = 105
The maximum number of level-2 units = 29
The maximum number of iterations = 100
Method of estimation: restricted maximum likelihood

Weighting Specification

	Weighting?	Weight Variable Name	Normalized?
Level 1	no		
Level 2	no		
Precision	no		

The outcome variable is MATH_DIS

The model specified for the fixed effects was:

Level-1 Coefficients	Level-2 Predictors
INTRCPT1, B0	INTRCPT2, G00

The model specified for the covariance components was:

Sigma squared (constant across level-2 units)

Tau dimensions
INTRCPT1

Summary of the model specified (in equation format)

Level-1 Model

Y = B0 + R

Level-2 Model
B0 = G00 + U0

Iterations stopped due to small change in likelihood function

******* ITERATION 6 *******

Sigma_squared = 194.23476

Tau
INTRCPT1,B0 447.68322

Tau (as correlations)
INTRCPT1,B0 1.000

Random level-1 coefficient	Reliability estimate
INTRCPT1, B0	0.828

The value of the likelihood function at iteration 6 = -4.513105E+002

The outcome variable is MATH_DIS

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	46.922376	4.317423	10.868	28	0.000

The outcome variable is MATH_DIS

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	46.922376	4.241453	11.063	28	0.000

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	21.15853	447.68322	28	225.44849	0.000
level-1,	R	13.93681	194.23476			

Statistics for current covariance components model

Deviance = 902.620973
Number of estimated parameters = 2

High_Math_Dis_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        17 November 2005, Thursday
 Time:         0: 2:23
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116_dis
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\High\hlm2.txt
  The maximum number of level-1 units = 105
  The maximum number of level-2 units = 29
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is MATH_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
        INTRCPT1, B0      INTRCPT2, G00
$                              EXP, G01
                           ISO9000, G02
 %      SES slope, B1     INTRCPT2, G10
$                              EXP, G11
                           ISO9000, G12
 %     SIZE slope, B2     INTRCPT2, G20
$                              EXP, G21
                           ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1076 *******

 Sigma_squared =    119.53745

 Tau
 INTRCPT1,B0    274.15910       3.00674      36.57388
      SES,B1      3.00674       0.11375       0.46744
     SIZE,B2     36.57388       0.46744       5.03713


Tau (as correlations)
 INTRCPT1,B0  1.000  0.538  0.984
      SES,B1  0.538  1.000  0.618
     SIZE,B2  0.984  0.618  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.659
       SES, B1                        0.249
      SIZE, B2                        0.290
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 13 of 29
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1076 = -4.430883E+002
```

The outcome variable is MATH_DIS

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	48.093420	4.111346	11.698	26	0.000
EXP, G01	-0.004954	0.003660	-1.353	26	0.188
ISO9000, G02	3.541912	7.906645	0.448	26	0.657
For SES slope, B1					
INTRCPT2, G10	-0.766048	0.181981	-4.209	26	0.000
EXP, G11	-0.000006	0.000151	-0.040	26	0.969
ISO9000, G12	0.370967	0.302824	1.225	26	0.232
For SIZE slope, B2					
INTRCPT2, G20	-0.811808	0.895394	-0.907	26	0.373
EXP, G21	0.001330	0.000765	1.739	26	0.093
ISO9000, G22	-0.199736	1.511574	-0.132	26	0.896

The outcome variable is MATH_DIS

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	48.093420	3.735713	12.874	26	0.000
EXP, G01	-0.004954	0.003472	-1.427	26	0.166
ISO9000, G02	3.541912	7.764072	0.456	26	0.652
For SES slope, B1					
INTRCPT2, G10	-0.766048	0.146367	-5.234	26	0.000
EXP, G11	-0.000006	0.000130	-0.046	26	0.964
ISO9000, G12	0.370967	0.303954	1.220	26	0.234
For SIZE slope, B2					
INTRCPT2, G20	-0.811808	0.908449	-0.894	26	0.380
EXP, G21	0.001330	0.000723	1.839	26	0.077
ISO9000, G22	-0.199736	1.105060	-0.181	26	0.858

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	16.55775	274.15910	10	76.36489	0.000
SES slope,	U1	0.33728	0.11375	10	16.46814	0.087
SIZE slope,	U2	2.24436	5.03713	10	28.69476	0.002
level-1,	R	10.93332	119.53745			

Note: The chi-square statistics reported above are based on only 13 of 29 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 886.176596
Number of estimated parameters = 7

High_Readind_Dis_Null Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        18 October 2005, Tuesday
 Time:         1:42:32
-------------------------------------------------------------------------------

 SPECIFICATIONS FOR THIS HLM2 RUN
  Problem Title: no title
  The data source for this run  = high_math_reading_dis_1018.mdm
  The command file for this run = I:\Final data set\High\high_reading_dis_model
1.hlm
  Output file name              = I:\Final data set\High\hlm2.txt
  The maximum number of level-1 units = 105
  The maximum number of level-2 units = 29
  The maximum number of iterations = 1000
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 ----------------------
                         Weight
                         Variable
            Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is READ_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                 Level-2
   Coefficients            Predictors
 ---------------------   ---------------
         INTRCPT1, B0      INTRCPT2, G00


 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + R

Level-2 Model
          B0 = G00 + U0

Iterations stopped due to small change in likelihood function
```

```
******* ITERATION 5 *******

 Sigma_squared =     96.70591

 Tau
 INTRCPT1,B0    439.42930


Tau (as correlations)
 INTRCPT1,B0  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.902
 ----------------------------------------------------

The value of the likelihood function at iteration 5 = -4.232877E+002

 The outcome variable is READ_DIS

 Final estimation of fixed effects:
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          59.019566   4.099672    14.396        28    0.000
 ----------------------------------------------------------------------------

 The outcome variable is READ_DIS

 Final estimation of fixed effects
 (with robust standard errors)
 ----------------------------------------------------------------------------
                                       Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          59.019566   4.028067    14.652        28    0.000
 ----------------------------------------------------------------------------



 Final estimation of variance components:
 -----------------------------------------------------------------------------
 Random Effect           Standard      Variance     df    Chi-square  P-value
                         Deviation     Component
 -----------------------------------------------------------------------------
 INTRCPT1,       U0       20.96257      439.42930    28     419.60712    0.000
  level-1,       R         9.83392       96.70591
 -----------------------------------------------------------------------------

 Statistics for current covariance components model
 --------------------------------------------------
 Deviance                       = 846.575464
 Number of estimated parameters = 2
```

High_Reading_Dis_Conditional Model

```
Program:                     HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                     Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                   Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        17 November 2005, Thursday
 Time:         0: 5:59
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116_dis
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\High\hlm2.txt
  The maximum number of level-1 units = 105
  The maximum number of level-2 units = 29
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is READ_DIS

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                     Level-2
   Coefficients                Predictors
 ----------------------     ---------------
         INTRCPT1, B0      INTRCPT2, G00
$                               EXP, G01
                            ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                               EXP, G11
                            ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                               EXP, G21
                            ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 2534 *******

 Sigma_squared =     72.14914

 Tau
 INTRCPT1,B0    392.48755       4.21294      22.52321
      SES,B1      4.21294       0.04552       0.24222
     SIZE,B2     22.52321       0.24222       1.29902


Tau (as correlations)
 INTRCPT1,B0  1.000  0.997  0.997
      SES,B1  0.997  1.000  0.996
     SIZE,B2  0.997  0.996  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.778
       SES, B1                        0.192
      SIZE, B2                        0.172
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 13 of 29
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 2534 = -4.252843E+002
```

The outcome variable is READ_DIS

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	60.777088	4.534341	13.404	26	0.000
EXP, G01	-0.002300	0.003953	-0.582	26	0.565
ISO9000, G02	-2.738130	8.937159	-0.306	26	0.762
For SES slope, B1					
INTRCPT2, G10	-0.460467	0.141020	-3.265	26	0.003
EXP, G11	-0.000072	0.000125	-0.577	26	0.568
ISO9000, G12	0.361954	0.203527	1.778	26	0.087
For SIZE slope, B2					
INTRCPT2, G20	-0.840983	0.686829	-1.224	26	0.232
EXP, G21	0.001114	0.000577	1.931	26	0.064
ISO9000, G22	1.201499	1.037778	1.158	26	0.258

The outcome variable is READ_DIS

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	60.777088	4.337060	14.013	26	0.000
EXP, G01	-0.002300	0.003788	-0.607	26	0.549
ISO9000, G02	-2.738130	7.910908	-0.346	26	0.732
For SES slope, B1					
INTRCPT2, G10	-0.460467	0.104330	-4.414	26	0.000
EXP, G11	-0.000072	0.000077	-0.936	26	0.358
ISO9000, G12	0.361954	0.145221	2.492	26	0.020
For SIZE slope, B2					
INTRCPT2, G20	-0.840983	0.583888	-1.440	26	0.162
EXP, G21	0.001114	0.000441	2.524	26	0.018
ISO9000, G22	1.201499	0.624503	1.924	26	0.065

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	19.81130	392.48755	10	177.29134	0.000
SES slope,	U1	0.21335	0.04552	10	9.69247	>.500
SIZE slope,	U2	1.13975	1.29902	10	16.12512	0.096
level-1,	R	8.49407	72.14914			

Note: The chi-square statistics reported above are based on only 13 of 29 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 850.568641
Number of estimated parameters = 7

High_Graduation_Null Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:       HLM2.EXE (6.02.25138.2)
 Date:         18 October 2005, Tuesday
 Time:          1:47: 4
-------------------------------------------------------------------------------

 SPECIFICATIONS FOR THIS HLM2 RUN
  Problem Title: no title
  The data source for this run  = high_grad_1018
  The command file for this run = I:\Final data set\High\high_grad_model 1.hlm
  Output file name              = I:\Final data set\High\hlm2.txt
  The maximum number of level-1 units = 91
  The maximum number of level-2 units = 27
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
            Weighting?  Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     GRAD

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
         INTRCPT1, B0      INTRCPT2, G00


 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1


 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + R

Level-2 Model
          B0 = G00 + U0

Iterations stopped due to small change in likelihood function
```

```
******* ITERATION 6 *******

 Sigma_squared =    111.70005

 Tau
 INTRCPT1,B0    160.77481


Tau (as correlations)
 INTRCPT1,B0  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.758
 ----------------------------------------------------

The value of the likelihood function at iteration 6 = -3.625014E+002

 The outcome variable is     GRAD

 Final estimation of fixed effects:
 ----------------------------------------------------------------------------
                                      Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          76.052934   2.802871    27.134        26    0.000
 ----------------------------------------------------------------------------

 The outcome variable is     GRAD

 Final estimation of fixed effects
 (with robust standard errors)
 ----------------------------------------------------------------------------
                                      Standard             Approx.
    Fixed Effect         Coefficient   Error      T-ratio   d.f.     P-value
 ----------------------------------------------------------------------------
 For       INTRCPT1, B0
    INTRCPT2, G00          76.052934   2.749229    27.663        26    0.000
 ----------------------------------------------------------------------------



 Final estimation of variance components:
 -----------------------------------------------------------------------------
 Random Effect           Standard      Variance     df    Chi-square  P-value
                         Deviation     Component
 -----------------------------------------------------------------------------
 INTRCPT1,       U0       12.67970     160.77481    26     157.37864    0.000
  level-1,       R        10.56882     111.70005
 -----------------------------------------------------------------------------

 Statistics for current covariance components model
 --------------------------------------------------
 Deviance                       = 725.002836
 Number of estimated parameters = 2
```

High_Graduation_Conditional Model

```
Program:                       HLM 6 Hierarchical Linear and Nonlinear Modeling
Authors:                       Stephen Raudenbush, Tony Bryk, & Richard Congdon
Publisher:                     Scientific Software International, Inc. (c) 2000

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-------------------------------------------------------------------------------
 Module:      HLM2.EXE (6.02.25138.2)
 Date:        17 November 2005, Thursday
 Time:         0: 9:12
-------------------------------------------------------------------------------


 SPECIFICATIONS FOR THIS HLM2 RUN


  Problem Title: no title

  The data source for this run  = 1116_grd
  The command file for this run = whlmtemp.hlm
  Output file name              = D:\Final data set\High\hlm2.txt
  The maximum number of level-1 units = 91
  The maximum number of level-2 units = 27
  The maximum number of iterations = 100
  Method of estimation: restricted maximum likelihood

 Weighting Specification
 -----------------------
                        Weight
                        Variable
           Weighting?   Name        Normalized?
 Level 1        no
 Level 2        no
 Precision      no

  The outcome variable is     GRAD

  The model specified for the fixed effects was:
 ----------------------------------------------------

   Level-1                  Level-2
   Coefficients             Predictors
 ----------------------   ---------------
         INTRCPT1, B0      INTRCPT2, G00
$                               EXP, G01
                            ISO9000, G02
 %      SES slope, B1      INTRCPT2, G10
$                               EXP, G11
                            ISO9000, G12
 %     SIZE slope, B2      INTRCPT2, G20
$                               EXP, G21
                            ISO9000, G22

'%' - This level-1 predictor has been centered around its grand mean.
'$' - This level-2 predictor has been centered around its grand mean.

 The model specified for the covariance components was:
 ---------------------------------------------------------

         Sigma squared (constant across level-2 units)

         Tau dimensions
               INTRCPT1
                    SES slope
                   SIZE slope

 Summary of the model specified (in equation format)
 ---------------------------------------------------

Level-1 Model

          Y = B0 + B1*(SES) + B2*(SIZE) + R

Level-2 Model
          B0 = G00 + G01*(EXP) + G02*(ISO9000) + U0
          B1 = G10 + G11*(EXP) + G12*(ISO9000) + U1
          B2 = G20 + G21*(EXP) + G22*(ISO9000) + U2

Iterations stopped due to small change in likelihood function
******* ITERATION 1982 *******

 Sigma_squared =     21.47259

 Tau
 INTRCPT1,B0    231.52678       5.42287     -24.82301
      SES,B1      5.42287       0.12880      -0.48980
     SIZE,B2    -24.82301      -0.48980       8.23342


Tau (as correlations)
 INTRCPT1,B0  1.000  0.993 -0.569
      SES,B1  0.993  1.000 -0.476
     SIZE,B2 -0.569 -0.476  1.000

 ----------------------------------------------------
  Random level-1 coefficient   Reliability estimate
 ----------------------------------------------------
  INTRCPT1, B0                        0.785
       SES, B1                        0.567
      SIZE, B2                        0.633
 ----------------------------------------------------


Note: The reliability estimates reported above are based on only 13 of 27
units that had sufficient data for computation.  Fixed effects and variance
components are based on all the data.

The value of the likelihood function at iteration 1982 = -3.393708E+002
```

The outcome variable is GRAD

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	77.764933	3.963935	19.618	24	0.000
EXP, G01	0.001815	0.003269	0.555	24	0.584
ISO9000, G02	-4.455015	7.478742	-0.596	24	0.557
For SES slope, B1					
INTRCPT2, G10	-0.534729	0.121745	-4.392	24	0.000
EXP, G11	-0.000084	0.000101	-0.830	24	0.415
ISO9000, G12	-0.091572	0.201405	-0.455	24	0.653
For SIZE slope, B2					
INTRCPT2, G20	-0.943511	0.874304	-1.079	24	0.292
EXP, G21	0.000050	0.000726	0.069	24	0.946
ISO9000, G22	2.323250	1.559048	1.490	24	0.149

The outcome variable is GRAD

Final estimation of fixed effects
(with robust standard errors)

Fixed Effect	Coefficient	Standard Error	T-ratio	Approx. d.f.	P-value
For INTRCPT1, B0					
INTRCPT2, G00	77.764933	2.446311	31.789	24	0.000
EXP, G01	0.001815	0.001688	1.075	24	0.294
ISO9000, G02	-4.455015	9.186392	-0.485	24	0.632
For SES slope, B1					
INTRCPT2, G10	-0.534729	0.093852	-5.698	24	0.000
EXP, G11	-0.000084	0.000068	-1.228	24	0.232
ISO9000, G12	-0.091572	0.223090	-0.410	24	0.685
For SIZE slope, B2					
INTRCPT2, G20	-0.943511	0.529183	-1.783	24	0.087
EXP, G21	0.000050	0.000468	0.108	24	0.916
ISO9000, G22	2.323250	1.765328	1.316	24	0.201

Final estimation of variance components:

Random Effect		Standard Deviation	Variance Component	df	Chi-square	P-value
INTRCPT1,	U0	15.21600	231.52678	10	382.53852	0.000
SES slope,	U1	0.35889	0.12880	10	66.23856	0.000
SIZE slope,	U2	2.86939	8.23342	10	102.18607	0.000
level-1,	R	4.63385	21.47259			

Note: The chi-square statistics reported above are based on only 13 of 27 units that had sufficient data for computation. Fixed effects and variance components are based on all the data.

Statistics for current covariance components model

Deviance = 678.741680
Number of estimated parameters = 7

VITA

Education

- M.S. The Pennsylvania State University, University Park, PA. Workforce Education and Development. May 2004.
- B.A. The Seoul National University, Seoul, Korea, Ethics Education. August 1995.

Scholarship and Awards

- 2005 Outstanding Research Presentation Award (1st place), the Annual Association for Career and Technical Education Research (ACTER) Conference, Kansas City. MO
- 2005 The Alumni Society Distinguished Graduate Student Scholarship, Penn State.
- 2005 Graduate Student Recognition Award, Penn State.
- 2004-2006 Graduate Research Assistantship, Penn State.
- 2003 The Third Prize Winner, the Nineteenth Annual Graduate Exhibition (Social and Behavioral Science Category), Penn State.
- 2002 Korean Government Fellowship for Overseas Study, Korea.
- 2000 Presidential Award for Excellent Government Officer, Korea.

Position and Professional Experiences

- Graduate Teaching and Research Assistant at the Department of Learning and Performance Systems, Pennsylvania State University (August 2003 – May 2006).
- Deputy Director, The Ministry of Education and Human Resources Development, Korea (Feb, 1993-August 2002).

Scholarly Works

- Gray, K., Bae, S. H., & Yeager, G. (2006). Performance of career and technical education (CTE) students on a state-mandated proficiency test: A retrospective cohort study. Paper presented at the 2006 AERA meeting, San Francisco, CA.
- Gray, K., Foster, J., & Bae, S. H. (2005). Challenges to the Pennsylvania Building and Construction Cluster, Policy paper prepared for Keystone Research Center, Harrisburg, PA.
- Bae, S. H., & Song, J. H. (2005). Youth Unemployment and the Role of Career and Technical Education: A Case Study of the Korean Labor Market, Paper presented at the Annual Association for Career and Technical Education Research (ACTER) Conference, Kansas City. MO.
- Bae, S. H., & Gray, K. (2004). ISO 9000, A Proven Factory Solution: Will It Work in Our Schools? Paper presented the 35th Annual NERA Conference, Kerhonkson, NY.
- Bae, S. H. (2004). The Politics of Standardized Testing: A Case Study of the Korean Basic Scholastics Ability Test. Paper presented the 35th Annual NERA Conference, Kerhonkson, NY.