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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

A HIERARCHICAL LINEAR MODELING OF  
SCHOOL EFFECTS AND STUDENT FACTORS  
AFFECTING PENILAIAN MENENGAH RENDAH  
(PMR) ACHIEVEMENT

BY

MOHD BURHAN IBRAHIM

INTERNATIONAL ISLAMIC UNIVERSITY  
MALAYSIA

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requirement for the degree of  
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## ABSTRACT

The purpose of this study was to gain a more complete understanding of the student and school level factors that influence the students' achievement in the Penilaian Menengah Rendah (PMR) examination at Sekolah Menengah Kebangsaan (SMK) in Selangor. Using Hierarchical Linear Model (HLM) and the data collected from a self-administered survey, this study examined the influence of student level factors (e.g. student's gender, student's prior achievement, student's activities during and after school hours, and parental involvement) and school-level factors (school's location and enrolment) on the students' Penilaian Menengah Rendah achievement. The results indicated that the proportion of variance in the PMR achievement was observed to be bigger between schools even after the school's location is controlled. The study had also provided evidence that students who have fared well in the Penilaian Menengah Rendah examination tended to have the following characteristics: a) high Ujian Pencapaian Sekolah Rendah (UPSR) performance, b) high SES levels, c) more time spent engaging in academic oriented activities after school hours, d) high attitude towards education and learning, e) low beliefs towards education and learning, and f) high parental involvement in education. Gender, in-class learning activities (active, passive) and after school hours non-academic oriented activities had statistically insignificant relationships with Penilaian Menengah Rendah achievement. The influence on Penilaian Menengah Rendah schools' mean achievement varied from school to school with respect to school's location and not enrolment. Schools which are located in the urban areas were found to have higher means for the Penilaian Menengah Rendah achievement. However, of these two variables, the school's enrolment was observed to have influenced the magnitude of the student's UPSR performance-Penilaian Menengah Rendah achievement relationship. Evidence indicated that the impact of UPSR performance on PMR achievement is stronger in schools with lower enrolment as compared to schools with bigger student populations. Apart from this, neither school's location nor enrolment had an impact on the relationship between PMR and the other statistically significant student-level variables. Overall, most of the variables that are traditionally associated with student academic achievement were observed to influence student's Penilaian Menengah Rendah achievement. Differences in the mean achievement attained among the schools in the population as well as the differential influence by student's level factors towards Penilaian Menengah Rendah achievement observed warrant further investigation.

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## **APPROVAL PAGE**

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## **DECLARATION**

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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Signature.....

Date.....

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**A HIERARCHICAL LINEAR MODELING OF SCHOOL EFFECTS  
AND STUDENT FACTORS AFFECTING PENILAIAN MENENGAH  
RENDAH (PMR) ACHIEVEMENT**

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# **CHAPTER ONE**

## **INTRODUCTION**

### **BACKGROUND**

According to Caroll (1963), educational achievement refers to the degree of learning in some procedures intended to produce learning such as a formal or informal course of instruction or a period of self-study of a topic, or practice of a skill. In general, it refers to personal attainment and the accomplishment of goals. It is a multifaceted process in education in which learners strive to master criteria and information that are presented in various formats. This process involves intrinsic as well as extrinsic factors and is promoted by instruction or training by which people learn to develop and use their mental, moral and physical powers to successfully reach a required standard of performance set by individuals or by society.

In Malaysia, the democratization of education has shaped the Malaysians' ideals and ingrained in them the expectation that all students should be afforded an appropriate educational opportunity. The Malaysian society has recognized the value of a quality education and its potential to translate into improved student educational achievement and, ultimately, success in life.

Despite the ample evidence for the improvement of academic achievement over the years (Malay Mail, 2004,), there is still room for enhancement at the level of educational achievement attained thus far. Educational leaders and policy makers, equipped with well laid out policies, have persisted in their attempts to address any concerns associated with student academic achievement (New Strait Times, 2004, 2005; Malay Mail 2003; Johan, 2004). One of the examples is by means of school reform efforts such as standards-based education. There are, however, many questions which are left unanswered pertaining to the condition of schools and educational achievement.

Various factors have been found to affect students' academic achievement. School effect research in Third World countries has generally reported that school effects are greater than family effects as school related factors are more important than out-of-school factors in explaining achievement variance (Black et al., 1993; Fuller & Clarke, 1994). In contrast, the findings of numerous studies conducted in industrialized countries over the past several decades have consistently reported that family background accounts for differences in student achievement more than school factors (Coleman et al., 1966; Averch et al., 1974; Bridge et al., 1979; Boardman & Murname, 1980; Cohen, 1981; Heyneman & Loxely, 1982, 1983; Good & Brophy, 1986).

## **STATEMENT OF THE PROBLEM**

Researchers have suggested that achievement is a function of many interrelated variables: students' ability, attitudes and perceptions, socioeconomic variables, parent and peer influences, school-related variables, and many others. Many of these variables are home- and family- related and are, thus, difficult if not impossible to

change, as they fall outside the control of educators. However, there are school-related variables such as students' academic engagement, perceptions and attitudes, and knowledge of the role of educational achievement in future career opportunities that can be influenced and are amenable to change by educational interventions. Thus, understanding the role of such factors on students' achievement has attracted serious attention in recent years.

During the past several decades, extensive research has been conducted to identify and examine the factors that explain students' achievement. Factors such as attitude (Ma, 1997), beliefs (Garofalo, 1989; Kloosterman, 1995; Schoenfeld, 1985; Schommer, 1990), gender (Benbow & Stanley, 1980; Fennema & Carpenter, 1981), parent education (Ethington & Wolfe, 1984; Ma, 1997; Tsai & Walberg, 1983), employment (Greenberger & Steinberg, 1986), homework (Keith & Cool, 1992) and school size (Lee & Smith, 1997) have been researched.

Among his findings, Henderson (1987) stated that “involving parents in their children’s formal education improves student achievement” (p.9). Parent involvement in school was found to have a positive influence on student achievement; however most of the research was focused on elementary school children (Paulson, 1994). Similarly, school climate has been shown to have a significant impact on student achievement. Hoy and Tarter (1992) conclude that healthy schools appear to be high achieving. Sutherland’s (1994) research indicates that the school climate does make a difference in the achievement levels of students. In one of their findings, Brookover et al. (1979) state that children’s achievement in academic subjects is “partly a function of the social and cultural characteristics of the school social system” (p.6). They believe that the school environment affects learning outcomes by asserting that the school climates and organizations that promote and perpetuate non-learning are



unlikely to produce high levels of achievement, but schools that are designed to produce high levels of achievement can function as well as any other social system (1979, p. 148). Sweeney (1992) writes that school size, community type, and the level of attendance make a difference in the school climate. He suggests that as the size of the school increases, the climate becomes less positive, observing that suburban schools tend to have more positive climates than rural schools and, in general, urban schools have the least positive climates.

A large corpus of Northern Hemisphere literature has evolved which examines the relationship between particular constructs and academic achievement. Many of these studies have focused on the academic attainments of primary school students and junior secondary school students. Early British studies, for example, highlighted the association between family environmental factors and school performance (Swift, 1967), and a strong correlation between academic motivation and school attainment (Entwistle, 1969). Writing in an Israeli context, Eshel & Kurman (1991) indicated that factors such as perceived academic ability and father's educational level were determinants of primary school academic success. Brown & Steinberg (1991), drawing from a broad North American student population, established that high school achievement was affected by a mixture of family, peer, and school influences. Moreover, Khayer (1986) reported that gender was related to school achievement in Iran.

A study which concentrated on the academic attainments of final year school students was undertaken by Maqsud (1983). Using a sample of Nigerian Form Four students (average age of 16.73 years), he found that four independent variables, namely socio-economic background, locus of control, intelligence, and self-esteem had significant effects on academic achievement. The results reported by Duran &

Weffer (1992) were also important since the relationships among final-year school achievement and several variables were explored. They found that the academic performance of their sample of Mexican-American students was influenced by pre-high-school attainment, academic skill development, the curriculum studied, and commitment shown to school-related tasks. Therefore, many studies support the contention that a combination of personal and environmental factors impact school achievement.

Students' affective characteristics (such as academic self-concept and achievement motivation) are also found to be significant predictors of subsequent academic achievement. For instance, self-beliefs have been found to predict the grade performance and achievement test scores of elementary and secondary school-aged students (Lyon, 1993; Lyon & MacDonald, 1990; Song & Hattie, 1984). Academic self-concept was observed to be a significant predictor of achievement in college mathematics (House, 1993a; Wilhite, 1990), science (House, 1993c), and chemistry (House, 1994, 1996). Similarly, achievement expectancies were found to significantly predict achievement in introductory college mathematics (House, 1995a, 1995b) and of overall grade performance (House, 1993b). More recent findings also indicate that self-beliefs are significantly associated with the achievement of students in science, engineering, and mathematics (House, 2000).

Several models pertaining to school learning and student achievement which incorporate arrays of achievement predictors have been developed in the past. In a model developed by Wiley and Harnischfeger (1974) and Harnischfeger and Wiley (1976), six components were hypothesized which could be divided into three categories; (a) *background*, which includes curriculum, institutional factors, and personal characteristics of teachers and students; (b) *teaching-learning process*, which

includes student pursuits and teacher activities; and (c) *acquisition*, which is student achievement. Background includes such factors as the courses offered, courses taken, school size, school climate, school resources, parent education level, and student attitudes. The teaching-learning process includes such factors as in-class and out-of-school pursuits or activities. Examples of in-class pursuits are answering questions in class, working in groups, while the activities that can be labeled out-of-school pursuits include, among others, athletics, employment, or homework. In this model, the partitioning of time on the basis of type of student pursuit allows one to examine more accurately the amount of time a student is engaged in an activity and the potential impact on achievement. Finally, acquisition is the achievement level for a student in a given content area or overall.

In another learning model that was developed by Willms and Raudenbush (1989), student outcome scores have been defined as an additive model. According to their model, a student's outcome score is composed of: (a) the population mean (the average score of all students in the defined population of schools) + (b) the effect of background factors (pre-entry abilities, family environment, sex, etc.) + (c) the effects of school policies and practices (organizational structure, resources, etc.) + (d) the effects of school characteristics (per-pupil expenditure, class size, teacher salary scales) + (e) effects of exogenous social, economic and cultural factors (average SES of school, local unemployment rate, etc.) + (f) any unmeasured effects unique to the child's school + (g) random error.

Although the investigation of individual factors is important, multifactor models possess a distinct advantage over individual characteristics and constructs because their examination permits not only the study of each individual characteristic's or construct's association with achievement but also the exploration

and examination of the relationships among those characteristics. Keith (2002) stated that multivariate models are needed to understand the influences of academic enablers and school learning variables on learning, as well as the influences of these variables on each other. Shavelson, McDonnell, Oakes and Carey (1987) argued that a “phenomenon as complex as education” requires models because a single indicator is not able to provide adequate information.

In social sciences, particularly education, variable structures are often hierarchical. If the nature of different variables affecting the students’ achievement is closely examined, it is very likely to yield a hierarchical pattern of the hypothesized factors. For instance, students, family background and pre-intake abilities are embedded in individual students. They are student-level data. School policies and practices directly under the control of individual schools influence all pupils in a school; they are school level variables. In states or districts where education authorities operate schools, we can have authority-level data, and so on.

While school effect research has consistently differentiated between the achievement variance attributable to student level variables and the variance due to school level variables, it has reported differences in the school effects expressed in terms of the percentage or proportion of variance explained by school factors relative to the proportion of variance explained by family background variables. As previously mentioned, several studies (Baker & LeTendre, 2000; Heyneman & Loxely, 1982; 1983) revealed that the relative effects of institutional and student level factors vary with the economic development level of the country. However, in a developing country like Malaysia, the relative effects of institutional or school factors, student factors and family background on students’ achievement have yet to be widely investigated.

Over the years, several studies have been conducted in Malaysia to determine the factors that influence students' academic achievement either overall or in specific content areas such as mathematics, sciences and languages (Mohd Nasir, 1997; Zalizan, 1988; Mohyani, 1986; Saat, 1989; Tengku Ab. Aziz, 1989). These studies were separately conducted either at the student level, investigating the influence of student characteristics or at the institutional level investigating the effect of school characteristics on students' achievement. Even though the hierarchical structure in educational research is prevailing, past studies often failed to address them adequately thus ignoring the nested nature of the data. To the researcher's knowledge, there has not been a single local study which investigated both the student and school level factors in predicting students' achievement simultaneously.

## **METHODOLOGICAL DRAWBACK**

Despite the relative consistency in research findings on factors affecting students' achievement and indicators of school effectiveness, several recent studies have pointed to the methodological drawbacks of the research in this field in developing countries (Al-Nahr, 2000). By aggregating a lower level data at a higher unit level, lower unit-level variances will be caused to be automatically suppressed. Aggregate bias inflates the effects of student background on outcomes relative to institutional effects. On the other hand, when data are analyzed at the student-level, the fact that groups of students come from different types of schools is ignored. This results in smaller standard errors and narrower confidence intervals for the estimates of parameters. In addition, Ordinary Least Squares (OLS) regression blends the between- school variance and within-school (between student) variance together. In his attempt to compare ordinary regression with multilevel regression technique,

Patterson (1994) demonstrated how ordinary regression misleadingly attributed to SES some achievement differences which were actually due to school practice.

Riddell (1989; 1997) proposed the application of multilevel analysis in school effectiveness research to overcome these methodological drawbacks. These models are capable of analyzing data simultaneously at different levels of the educational hierarchy – at the student level, the level of the classroom and the level of the school or a higher level such as educational directorate or education authority. Thanks to this simultaneous multi-level modeling, one can determine the effect of inclusion of different explanatory variables at each level. That is, in the two-level model (student and school), two residual terms are specified; each relating to a particular level and the explained proportion of variance at each level can then be analyzed.

## **RATIONALE OF THE STUDY**

Academic achievement has been and remains an important issue in Malaysian education. Understanding the relationship between the factors at both the student and the institutional or school levels that affect academic achievement will not only provide information in general, but will also provide information about individual students pertaining to educational achievement. One of the main purposes of this study is to identify the factors that could be used to predict students' academic achievement particularly at the lower secondary level.

Secondly, this study adds to the knowledge of student and school variables which, when examined simultaneously through an integrated conceptual model, impact academic achievement. Until recently, institutional or school and student level factors could not be examined simultaneously. One level had to be ignored, or simply

aggregated to the other. But with new analysis techniques, simultaneous examination has become possible.

In short, the purpose of this study is to examine the relationships among academic achievement on the one hand and student and school factors on the other hand, based on models of achievement. In this study, the researcher focused on defining a conceptual model of achievement that simultaneously considers student and institutional level variables in the Malaysian context and tested selected components of the model using the data gathered.

## **SIGNIFICANCE OF THE STUDY**

As the issue of academic achievement has long been the interest of educators, policy makers, parents and school personnel, it is important that student background or student-level and institutional or school-level factors that affect achievement are identified. In addition, it is also important for policy makers to know how these factors from two different levels interact to influence students' academic achievement positively or negatively.

Another important issue that is related to achievement is the issue of educational equality. To achieve equality in education, all students are entitled to an equal opportunity and right environment in order for them to perform academically. Nevertheless, an environment that is conducive for a group of students may not be conducive for the others to perform academically. There is no such environment as "one size fits all". For instance, students of lower SES groups may require an environment with smaller enrolment that promotes closer student-teacher and among peers' relationships.

The findings of this study will assist educators and policy makers in particular, in manipulating factors that are amenable such as providing the right environment so that the student and the school factors can interact to positively influence students' academic achievement. In addition, despite its apparent complexity, the multivariate model discussed and developed is immanently practical. With its focus on multiple manipulable influences on learning, this model can help in understanding the likely relative payoff for interventions targeting different influences, and how possible interventions may work in combination.

## **RESEARCH QUESTIONS**

In this particular study, the researcher intends to examine the relationships between the state of Selangor students' achievement in PMR 2003 with selected student-level and school-level variables. The selected student-level factors include factors related to home backgrounds and students' personal factors, while the school-level factors include aspects that are institutionally related. The main goal is to identify some significant student-level and school-level factors and the extent to which they account for the variation in PMR 2003 achievement. Specifically, this study is aimed at answering the following research questions:

- a) Are there any differences in the mean PMR achievement among Sekolah Menengah Kebangsaan (National Secondary Schools) in the state of Selangor?
- b) What are the school-level variables associated with differences in the mean school achievement?
- c) What are the student-level variables that explain differences in PMR achievement?