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主　論　文　の　要　旨

論文題目	Factors influencing quality of education: A case study of eighth grade students' mathematics learning achievement in Nepal
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論　文　内　容　の　要　旨

After the commitment made to Education for All (EFA) in 1990, Nepal has made substantial progress in expanding educational opportunities, which can be demonstrated with the fact that net enrolment ratio (NER) at primary level increased from 67% in 1990 to 95% in 2012 (DOE, 2012). However, improving quality of education which is generally measured by higher test scores in examinations (Chapman et al., 2005) is a daunting challenge. Many children leave school without developing their potential and acquiring basic skills which are necessary for raising their standards of livings and the knowledge needed to effectively function in society. More importantly, systematic measurements of learning achievements of internationally acceptable standards are still absent. However, Nepal has carried out national assessments at regular intervals.

With the given problem of statement above, this study first examines the factors affecting the quality of education with a specific focus on learning achievement in mathematics. It particularly examines the effects of family characteristics, student characteristics, parental involvement, and school characteristics on learning achievement in mathematics of eighth grade students in Nepal. Second, this study analyzes the mathematics test focusing on its areas of learning (arithmetic, algebra, geometry, and statistics) which is known as the content domain of learning, and knowledge and development of mathematical skills which is considered as cognitive domain (knowledge, understanding, applying, and problem solving). Furthermore, it examines the mathematics knowledge, concepts and skills that are associated one another, and which knowledge and skills need to be developed primarily so that students can build further mathematical learning onto them.

It is of interest to examine the determining factors for learning achievement in mathematics because it informs policy makers and teachers about various factors that affect children's performance. At the same time, analyzing mathematics test will provide useful information to policy makers, curriculum developers, teachers, and other stakeholders to identify areas, concepts and topics of mathematics that need more focus and effort to improve the quality of education in Nepal. Similarly, policy makers and teachers will benefit from knowing what are the mathematical knowledge and concepts associated with each other and which concept needs focus to improve mathematics learning.

A multi-stage random stratified sampling method was used to select the samples. Initially, two stages of sampling –ecological zones and districts –were identified. Based on the proportion of students in three ecological zones –mountain, hill and lowland (Tarai) – nine districts were selected: one mountain district, four hill districts, and four lowland (Tarai) districts. Altogether, the samples consisted of 21 secondary schools with 762 eighth grade students (400 girls). Out of the total 21 sample secondary schools, four secondary schools are privately managed and 10 secondary schools are in urban areas. One head teacher and one mathematics teacher from each school participated in the study. Four types of instruments -mathematics tests, and questionnaires for students, head teachers, and mathematics teachers -were developed to collect the data for this dissertation.

Three types of methods were used to analyze the data for this study. First, multiple regression analysis is used to answer the first question, which predict the relationship between the dependent variable (mathematics score) and the set of independent variables (family characteristics, student characteristics, parental involvement, and school characteristics). Second, I used weighted mean and one-way ANOVA to analyze mathematics learning and to examine the differences among content and cognitive domain of mathematics learning by students with different attributes such as gender, ethnic background of students, type of schools, and location. Finally, principle component analysis (PCA) is used to examine the mathematics knowledge, concepts and skills that are associated one another, and which knowledge and skills need to be developed primarily so that students can build further mathematical learning onto them.

There are seven chapters in this dissertation. The first chapter overviews this dissertation. It particularly explains the background of the study, the statement of problem, the objective of the study, the research questions, and methodology that this study has adopted. Chapter 2 presents the conceptual framework used for this study. It reviews the previous studies on the relationship between students' learning achievement and factors affecting it such as family characteristics, student characteristics, parental involvement, and school characteristics. Furthermore, it explains the framework for assessments, particularly for mathematics learning.

Chapter 3 explains the methodology that this study has adopted for data analysis. It describes the sampling strategy, development of instruments for data collection, and methods for data analyze. It mainly explains the multiple regression analysis and principal component analysis (PCA) which are the main methods used for data analysis of this study. Chapter 4 presents an overview of educational development in Nepal, focusing particularly on the period after the 1990s. It describes the history of educational development, the current development status of school education, the educational structure, and current educational policies in Nepal.

Chapter 5 examines the factors affecting the mathematics learning achievement of eighth grade students in Nepal. It particularly answers the first research question which is *what are the factors affecting mathematics learning achievement of eighth grade students in Nepal?*

By using the multiple regression analysis, I developed the four models. The first model (Table 5.4) the set of family characteristics variables, were significantly related to students' learning achievement in mathematics (R^2 = 30.5, adjusted R^2 = 29.9). The standardized regression coefficient from model I indicated that the number of family members, father's and mother's education, the number of books in the home and presence of certain household items, but not travel time to school, were significantly related to children's mathematics performance in Nepal.

The effect of mother's education (.220, <0.01) is estimated stronger than fathers' education (.170, <0.01) on their children's learning achievement in mathematics although fewer mothers (24%) have completed secondary education compared to fathers (44%). There are two possible reasons for the higher effect of mothers' education. The first reason is that mothers are less employed than fathers, regardless of their level of education, which provide mothers more opportunities to spend time on their children's schooling, and found more supportive to their children's schooling particularly homework completion. Another specific reason for the higher effect of a mother's education is explainable by ownership on household resources. It is believed that the distribution of resources is more effective when women participate in decision making.

The findings indicated a negative relationship between family size and students' mathematics achievement. Students with smaller families (three to five family members) outperformed children in larger families (-.118, $p<0.01$). Similarly, availability of additional books at home and presence of certain items e.g., radio, bicycle, water tap, cassette player, television, telephone, gas stove, computer and motorbike which reflects family socio-economic status (SES) is significantly related to students' academic achievement with standardized regression coefficient of (.240, p<0.01) and (.090, p<0.05) respectively.

In Model II (Table 5.4), student characteristics variables were combined to the set of family characteristics variables. The result found a significant relationship with mathematics learning achievement (R^2 = .490, adjusted R^2 = .479; F(10,752) = 2.38; p<0.01). Student characteristics accounted for 18% of the variance in mathematics achievement, with a correlation coefficient of .70. Standardized coefficients for the Model II indicated that absenteeism, homework completion, time spent on household chores, preschool experience, and gender –but not time spent studying at home –were significantly related to mathematics learning achievement.

The findings of this study indicated that gender was significantly related to mathematics learning achievement (0.83, p<0.05). Overall, boys outperformed girls, with a mean difference of -3.05. However, for students attending private schools, girls (mean score = 24.37) outperformed boys (mean score = 21.27). The findings suggest that ethnic background of student is negatively related to students' mathematics learning achievement. Even though the improvements in school participation at all levels of school education, grade repetition and school absenteeism are still the major concern for educational development of Nepal. This study found the negative effect of grade repetition (-.50, p<0.10) and school absenteeism (-.185, p<0.01) on children's mathematics learning achievement. Similarly, involvement in household chores is found negatively associated to mathematics learning achievement (-.61, p<0.05). Private school students are found less involved on household chores (mean = 1.77 hours per day) compared to public school students (mean = 2.45 hours per day). Other variables- homework completion (.126, p<0.01) and experience of early childhood development (.086, p<0.05) are also found significantly related to mathematics learning of eighth grade students of Nepal.

The third model, the set of parental involvement variables were added to the model that included the sets of variables for family and student characteristics and found significantly related to mathematics learning achievement (R^2 = .513, adjusted R^2 = .50; $F(3,759) = 2.39$; $p<0.01$). The correlation coefficient for model III was .71.6 and accounted for 2.1% of variances in children's mathematics learning achievement. The findings indicated significant relationship between parental involvement in homework and children's school performance (1.31, $p<0.01$). Mothers are found helping their children's study more particularly in homework than fathers. However, huge differences on parental support are found between private and public schools. 72% of students from private schools reported that they get help from their parents on their study while it is 35% in the case of public schools. Similarly, parental support (0.72, <0.05) and monitoring (0.83,<0.05) are also found important for children's better school outcomes.

The fourth model (Table 5.4), which is the combination of school characteristics variables with family characteristics, student characteristics and parental involvement variables was found significantly related to students' mathematics performance (R^2 = .601, adjusted R^2 = .586; $F(8,754) = 5.93$; $p<0.01$). The correlation coefficient for the model IV was .775, which accounted for 8.6% of the variance in students' academic outcomes. This dissertation found significant differences in mathematics learning achievement between private (mean score = 22.31) and public schools (mean score = 9.47). Findings of this study indicated negative relationship between teacher-student ratio and students' academic achievement (-.102, $p<0.05$) which indicates children in smaller classes outperformed children in larger classes. The findings of this study estimated positive relationship between teacher training and students' mathematics achievement (0.77, $p<0.05$). Similarly, the number of school days in an academic year was significantly related to students' academic achievement (0.119, $p<0.01$).

Finally, findings of Chapter 5 indicated that family characteristics explained the largest amount of variance (29%) in mathematics learning achievement, followed by student characteristics (18%), parental involvement (2%), and school characteristics (8%) respectively. It further indicated that average mathematics learning of eighth grade students' in Nepal is relatively low with average of 11.55 out of maximum 50 marks.

Since the Chapter 5 indicated the low level of mathematics learning achievement, it is important to analyze mathematics test because it will inform the knowledge and skills of mathematics need to be improved. In Chapter 6, I analyzed mathematics learning by its areas such as arithmetic, algebra, data management, and geometry which is known as content domain, and development of mathematics skill and knowledge (knowledge, comprehension, application, and problem solving) which is considered as cognitive domain of learning. I particularly answered the second research question in Chapter 6 which is *What are the mathematical knowledge/concepts and skills associated with each other, and which are the knowledge and skills essential to develop further mathematical knowledge onto them and, then, to improve the mathematics learning of eighth grade students in Nepal?*

The analysis of mathematics test items (Table 6.3) showed that within the content domain of mathematics, students perform lowest in geometry, with an average of aggregate points of 17, followed by arithmetic, algebra and statistics, with averages of 0.29, 0.32 and 0.41 respectively. Similarly, students performed low in the cognitive domain (Table 6.4) regarding the capacity to *Apply* basic mathematical knowledge to the question in front, with the aggregate points of 0.17. The cognitive domain regarding the skills for *Problem solving* is considered to be the highest level of skills according to the Bloom's taxonomy (Figure 2.3). In this cognitive domain, students were found to perform higher than in the domain of the *Application*, with an average of 0.29. In the other cognitive domains, *Knowledge* and *Comprehension*, even if not encouraging, students perform relatively better, with averages of 0.50 and 0.36 respectively.

Similarly, data analysis (Table 6.5 and Table 6.6) showed that there are significant differences in the students' capacity to solve questions for various content and cognitive domains between gender, type of school, and location of school. However, no significant differences were found between students from middle and marginalized ethnic backgrounds, and students from hill and mountain eco-logical zones in content and cognitive domains of mathematics.

Finally, the result of principle component analysis (PCA) (Table 6.9) showed the mutual relationship among number system within arithmetic and algebraic items such as multiplication and division. This fact indicated that if the students' ability in the content domain on the number system is improved, the knowledge of algebraic multiplication and division is also likely to be improved. Similarly, geometric skills, particularly measurement and algebraic factorization (HCF and LCM), percentage, and profit and loss are found positively correlated with each other. Although this study does not explain how theses knowledge and skills influences each other, correlation coefficient of mathematics test items (Table 6.7) and PCA (Table 6.9) show that knowledge of geometric skills, particularly the skills of measurement and knowledge of percentage, are important to improve the knowledge of algebraic factorization and arithmetic knowledge of profit and loss respectively.

Furthermore the result (Table 6.8) showed that mathematics test items are clustered in five different components which have eigenvalue greater than 1. It indicates that the first component, whose constituent items are all about the knowledge on the number system, explain the variance in the test scores of sample population at the highest level (27%) followed by geometric skill (7%), data management (5%), ratio, percentage and proportion (5%), and algebraic expression (5%) respectively.

Chapter 7 concludes the findings of this dissertation, and its implications are explained. The finding of this dissertation that family characteristics are responsible for a large proportion (29%) of the variance in students' academic achievement has profound implications for educational development in Nepal, where more than 40% of parents are still illiterate. The study found that children with educated parents and in homes with greater material resources exhibited better academic performance, which suggests that educational policies should focus on families as well as schools.

The finding that gender and ethnic background of student were differentially associated with mathematics performance in Nepal is associated with the current political debate of equal opportunity of different groups of people to maintain social equity and harmony. This issue should be investigated further to determine the extent to which teacher training promotes gender sensitivity and schools provide inclusive and gender-friendly as well as gender-balanced curriculum and textbooks. Also, the study found significant differences in mathematics learning achievement between public and private schools, which is a serious concern for policy makers, teachers and parents. It means that the Nepalese government should adopt policies to reduce learning gaps in both types of school (private and public) they are offering.

The results of this study indicated a strong negative relationship between student absenteeism and mathematics performance. In the context of high absenteeism in both private and public schools and its diverse reasons, further study is needed to thoroughly understand this phenomenon. Nationally, the average teacher-student ratio is 44:1 at the basic education level. However, the average teacher-student ratio was 60:1 in the schools participating in the study, which is much higher than the national average, and indicates that human resources in education are not equally distributed. Policies such as teacher redeployment within and between districts should be introduced to distribute existing resources more equitably. Study findings also revealed that the schools' academic year did not provide the minimum number of days required by educational legislation and regulations, which is a serious concern for policy makers, educational administrators and other stakeholders.

Another implication of this dissertation belongs to the analysis of mathematics test conducted with eighth grade students. The result indicated that students perform low in geometry content domain of mathematics and indicated the significant differences in mathematics learning between gender, ethnicity of students, type of schools (private and public), and location of school. Other findings of mathematics test analysis (Table 6.8 and Table 6.9) indicated that mathematics test items are clustered in five components. They are number system, geometric skills, data management, ratio, and percentage, and algebraic expression. The first component number system is accounted for the highest variances (27%) in mathematics learning which suggested that policy makers and teachers should focus on improving basic mathematics skills (number system) for improving performance in other complicated areas of mathematics such as geometric skills, data management, ratio and percentage, and algebraic expressions. The analysis of mathematics test (Table 6.3 and Table 6.4) also indicated that students performed low in higher domain of mathematics learning such as skill and problem solving because many students fail to acquire basic mathematics skills (number system).