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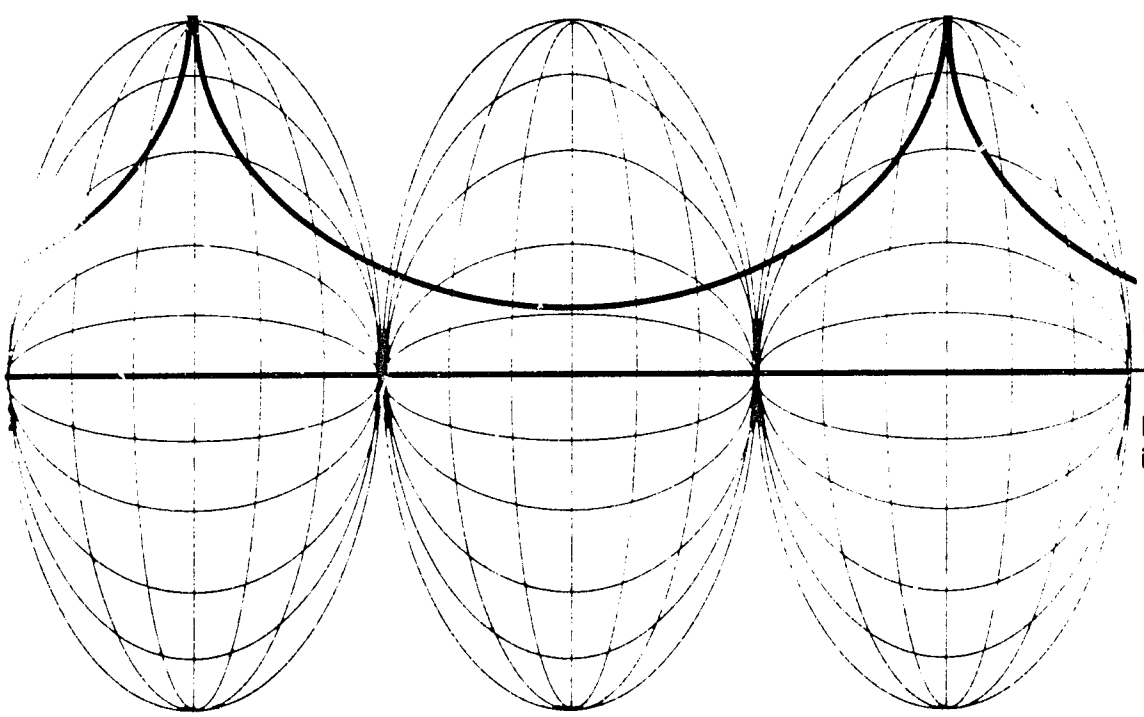

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The Effects of Pre-Primary Access and Quality on Educational Achievement in Thailand

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Abstract

Considerable research evidence supports the contention that investments in pre-primary education in developing nations can boost educational achievement. Moreover, researchers and policymakers have advocated expansion of the pre-primary sector as a strategy for overcoming inequality of educational opportunity. At present, however, the pre-primary education sector often magnifies rather than diminishes educational inequality in Third World nations for two reasons: first, rural and poor children are less likely than others to have access to pre-primary education; second, when rural and poor children do have access, the academic quality of the programs they attend tends to be relatively low. This paper examines the effect of pre-primary experience for children of varied backgrounds in Thailand. It then assesses the importance of inequalities in pre-primary access and quality for understanding disparities in math and language achievement at the primary level. Data from a nationally representative sample of Thai third graders were reanalyzed by means of hierarchical linear model. Based on this analysis, two policy options were considered: expanding access to pre-primary schooling and improving the quality of such schooling. Theoretical and methodological implications for comparative research on pre-primary education are discussed.

Throughout the Third World, educational policymakers face difficult choices as they seek to improve the outcomes of schooling. On the one hand, resources for school improvement are scarce: overall spending for education is limited and initiatives to improve school quality must compete for resources with proposals to expand the provision of education. On the other hand, policymakers confront a multitude of options: improving facilities, supplying educational materials, improving the preservice and inservice education of teachers, and strengthening school management and supervision, to name a few.

One strategy for improving the outcomes of primary and secondary schooling is to expand access to pre-primary schooling. Pre-school experience may prepare children cognitively to benefit from primary school instruction; and this "head start" may be especially important for linguistic minority children and for those whose home educational environments prepare them least well for the demands of the primary school classroom.[1]

Indeed, there is considerable evidence from research in developing nations that well conceived, well implemented pre-primary educational programs can significantly increase the cognitive outcomes children obtain during their primary school years.[2] In Chile, Argentina, and Bolivia, such programs have been found particularly effective for poor, rural children.[3] In the United States, a series of well-controlled longitudinal studies have concluded that effective pre-school education for poor children has significant short-term effects on cognitive outcomes and lasting and substantial effects on overall educational attainment and social behavior.[4]

Of course, pre-primary education also has important non-academic objectives: to improve nutrition and social development and to increase labor

force participation. The potentially multiple benefits of pre-primary expansion actually increase its appeal as a strategy for boosting academic outcomes. Moreover, the multiple objectives of pre-primary expansion may be mutually reinforcing: improving nutrition and social development may enhance cognitive growth, and the children who stand to gain most from enhanced nutrition might also benefit most from the enriched academic environment of the effective pre-school.

Buoyed by these arguments and by the encouraging results of research, many commentators have conceived of pre-primary schooling as a major policy strategy not only for improving the average level of student achievement, but also for reducing social disparities in educational outcomes. Ironically, however, there is compelling evidence indicating that, at present, the pre-primary sector in developing nations actually magnifies rather than reduces urban-rural and social disparities in educational attainment, for two reasons.

First, disadvantaged children have been found substantially less likely than advantaged children to have <u>access</u> to pre-primary education. Studies conducted in Argentina, Guatemala, India, Kenya, and Thailand have found that pre-primary programs are likely to be found in urban areas and to serve children of relatively high socioeconomic status.[5]

Second, when disadvantaged children have had access to pre-primary education, the schools they have attended have tended to be of lower academic <u>quality</u> -- with less intensely academic curricula, larger child-staff ratios and less trained teachers -- than schools attended by more advantaged children.[6] Such schools have tended to emphasize nutrition and custodial care more than cognitive development. And although there is some evidence that improved nutrition, health surveillance, and custodial care can by

themselves increase academic achievement,[7] the magnitude of such effects would seem necessarily smaller than those of cognitively-oriented programs which also guarantee appropriate health, nutrition, and socialization.

The growing body of evidence about the efficacy of pre-primary education holds promise for Third World educational policy-makers, but scarce resources confront them with dilemmas as well. One dilemma is that expanding the pre-primary sector is but one of many possible policies for improving primary school outcomes, and these policies must compete for scarce resources. Evidence about the likely costs and consequences of alternative policies would be most helpful for policy makers. A second dilemma is that a proposal to expand the pre-primary sector must compete against proposals to expand access to the secondary or higher education sectors. Our data do not provide guidance in approaching these dilemmas, which policy-makers, nonetheless, cannot ignore.

Even after a decision is made to expand investment in the pre-primary sector, however, a new dilemma arises: Should the investments maximize access to pre-primary schooling? If so, what minimal quality standards must be guaranteed? On the other hand, perhaps a wiser investment is to guarantee the highest possible quality, allowing access to expand only slowly. If quality is key, what minimal access is required to make the program meaningful? Our data have some bearing on this dilemma.

Of course, the access/quality choice is not dichotomous. The effects of access and quality on a society's educational achievement must be viewed as interactive: the value added to total attainment is the product of the number of children included times the benefit per child of participating.

This paper estimates the effect of pre-primary experience on educational achievement in Thailand. We also assess the importance of pre-primary experience for understanding urban - rural and socioeconomic gaps in achievement. We focus on two outcomes: mathematics and Thai language achievement. Thai policy makers view knowledge in these two areas as foundational for later academic learning.

We begin by reviewing research on the distribution, cost, and quality of alternative pre-primary education programs in Thailand. We then present the results of a re-analysis of data from a nationally representative sample of Thai third graders.[8] The data, which were collected in 1982, were re-analyzed separately for urban and rural sectors by means of the hierarchical linear model described by Raudenbush and Bryk.[9] Based on this analysis, two policy options were evaluated: expanding access to pre-primary education in rural areas and increasing the quality of pre-primary education in rural areas. The results illustrate our contention that these options should not be considered separately because of the interactive effects of increasing access and quality. We expect this principle to apply in other developing nations as well.

The Distribution of Pre-Primary Educational Opportunity in Thailand

In 1987 the National Education Commission (NEC) of Thailand recommended expansion of pre-primary access with a particular emphasis on nationally-declared deprived areas, remote rural areas, congested slum areas, and localities with a high proportion of residents speaking languages other than

Thai.[10] This recommendation is based, in part, on past research on the distribution, cost, and quality of pre-primary education.

Three broad categories of pre-primary schooling serve children in Thailand: two-year kindergartens, one-year kindergartens, and child care centers. Table 1 displays the types of pre-primary schools operating in Thailand in 1985 and provides enrollments for each of these categories.[11] There are, of course, differences among the schools within the three categories, but the differences among the categories themselves are of principal importance for our purposes. These include differences in academic intensity, cost per head, and student outcomes. The more academically intensive schools are also the most costly and have been found to produce the greatest cognitive gains. Such schools are attended more often by urban children than by rural children, and more often by children of high socioeconomic status (SES) than by children of low SES.

Insert Table 1 About Here

Two-year kindergartens. Programs offering two years of attendance are operated either privately, by public universities or teachers colleges, or by the Office of the National Primary Education Commission (ONPEC), the agency which administers most primary schools in Thailand, including the vast majority of rural primary schools. The private sector supplies most of the two-year schooling, as Table 1 shows. These schools are typically located in cities and provincial capitols and are attended primarily by children of government officials and relatively wealthy families. These schools emphasize literacy skills and have been found to produce the highest levels

of cognitive outcomes among the three categories of primary schooling. Per head, per year costs of have also been higher for this category than for the others (see Table 2).

One-year kindergartens. These programs are provided in primary schools under the control of ONPEC or the municipal governments. By far the most numerous among them are located in rural schools under the control of the ONPEC (Table 1). These schools, funded publicly, are designed to serve children who are unable to attend the two-year kindergartens. The programs aim to promote school readiness and have been found to produce higher levels of cognitive outcomes than have the child care centers, but not as high as those produced by the two-year kindergartens. The per head, per year cost is also higher than that of the child care centers but lower than that in the two-year kindergartens (Table 2). An attractive economic feature of these schools is that in some primary schools with excess teaching staff, the pre-primary programs can be staffed inexpensively by utilizing otherwise underutilized staff. In general, teacher qualifications are higher in the one-year kindergartens than in the child care centers.

Child Care Centers. These centers are located in monastery schools under the jurisdiction of the Department of Religion of the Ministry of Education; in young children's centers under either the Department of Community Development or the Border Police (Ministry of the Interior); in child nutrition programs under the jurisdiction of the Department of Health, Ministry of Public Health, and in child care centers under the National Women's Council. The centers are most often found in remote rural areas. Their staff are, on average, less trained than staff in the other categories. Costs per head are lower than in the other categories (see Table 2) and

cognitive outcomes have been found significantly lower than those in the other categories. Unfortunately, we have not been able to obtain effect sizes for the cognitive outcomes of the three types of pre-primary education.

Insert Table 2 About Here

Questions for the Re-analysis

Previous research on the costs and effects of pre-primary schooling in Thailand, reviewed above, suggests that pre-primary experience boosts student achievement. Therefore, increasing access to pre-primary schooling is one vehicle accessible to policy-makers for improving primary school achievement. This research also makes clear that variations in programs' quality as indicated by their academic emphasis, duration, and cost are associated with variations in achievement. Hence, an alternative strategy for boosting student achievement is to improve the quality of the existing programs, as opposed to increasing access. Of course, the strategies of increasing access and increasing quality may be used in combination.

The research reviewed above is consistent with past research in the developing world which reveals an unequal distribution of the quality of pre-primary programs as a function of urbanicity (urban versus rural residence) and SES. Urban children and more affluent children have been significantly more likely than other Thai children to attend the kinds of pre-primary schools found to have been especially effective in boosting student achievement.

In the present study, we reanalyzed a nationally representative sample of students collected in 1982 with the following questions in mind:

1. What has been the average effect of attending pre-primary school on mathematics and Thai language achievement?

2. Is the effect of pre-primary experience more pronounced for urban children than for rural children or for high than for low SES children?

3. To what extent does access to primary schooling depend on urbanicity and SES?

4. How important are inequities in the distribution of pre-primary access and quality as sources of urban-rural and socioeconomic gaps in achievement?

The design of the survey did not allow estimation of the separate effects of the different types of pre-primary experience. Rather, children were simply asked to indicate whether or not they had attended pre-primary school. However, since previous research suggested that urban children were far more likely than rural children to attend higher quality academic programs, we predicted that the effect of pre-primary attendance would be more pronounced in urban than in rural areas. Similarly, because high SES children have been found to attend higher quality pre-primary schools than do low SES children, we predicted that higher SES children would benefit more from pre-primary attendance than would lower SES children.

Policy relevance. Having estimated the effect of pre-primary education on overall achievement and on disparities based on urbanicity and social class, our next task was to evaluate alternative policies regarding pre-primary education. The survey provided no data on the variety of alternative pre-primary programs. We could, however, estimate the likely effect of expanding access to pre-primary programs, assuming that the average effect of these programs would hold constant. We also were able to estimate the effect

of increasing the average effectiveness of programs in the rural sector until it approached the average effectiveness of programs in the urban sector. Similarly, we could estimate the joint effect of increasing both access and quality.

Methodological limitations. The first inferential difficulty is in drawing causal inferences from cross-sectional data. Although our analysis controls for available student and community background characteristics, it is indeed possible that part of the effect we have attributed to pre-primary education results from uncontrolled effects of selection of children into pre-primary schools. In the present case, our causal inferences are, however, strengthened by prior research about the distribution of access and quality of pre-primary education.

A second methodological difficulty is that patterns of pre-primary enrollment may have changed since the 1982 data were collected, in part as a result of changes in government policy. During the fifth National Educational Development Plan (1982-1986) the government expanded pre-primary access for children in nationally declared deprived areas and children living in localities where more than 50% use language other than Thai at home. A subsequent survey conducted during 1988 will allow an evaluation of the effects of such changes, providing a better estimate of what changes in achievement can be expected to result from policy changes in access to and quality of pre-primary education. This evaluation will also improve controls on selectivity bias.

A third limitation is that we must assume that most "rural" children received their pre-primary schooling in rural areas and that urban children received their pre-primary experience in ruban areas. Undoubtedly some

migration has occurred, and we must assume that its incidence was small enough not to have distorted our key findings.

Method

Data. Data for this study were collected by the NEC as part of multi-purpose assessment of primary school efficiency.[12] The sampling design for this survey involved a multi-stage cluster sample. At the first stage, 18 of Thailand's 72 provinces were selected using a stratified random sample with three provincial strata classified by the number of primary schools in each province. The probability of selection of a province was proportional to its size. At the second stage, within each province, a simple random sample of schools was selected. Within schools, a third grade classroom was randomly selected and all students in that classroom were observed. The final sample included 399 schools, 11,442 students, 1074 teachers, and 3951 local residents; 389 schools had sufficient data for the analysis.

The dependent variables were standardized tests of mathematics and Thai language achievement. Independent variables include, at the student level, age, sex, SES (a composite of income, mother's education, and regularity of having pocket money) and pre-primary attendance (yes or no). At the school level, variables included average social class, the presence of disturbances in the community (as indicated by the presence of noise, smoke, smell, or flooding in the school area), a composite measure of the socioeconomic level of the community and the proportion of pupils with pre-primary experience.

Analyses. Analyses were conducted separately for urban and rural sectors by means of the hierarchical linear model. This method enables separate specification of models within and between schools and allows intercepts and within-school regression coefficients to be either fixed or

random. The method provides more credible results than does multiple regression analysis for data such as ours, where students are nested within schools.[13]

Results

Preliminary Analyses

Results of several preliminary analyses provided a useful context for interpreting the results of the analysis of the effect of pre-primary education. These analyses included assessments of a) the magnitude of school differences in achievement; b) the magnitude of urban-rural differences; c) the effects of child background; and e) the effects of school composition. We summarize the results of these preliminary analyses below. Details are available in a technical report.[14]

School differences. This first preliminary analysis was intended to determine the degree to which Thai primary schools vary in their achievement levels. The results showed substantial variation among schools in achievement levels: 31% of the total variation in math achievement reflected differences among schools, while the remaining 69% of the variation reflected differences among children within schools. In the case of Thai language achievement, 35% of the total variation reflected variation among schools with 65% of the variation lying within schools.

Urban-rural differences. Urban-rural achievement gaps were substantial. Urban children scored .55 standard deviation units higher than did rural children in mathematics and .62 standard deviations higher in Thai language. When measured as a fraction of the among-school standard deviations, these

urban-rural differences are even more dramatic: .99 sd units in mathematics and 1.10 sd units in Thai language.

Pupil background. Any assessment of the effect of pre-primary education would have to adjust for the effect of pupil background. The next analysis, therefore, aimed to discover which pupil background variables needed to be taken into account. In this preliminary analyses, we used the 10 percent significance level as a conservative criterion to avoid leaving out a pupil background variable which might be important.

In the case of mathematics achievement, pupil sex, socioeconomic status (SES) and age were found to be significantly related to achievement. Boys outscored girls in math and higher SES children outscored lower SES children.

Age was negatively related to achievement. Students in the study were third graders, and older children tended to be those who had been held back a grade. It may be argued that age should not be controlled in a study of pre-primary effects, because one of the benefits of pre-primary education may be to prevent repetition. However, repetition may also reflect developmental or home and school environmental effects. Our decision to control age, therefore leads perhaps to a conservative estimate of the effects of pre-primary education.

In the case of Thai language achievement, sex, SES, and age were also significantly related to achievement. However, in this case, girls outscored boys. Again, SES was positively related to the outcome and age was negatively related to the outcome.

One of the advantages of hierarchical linear models is that they allow the investigator to examine whether the effect of a child background variable varies significantly from school to school. We found that the effects of SES

and age were quite homogeneous across schools for both outcomes. However, in both cases, the effect of sex varied significantly from school to school. This means, for example, that although boys outscored girls on average in math, this "gender gap" varied significantly from school to school. Apparently sex differences in math achievement in some schools are small or non-existent. Similarly, girls outscored boys, on average, in Thai language achievement, but this difference was more pronounced in some schools than in others. Hence, a goal of subsequent research might be to discover characteristics of schools, teachers, and pupils which account for this variation in the magnitude of the "gender gap." Our subsequent analyses did take account of this variation.

School composition and context. We reasoned that any estimate of the effect of pre-primary experience would have to take into account the effects of school composition and community background. Three such measures were available: the average SES of the school, the presence or absence of disturbances in the community around the school and a composite measure of the socioeconomic level of the community in which the school was located. We found that the average SES of the school was significantly positively related to both math and Thai language achievement in both the urban and the rural areas. Once average SES was controlled, the presence of community disturbances and the socioeconomic level of the community were not significantly predictive of achievement. Student background and school composition differences accounted for a substantial proportion of the urban-rural gaps in both math and Thai language (64% and 74%, respectively). However, the remaining differences between urban and rural means were substantively important and statistically significant.

Estimates of the Effect of Pre-Primary Attendance Controlling for Pupil and School Background

To assess the effect of pre-primary education, models were estimated separately for the urban and rural sectors. Within-child predictors included sex, age, social class, and pre-primary education. Two-way interaction effects between pre-primary education on the one hand and pupil sex and SES, on the other, were also tested. Based on results reported above, the effect of sex was allowed to be random (ie to vary from school to school) and the effects of social class and age were fixed. Because a preliminary analysis showed no significant variability from school to school in the effect of pre-primary education, this effect was also fixed.

Between-school variables included average social class of the school, and the proportion of children attending pre-school. Key results (see Table 3) were as follows.

Math Achievement Results (see Table 3a).

1. In the urban sector, children attending pre-primary school scored, on average, 1.36 points higher than children not attending pre-primary education, $Z = 4.54$, $p < .001$. This effect is equivalent to about .15 standard deviation units.

2. In the rural sector, the estimated advantage of pre-school education was .81 points, $Z = 2.60$, $p < .005$. This effect is about .08 units of a standard deviation.

3. There were no interaction effects at the individual level between pre-primary education and sex or pre-primary education and social class.

Thai language achievement results (see Table 3b).

1. In the urban sector, children who had attended pre-primary education scored 1.49 points higher in Thai language achievement than did children with no pre-primary experience after controlling for the effects of age, SES, and sex, $Z = 5.51$, $p < .001$. This effect is equivalent to .16 standard deviation units.

2. In the rural sector, the estimated effect of pre-primary attendance on Thai language achievement was .90 points, $Z = 2.96$, $p < .01$. This effect is equivalent is .10 standard deviation unit.

3. In contrast to the math achievement results, there was a significant interaction effect between pre-primary attendance and pupil SES in the rural sector. Specifically, the effect of pre-primary attendance was more pronounced for high SES children than for low SES children, $Z = 2.80$, $p < .01$.

Insert Table 3 About Here

Discussion

We shall first summarize the key results of the investigation. We then consider the implications of these results for policy aimed at improving the quality of primary education and reducing urban-rural and socioeconomic disparities in math achievement. We conclude by considering implications for new research needed to inform policy-making in these areas.

Key Results

Third graders attending pre-primary schools in Thailand achieved significantly more in mathematics and Thai language than did children of similar social background, sex, and age with no pre-primary experience. If

we assume that statistical controls for student background and school composition, including pupil and school social class, pupil sex, and pupil age, are adequate, we may infer that pre-primary education boosts primary math achievement. The size of the effect is modest but not trivial, equivalent to 15 to 16 percent of standard deviation in the urban sector and nine to ten percent of the standard deviation in the rural sector.

In the rural sector, the effect of attending pre-primary school on Thai language achievement was more pronounced for high- than for low-SES students. This result is consistent with research on Thai pre-primary education, summarized above, showing that high-SES children attended more academically effective programs than did low-SES children. Other interpretations are, of course, possible. For instance, it might be argued that high SES children's home background better equips them to benefit from pre-primary education. However, research cited earlier provides no evidence of such an effect. In fact, several studies found just the opposite: that poorer children benefited more from pre-primary education than did better-off children when the program was held constant. No interaction effect occurred in the case of mathematics achievement.

It is interesting to speculate about why the interaction between pre-primary exposure and SES occurred in the rural but not the urban areas and with respect to Thai language but not math. One plausible interpretation concerns the role of dialect. Use of dialects other than Central Thai is far more common in rural than in urban areas. It may be that effective pre-primary programs in rural areas focus heavily on teaching Central Thai -- the language of instruction. If high SES children had greater access than low SES children to such programs, an interaction similar to that observed would be expected.

The role of language learning in the effective pre-school -- especially in areas where non-standard dialects are spoken -- is a topic of major importance for future research, for it could be that providing linguistic minority children a "head start" would serve as a major purpose for pre-primary schooling.

Implications for Urban-Rural Equity.

Despite its modest size, the effect of pre-primary education is important for understanding the disparity in achievement between urban and rural areas in Thailand, for two reasons. First, while 50.3% of urban children attended pre-primary schools in 1982, only 28.8% of the rural children had any pre-primary experience. Second, the effect of pre-primary education was estimated to be 68 percent larger, on average, in the urban than in the rural sector for mathematics achievement and 65 percent larger in the case of Thai language achievement (see Table 3).

It is possible that the apparent discrepancy in the efficacy of pre-primary education resulted from chance. It might also be that urban children are more susceptible to influence by such education than are rural children, though previous research makes that hypothesis implausible. And it could be that our controls for background are inadequate. Nevertheless the hypothesis of differential quality of urban and rural pre-primary programs is strongly supported by research reviewed earlier on the duration, academic emphasis and effects of pre-primary programs available to urban and rural children.

The implication of these results is that two strategies are available for using investment in the pre-primary sector to reduce urban/rural achievement

disparities. The first is to increase access to pre-primary education in rural areas. The second is to increase the quality of pre-primary education in rural areas. Because the effects of access and quality are interactive, a third strategy is to combine these two strategies.

As mentioned, the total effect of investing in pre-primary schooling may be viewed as the product of the value added to each student's outcomes multiplied by the number of students exposed. Improving quality presumably increases the value added; increasing access increases exposure. Given fixed resources, one can imagine maximizing the total effect by considering the costs associated with improving quality and increasing access. However, this forumlation ignores equity concerns: distributing the benefits equitably may override maximiing the total net contribution.

Although our data provide at best a very rough estimate of the possible effects of pursuing these strategies alone or in combination, it is informative to use our estimated models to explore the importance of differential access and quality as sources of the urban-rural disparity. To do so we re-estimated the urban- rural gaps in mathematics and Thai language under four models.

Model 1 provides an adjusted estimate of the urban/rural gap.[15] The essential purpose is to estimate the urban-rural achievement gap after removing the effect of differences in pupil background. The reasoning is that educational policymakers have little or no direct impact on pupils' social background. On the other hand, the component of the urban-rural gap which is independent of social background is potentially amenable to direct influence by educational policy. Subsequent models were intended to assess

the contribution of pre-primary educational policy to this adjusted urban-rural achievement gap.

Model 2 might be called the "equal access model". Our goal was to simulate the effect of equalizing access to pre-primary education in the urban and rural sectors.[16]

Model 3 might be called the "equal quality" model. Our goal was to simulate the effects of equalizing pre-primary quality in the urban and rural sectors.[17]

Model 4 might be called the "equal access and quality" model. The goal here was to simulate the effects of equalizing both access and quality between the two sectors[18].

The results of this simulation are presented in Table 4. We see that the "equal access model" reduces by about eight percent the adjusted urban/rural gap for both math and Thai language achievement. The "equal quality" model reduces by about 10 percent the gap in math and by about 17 percent the gap in Thai language. The "equal access and quality" model reduces the adjusted urban/rural gap by 23 percent in the case of math and 34 percent in the case of Thai language.

Insert Table 4 About Here

Although admittedly speculative, these simulations illustrate the interactive effects of access and quality. Increasing access and quality may be expected to produce gains in excess of the sum of their separate effects. The simulation also provides evidence that disparities in access to and quality of pre-primary education in the urban and rural areas

contribute importantly to the urban/rural achievement gap about which Thai policy-makers and policy-makers in other Third World countries are deeply concerned.

Effects On Social Class Equity.

Our data provide some evidence that the distribution of both access to and quality of pre-primary education are important to understanding the gap between rich and poor children's math achievement in Thailand. The data suggest clearly that children of high SES are considerably more likely to attend pre-primary school than are children of low SES. Specifically the mean difference in SES between those attending and those not attending is .67 standard deviation units, $t = 36.16$, $p < .0001$. Because pre-primary experience predicts later achievement, this differential access is a source of the socioeconomic gap in math and Thai language achievement. Moreover, as mentioned, the effect of pre-primary experience on Thai language achievement was found to be more pronounced for high-SES children than for low-SES children in the rural sector. Past research on the differences in quality of pre-primary schools attended by children of varying SES leads us to conclude that at least part of this effect results from differential quality.

Policy Implications

Both these data and previous research suggest that student achievement can be boosted by expanding access to pre-primary schools and/or by increasing the duration and instructional effectiveness of existing pre-primary programs. We expect that such changes, if targeted to rural areas and areas with large poverty concentrations, would also reduce inequities in the distribution of student achievement. Moreover, research reviewed earlier provides some

information about the likely costs of such changes. It is particularly noteworthy that Thailand has found pre-primary schooling to be an effective measure for utilizing excess teaching personnel. Many rural primary schools with excess teachers have recently begun taking in pre-primary age children. The excess teachers are assigned to teach these children. This increased utilization of the teaching force has a beneficial effect and provides a politically effective measure for coping with overstaffing which is present in some areas as a result of a declining birth rate. In other societies with teacher shortages, expanding the pre-primary sector may be relatively more expensive.

It would be a mistake, however, to choose between boosting access versus increasing quality based on separately considering likely costs and effects. The combined effect of access and quality are, rather, interactive, so that the challenge is to find the optimal mix of the two rather than to choose between them.

In considering the implications of these results for policy, one must keep in mind that pre-primary investment is one strategy among many for improving the outcomes of schooling. Effective policy-making requires information about the likely costs and consequences of these alternative strategies. At a minimum, our results suggest that pre-primary investment should be seroiusly consdiered as one of the alternatives.

Implications for Future Research in Thailand

Since 1982, the government of Thailand has sought to increase pre-primary access with a special emphasis on nationally declared deprived areas and localities with large proportions of linguistic minority children. This effort may be viewed as a kind of "natural experiment", the results of which

may be of great help in clarifying questions left unanswered by the analysis presented here. The cost of the program and its success in expanding access are all highly relevant to the questions raised in this paper.

Of equal importance is the need for data on cost and effects of alternative strategies for improving quality, strategies such as improving facilities, school management, teacher competency, and instructional materials in rural areas. Only in the context of data on these alternatives can any single strategy for improving primary quality be evaluated. These issues supply topics for subsequent policy analyses to be conducted under the auspices of Project BRIDGES in Thailand.

Implications for Comparative Research

Our finding that particicpation in pre-primary schooling predicts improved achievement in language skills and mathematics is consistent with research cited earlier about the benefits of pre-primary schooling in numerous countries. In this case the finding is based on a large, nationally representative sample, and the results reveal that the effect is positive in rural and urban areas and for children of varied socioeconomic and linguistic backgrounds.

On the other hand, our results seem, at least on the surface, to contradict findings from other countries, cited earlier, which indicated that disadvantaged children benefited more than advantaged children from pre-primary experience. Our results suggest, by contrast, that advantaged children in Thailand benefited more from pre-primary school than did disadvantaged children. However, the discrepancy can be explained on methodological grounds. Understanding the methodological source of the discrepancy points toward future research needed in comparative studies of pre-primary schooling.

Earlier studies reported that poor children may be especially receptive to the benefits of pre-school. This inference, of course, requires a research design which holds constant the quality of the program to which children of varied backgrounds were responding. Such studies typically cannot tell us, however, about the net effects of national pre-primary policy across an entire society, because, in practice, program quality varies across a society and is related to child background.

The present study, in contrast, was a large-scale survey in which it was indeed possible to assess the net effects of pre-primary policy for various types of children. Unfortunately, information on program quality was not collected. Thus the present study can tell us nothing about the comparative benefit of any particular program for children of varied background.

What seems to be needed in future research are studies which a) monitor and measure the variations in quality of pre-primary programs across entire societies; and b) examine the responses of children of different backgrounds to the particular programs. Only then will it be possible to disentangle the effects of differential program quality from the effects of differential child response. Future policy studies must also examine the cost effectiveness of pre-primary expansion relative to other direct investments in basic education.

Such unsolved problems, should not, however, obscure the convergent aspects of research on pre-primary schooling in developing nations. Pre-primary experience has been found consistently to predict enhanced academic achievement. In most third World nations, access to pre-primary education is limited and does depend on social background. Thus, there is every reason to expect that expansion of the pre-primary sector will improve educational outcomes and enhance equality of opportunity in those nations.

Notes

[1]See, for example, S. M. Grantham-McGregor, "Development of Intervention Strategies for Young Children;" N.O. Ortiz, "Psychosocial Stimulation and Complimentary Nourishment During the First Three Years; Its Repercussions on Scholastic Achievement;" J.R. Berrueta-Clement, L.J. Schuenhart, and D.P. Weikart, "Lasting Effects of Preschool Education on Children from Low-income Families in the United States;" P. Pozner, "Relationship Between Preschool Education and First Grade in Argentina," in Preventing School Failure: The Relationship Between Preschool and Primary Education (International Development Research Center (IDRC), 1983).

[2]See IDRC, 1983, as well as R. Halpern, and R. Myers, Effects of Early Childhood Intervention on Primary School Progress and Performance in the Developing Countries, (High/Scope Educational Research Foundation, 1985, ED 279 392), which provide evidence from many countries on the effects of pre-primary schooling on later achievement.

[3]See J. Flip, S. Donoso, C. Cardemil, E. Dieguez, J. Torres, and E. Schiefelbein, "The relationship between pre-primary and grade one primary education in state schools in Chile," in IDRC, 1983; and also Halpren and Myers, 1985, page 22.

[4]Consortium for Longitudinal Studies, As the Twig is Bent: Lasting Effects of Preschool Programs (London: Lawrence Erlbaum Associates, 1983).

[5]P. Pozner, "Relationship between preschool education and first grade in Argentina;" O.N. Gakuru, "Education and social class formation: the case of preschool education in Kenya;" N. Passornsiri, "Preschool services in Thailand;" V.R. Mistry, "Fostering readiness for primary grades: innovative action programs with municipal schools in India;" Y. deBaessa, "Sociocultural correlations involved in the cognitive and physical development of children from urban Guatemala;" all in IDRC, 1983.

[6]Halpern and Myers, 1985, review research indicating that preschools in Argentina serving wealthier children had smaller classes than schools serving poorer children; in both Argentina and Chile, such classes were characterized by more active, child-centered learning. In Colombia and Bolivia, pre-schools serving poor children had less well-prepared teachers and tended to emphasize health and nutrition rather than academic learning. Similar evidence from Kenya is reported in O.N. Gakuru, 1983. Detailed evidence from Thailand is reviewed below in the present article but may also be found in Passornsiri, 1983.

[7]Halpern and Myers, 1985, report that a modestly funded program using minimally trained community people as staff and emphasizing nutrition produced modest but statistically significant effects on cognitive, social and motor development. They also reviewed results from Colombia indicating that an experimental program of supplementary nutrition and health surveillance without extra educational stimulation produced significantly higher cognitive outcomes than did a no-treatment control.

[8]A. Chantavanich, N. Wiratchai, W. Artidtieng, U. Wong-a-piwatkul, The Determinants of Primary School Efficiency: An Evaluation Study of Primary School Efficiency in Thailand; (Bangkok: Office of the National Education Commission, 1982).

[9]S.W. Raudenbush, and A.S. Bryk, "A hierarchial model for studying school effects," Sociology of Education, vol. 59 (1986).

[10]Office of the National Education Commission's Sixth National Educational Development Plan for 1987-1991, (Bangkok: Office of the National Education Commission, 1986).

[11]The results presented in this section were synthesized by the second author from the following documents, produced by the Office of the National Education Commission, Bangkok, Thailand: The Organization of Pre-primary School Centers in Thailand, 1979; The Efficiency and Effectiveness of Pre-primary School Center Organization, 1980; The Efficiency of Pre-Primary School Center Service, 1985; Cost Analysis of Pre-Primary School Management and Estimation of the Numbers of Students and Teachers, 1987; A Follow-up Study of the Project on Rural Kindergarten Schools, 1987; and also from the Office of the National Primary Education Commission's Primary Education in Thailand, 1984.

[12]Chantavenich, et al, 1982.

[13]Using the methodology described in detail by Raudenbush and Bryk, 1986, the variances and covariances among within-school intercepts and slopes are estimated and all fixed effects (group-level regression coefficients) are adjusted for such components of covariance. All parameters are estimated simultaneously by means of maximum likelihood using the EM algorithm. Advantages of this kind of approach for analyzing multilevel data are discussed by M. Aitkin and N. Longford, "Statistical modeling issues in school effectiveness studies," Journal of the Royal Statistical Society, vol. 144, Series A, (1986); W.M. Mason, G.Y. Wong, and B. Entwistle, "Contextual analysis through the multi-level linear model," Sociological Methodology, 1983-1984 volume (San Francisco: Jossey-Bass, 1984); Raudenbush and Bryk, 1986; and most recently by A.R. Riddell, "An Alternative Approach to the Study of School Effectiveness in Third World Countries", Comparative Education Review, vol. 33 (November 1989).

[14]S.W. Raudenbush, S. Kidchanapanish, and S.J. Kang, "Pre-primary Educational Policy as a Vehicle for Improving Primary School Outcomes," Technical Report (East Lansing, Michigan: Michigan State University, 1989).

[15]Specifically, we calculated predicted values of urban and rural means using the rural mean SES as a predictor with separate sector percentages of children receiving pre-primary education and separate sector effects of pre-primary education. Thus, social class is held constant in the two sectors but pre-primary access and quality are allowed to vary between sectors.

[16]To implement this goal, we calculated predicted values of urban and rural means holding constant both mean SES and the percentage of children attending pre-primary schooling. Specifically, we used the urban percentage (50.3 percent) as the predictor in both areas. The effect of pre-primary education was allowed to vary.

[17]To implement this goal, we calculated predicted sector means holding constant both mean SES and the effect of pre-primary education, but allowed the percentage attending pre-primary schools to vary. The effect of pre-primary education was held constant at the higher, urban, value.

[18] Predicted sector means were calculated holding constant mean SES, percentage of children attending pre-primary education, and the effect of pre-primary education.

Table 1 Distribution of Pre-primary Education In Thailand in 1985

School Type	Number of schools	Number of students	Percentage of 3-5 age population
1. Two-year kindergartens			
A. Demonstration schools in public universities and teacher's colleges	16	2,154	0.05
B. Private kindergartens	1,219	273,099	7.18
C. Provincial kindergartens under ONPEC	78	35,547	0.33
2. One-year pre-primary schools[a]			
A. Rural pre-primary schools under ONPEC or municipal schools	10,736	361,046	9.49
3. Child care centers			
A. Centers under the Department of Community Development	3,255	121,684	3.20
B. Child nutrition program centers (under Department of Health)	1,271	50,840	1.34
C. Others	353	20,699	0.55
Total	16,928	865,069	22.74

[a] The total number of rural primary schools under control of ONPEC was 31,172 in 1985; 465 were controlled by municipalities.

Table 2

Average Per Capita, Per Year Costs of Pre-primary Education in Thailand in 1985

Type of School	Cost per head per year (in US Dollars)
Two-year kindergartens	249.64
One-year pre-primary schools	164.80
Child care centers	91.56

Table 3

Effects of Pre-primary Education

(A) Mathematics Achievement

Fixed Effects

	Urban Sector			Rural Sector		
Fixed Effect	Estimate	Standard Error	Ratio	Estimate	Standard Error	Ratio
Base	100.650	.462	---	99.61	.368	---
AverageSES	9.61	1.44	6.67	11.48	1.07	10.68
Sex	-.514	.295	-1.74	-.271	.267	-1.02
Age	-.0109	.0137	-.80	-.0479	.0126	-3.81
SES	.0428	.0155	2.76	.0720	.0141	5.11
Pre-primary Education	1.36	.299	4.54	.807	.310	2.60

Random Effects

	Urban Sector				Rural Sector			
Random Effect	Estimated Variance	df	χ^2	p	Estimated Variance	df	χ^2	p
Bases	21.82	164	938.88	.000	13.77	216	893.69	.000
Sex Effects	4.04	165	231.94	.001	4.86	217	325.20	.000

Table 3 (Continued)

(B) Thai Language Achievement

Fixed Effects

	Urban Sector			Rural Sector		
Fixed Effect	Estimate	Standard Error	Ratio	Estimate	Standard Error	Ratio
Base	99.680	.449	---	98.17	.370	---
AverageSES	10.13	1.44	7.05	11.56	1.08	10.66
Sex	1.839	.289	6.35	1.984	.265	7.46
Age	-.0662	.0124	-5.36	-.0794	.0122	-6.51
SES	.0639	.0140	4.57	.0624	.0158	3.94
Pre-primary Education	1.49	.270	5.51	.903	.305	2.96
Pre-primary by SES interaction[a]	—	—	—	.0740	.0264	2.80

Random Effects

	Urban Sector				Rural Sector			
Random Effect	Estimated Variance	df	χ^2	p	Estimated Variance	df	χ^2	p
Bases	21.19	164	1171.60	.000	13.74	216	954.77	.000
Sex Effects	5.39	165	276.91	.000	5.40	217	348.13	.000

[a] This interaction was non-significant in the urban sector and, hence, was dropped from the model to improve estimation of the main effects.

Table 4

Relationship Between Pre-primary education and the Urban-Rural Achievement Gap

(A) Mathematics Achievement

Model	Urban Mean	Rural Mean	Urban-rural Difference	Percent Reduction[a]
1. Background effects	99.55	97.67	1.89	---
2. Equal Access	99.55	97.82	1.73	8.5
3. Equal Quality	99.55	97.85	1.70	10.0
4. Equal Access and Qualtiy	99.55	98.10	1.45	23.3

Table 4 (Continued)

Relationship Between Pre-primary education and the Urban-Rural Achievement Gap

(B) Thai Language Achievement

Model	Urban Mean	Rural Mean	Urban-rural Difference	Percent Reduction[b]
1. Background effects	97.74	96.17	1.57	---
2. Equal Access	97.74	96.30	1.44	8.3
3. Equal Quality	97.74	96.44	1.31	16.6
4. Equal Access and qualtiy	97.74	96.71	1.03	34.4

a, b Entries in this column indicate the expected reduction in the urban-rural achievement gap if access to pre-primary schooling were equalized between urban and rural schools; if quality were equalized; or if both access and quality were equalized. The expected reduction is computed as a percentage of the total urban-rural gap, after adjustment for pupil background.