5

The National Context

The activity system at the national level is linked to the school activity system by a nested hierarchical relationship. In fact, the school activity system itself is nested within the national system and acts as 'subject' in it. This inclusive hierarchical relationship between the two systems implies that the national system affects the school system and is affected by it, though to a lesser degree. As in the school activity system, the object of the math education activity in the national context is the learning of math. However, in the national system, 'school' plays the role of 'subject' (compared to 'student' in the school system) within the community of the schools of a country (compared to 'school community').

This chapter includes two major themes. First, the activity system of mathematics education in the national context will be described and its factors (nodes of the activity system) and their attributes, that may contribute to inequities in math education at the national level, will be identified. Second, the relevant research will be reviewed, synthesized, and interpreted within the framework of the activity system.

5.1 Math Education System at the National Level: Factors and Their Attributes

Figure 5.1 represents a schematic diagram of the activity system of math education at the national level. In this figure, each of the six nodes and its attributes are shown in a rectangle, with the name of the node in italics and its attributes as a list. The names of the factors (nodes) are the result of my interpretation of the factors of the activity system. The attributes that belong to each of the six nodes of the activity system are derived by logical analysis based on their relevance to equity.

Following is a brief description, with examples, of three of the factors and their relevant attributes as they apply in the activity system of mathemat-

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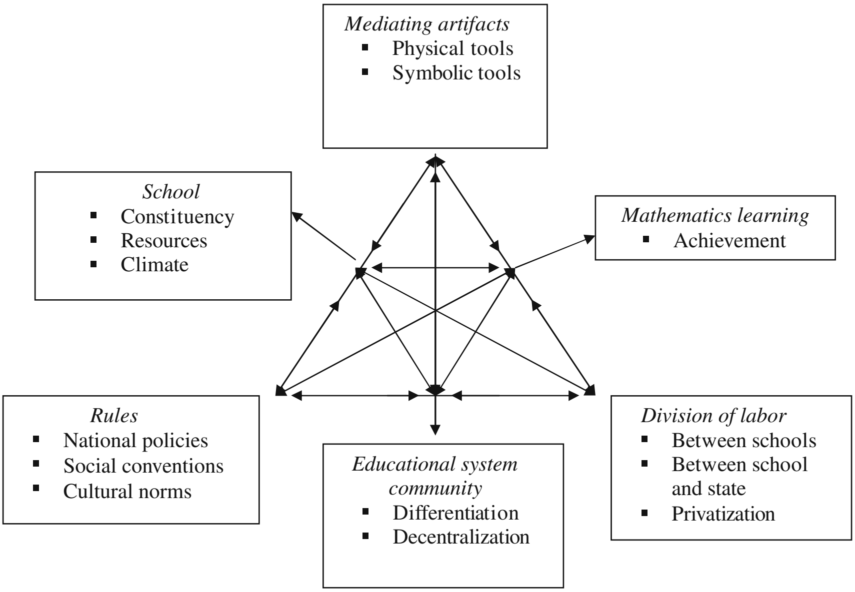

Fig. 5.1. Activity system of mathematics education at the national level with the potential inequity factors identified

ics education at the national level. The description of math learning, math mediating artifacts, and rules are the same as those in Chapter 4.

5.1.1 School

In the school as an activity system, school assumes the role of 'subject'. In fact, the students, math teachers and supervisors all constitute the 'subject' in the activity system. One of the salient school attributes is its constituency in terms of the students' sociocultural backgrounds and their personal traits, such as ethnicity, gender, and native language. Of course, we assume that the schools in one nation have, more or less, comparable variations in students' abilities and attitudes.

School resources refer to human resources as well as learning/teaching resources available to math instruction. They include teachers and their qualifications, as well as physical resources such as textbooks, calculators, computers... According to TIMSS 2003 (see Chapter 7 in this book), school climate involves three dimensions. The first dimension includes teachers' perceptions of job satisfaction, their understanding of the school's curricular goals, their success in implementing the school's curriculum, and their expectations for student achievement. A second component of the school climate is parent's support for student achievement and their involvement in school activities. A third component of school climate is students' regard for school property and their desire to do well in school.

5.1.2 Educational System Community

The educational system community consists of the students and math education community in the entire national education system. One aspect of the structure of the educational system is the degree of institutional differentiation in the system. Normally, the education system mandates institutional differentiation which requires students to choose a program or a curriculum at a certain age and this limits students' choice of programs and curricula and supposedly affects their opportunities for further education and career choices. Mathematics performance plays a role in channeling students to science or humanities programs of study and hence contributes to potential inequities produced by institutional differentiation.

Decentralization of schools allows for different degrees of school autonomy to enable schools to manage their own affairs. Many equity issues relate to school autonomy and these depend on the goals and extent of decentralization. Inequities in math education, as in any other school subject, are affected by decentralization in terms of source allocation and extent of state oversight.

5.1.3 Division of Labor

This refers to the way both labor and power are divided among the members of the educational system community, especially between the state and schools. Inequities may result from the imbalance in admission and assessment policies between private and public schools. Inequities also may result from the differences in autonomy granted to schools in the same country.

5.2 Interactions and Inequities: An Example

Inequities among schools in mathematics education at the national level are potentially generated by the interactions of the attributes of the factors in the activity system. Figure 5.1 (the bidirectional arrows in indicate such interactions), identifies the salient factors that belong to the six nodes of the activity system and their attributes. These, by themselves, are neutral to equity or inequity; it is the interactions of these factors and their attributes that may render them inequitable. The interactions of such factors or their attributes shall be called *inequity factors*.

The following example shows how interactions between the attributes of the factors in the system result in inequities in math education. For the sake of contrast two schools in a developing country are considered: One is private and the other is public. The constituency of the public school is likely to be from a predominantly low socioeconomic level and that of the private school from middle and high socioeconomic levels. It is likely that the public school students have home environments that are less favorable to learning than those of the private school students. It is also likely that the private school, in comparison to the public school, will have more and better teaching and learning resources, more qualified teachers, and more autonomy in their instructional decisions than the public school. Hence, it is reasonable to expect that the inequities in the two schools will result in different levels of math learning and achievement.

The rest of this chapter will be organized under the following titles:

1. Inequities Related to School, Education School System, and Mediating Artifacts Interactions
2. Inequities Related to the Interaction of School and Mathematics Learning Outcomes
3. Inequities Related to the Interaction of State Policies and the Education System

5.3 Inequities Related to School, Education School System, and Mediating Artifacts Interactions

5.3.1 General Pattern of Interactions

The interactions among the three factors of school, math mediating artifacts, and the educational system seem to account for most of the inequities in math education at the national level. Each of these three factors has at least one attribute which impacts the other attributes of the factor and hence defines it. Before discussing the interactions between the three factors, we shall identify and describe the defining attribute of each.

For the school factor, the school constituency is a defining attribute. First, the socioeconomic and cultural backgrounds of the students and teachers of the school define its sociocultural identity. Second, the school constituency also determines, in a direct and significant way, the quantity and quality of human and material resources available for mathematics instruction and learning in the school. Third, the two attributes of school constituency and resources together contribute towards defining the school climate.

The language used in teaching math is a defining attribute of the mediating artifacts. The language is both an artifact for communication and for cultural transmission. As a communication system, the language of instruction and learning affects the use of all other physical artifacts which use language, such as textbooks, the computer, and the internet. Language also plays a critical role in communicating mathematical concepts.

The structure of the education system is a defining factor of the educational system community. The degree of centralization and differentiation are two critical attributes of the education system structure. The degree of centralization in the system defines the extent to which schools are autonomous in their instructional decisions. On the other hand, institutional differentiation regulates the flow of students in the different curricula and programs.

How do the interactions among the defining attributes of the school, math mediating artifacts, and the educational system account for most of the inequities in math education at the national level? One can think of many patterns of interactions. One plausible such pattern is presented here. The interaction of school constituency with the use of a foreign language for math instruction is likely to produce inequities in the engagement and achievement of math learning because of the differences in home use and knowledge of that language among different socioeconomic and cultural groups. Moreover, some school cultural constituencies may regard teaching mathematics in a foreign language as discriminatory because it may carry cultural values and practices that may be incompatible with their own. Furthermore, the socioeconomic level of school constituency affects the extent to which schools can acquire and appropriate human and physical resources needed for mathematics instruction. The interaction of the school constituency with the education system is likely to produce inequities in math education. Schools with low socioeconomic level students normally depend on the government for their funding and hence have to follow a centralized system of education, which does not allow such a school autonomy in managing its own affairs. On the other hand, schools with high socioeconomic level students tend to be tuition based and consequently afford more flexibility and autonomy. Admittedly, the interactions outlined do affect inequities in other school subjects, However, with the exception of science, mathematics is more sensitive to language-related interactions than other subjects because it is more closely related to language and logic than other subjects. The complex interactions outlined often lead to a two-tier schooling system in the same country. Schools in the higher tier are perceived as having a higher degree of educational quality and as being privileged in terms of constituency and human and material resources, whereas schools in the lower tier are often perceived as having lower educational quality, and as being disadvantaged in their constituency and human and material resources. The two-tier schooling system is likely to produce two levels of mathematical literacy in the same country; one that prepares college-bound students and the other that prepares students for technical education or for the work force. The two-tier school system, being inequitable, often locks the schools in two separate modes of development (apartheid), hence maintaining, and often increasing, the gap between schools that belong to different tiers in the system.

The two-tier schooling system has historically taken different forms in different countries and is still present in almost all countries in one form or another. I believe that the factors which lead to the two-tier system differ from one country to another depending on the country's history, socioeconomic status, and social structure. The next two subsections describe and analyze two typical models of the two-tier national schooling system; one is typical of developing countries and the other of developed countries.

5.3.2 The Two-Tier Education System in Developing Countries

The so-called developing countries emerged as independent states in the few decades after the Second World War. According to Jurdak (1989), a first priority for most of these countries was to nationalize their education systems by using the national language as the language of instruction instead of the foreign languages of the colonial powers. The second priority for the newly independent states was to supply educational provisions for the increasing number of students entering the new national system of education and hence those countries had to adopt policies for universal elementary education. They also needed to educate and prepare the human resources necessary for staffing the administrations in the newly fledgling states. Third, aware of their socioeconomic disadvantage, compared to their former colonial rulers, the newly independent states started to address their lag in socioeconomic development by accelerating their development through education, science, and technology. Often, these countries looked up to their former colonial powers, to whom they were linked by ties of educational and cultural interactions, for models and sources for their own development. Fourth, these countries viewed mathematics as a subject that was the gateway to socioeconomic development and at the same time as a neutral universal subject that was not likely to affect their culture (Jurdak, 1989).

Profile of the School in the Public Sector

The urgency and challenges of meeting the educational demands of the newly independent developing states led them to adopt public education systems modeled after those of their former colonial powers, each country adapting the system to its national needs to varying degrees. This, the newly independent states generally did without much regard for the suitability of the foreign systems to the realities of their own countries. Typically, the public education system accommodated the great majority of students in the country, knowing that the system had already been strained for lack of human and material resources. Until then, the constituencies of public schools in most of these countries came from a low socioeconomic class; that itself often constituted the majority of the population. Moreover, the schools themselves suffered from poor resources, including poorly prepared teachers-a situation which generated an unfavorable climate for learning.

In public schools, the language of instruction, including that of mathematics, is the native language in most cases. In many of these cases, the equivalents of mathematical terms (which represent mathematical concepts) are translated from a foreign language into the native language without much consideration for the experiential linguistic level of students. This contributes to the students' perception of mathematics a 'technical' subject detached from experiential meaning. State-mandated mathematics textbooks, which are typically local language versions of western books, strengthen the perception that mathematics is learned by rote learning, mainly for the academic purpose of advancement in the educational system.

In most cases the public schools, which operate within a centralized system controlled by the ministry of education, have little autonomy in their instructional decisions, and hence do not have the ability to respond adequately to individual student needs. Moreover, often, the educational system limits the opportunities for choice, particularly for socioeconomically disadvantaged students, because of institutional differentiation policies that channel students to tracks within the school. Mathematics performance constitutes a key factor in the differentiation process, thus compounding the discriminatory role of institutional differentiation, especially if the system requires differentiation at an early age.

Profile of the School in the Private Sector

In general, the colonial powers kept their cultural links with the countries they had ruled through the private school system. The private schools, established during or after colonial rule, were initiated by religious missionaries, or by non-governmental, non-profit organizations, or lately, by individuals or even business firms. The current private schools are tuition-based and cater to the relatively small socioeconomically advantaged class who have had, or aspire to have, cultural ties with the societies of the former colonial power that once ruled the country. Because the constituencies of private schools in most of those countries come from the middle and upper socioeconomic classes, the schools very often have adequate resources, including well-prepared teachers in a foreign language and in mathematics and its pedagogy. Both the constituencies and resources of the private schools make the climate favorable to learning.

In some countries, the language of instruction of mathematics is a foreign language and the textbooks are imported books or locally-authored books in a foreign language. Teaching in a foreign language raises different sorts of problems. The foreign language is a cultural carrier in terms of behaviors, social relations, habits, and values (Jurdak, 1989). Some countries which are multilingual, like South Africa, resort to more than one language in teaching mathematics. In some other countries, which are multicultural, like Lebanon, schools in the private sector have competing cultural identities and use more than one foreign language. In such cases, not only is the cultural impact of the language of instruction compounded, but its social impact becomes an issue. If mathematics is taught in a foreign language, then instead of one filter, we end up with a double filter (Jurdak, 1989). Moreover, if the division between schools which use a foreign language or the native language in math instruction coincides with cultural and social class divisions, the language of instruction in mathematics will be a threat to social cohesion.

In most cases the private schools are not bound by the rigid bureaucracy of the ministries of education and as such they have more flexibility in managing their human and material resources and more autonomy in their instructional decisions. Moreover, private schools are able to work around institutional differentiation policies by enabling students to work in accordance with foreign curricula that are less stringent in their differentiation policies.

Contrasting Inequities Between Public and Private Schools

As indicated in Section 5.3.1, inequities in mathematics education result from the interactions of school constituency, language of instruction, and the education system structure. Since these three attributes differ in the public and private schools in developing countries, their patterns of interactions are likely to be different. The different patterns of interactions result in between-school inequities.

The constituency of a school reflects the choices of the community it serves and its socioeconomic and cultural identity. It is a result of parents' decisions to send their children to a particular school and this decision depends on many factors such as school proximity to home, ability to provide for school expenses, parents' perception of the school cultural identity as concretely reflected in the language of instruction of mathematics and sciences, and their perception of the quality of education in the school. Once parents choose a particular school for their children's education, any inequity that might affect the education of those children becomes a consequence of that choice. Public schools, in comparison to private schools, are perceived to offer less learning opportunities, less quality of material and human resources- especially teachers, a less favorable school climate, less school autonomy in accommodating students' learning needs, and less flexibility in manoeuvering around rigid state-mandated rules of differentiation.

How do these inequities between the public and private education systems impact mathematics education? Obviously, mathematics education is impacted in the same way other school subjects are; however, the impact of these inequities is more accentuated as far as mathematics education is concerned because of the cultural and social effects of the language of instruction in mathematics. The language of instruction in mathematics is a proxy to social class and to cultural differences. In the case of public schools in the developing countries, the translation of technical terms to the native language from a foreign language in teaching and in the textbooks contributes to the conception of mathematics as a set of definitions of mathematical terms and procedures for manipulating meaningless symbols. On the other hand, the use of a foreign language as a language of instruction in private schools may act as a divisive cultural and social factor at the national level.

5.3.3 The Two-Tier Education System in Developed Countries

The two-tier education system in developed countries has historically evolved for reasons different from those that contributed to the formation of the two-tier system in the developing countries. To illustrate the two-tier education system in the developed countries, consider two models: One from countries like the United States of America, Canada, and Australia, and the other from Western Europe. The first category of countries came into being in the last few centuries and was formed by European immigrants who championed conquering the new territories and valued the opportunities that the new land provided. Until the last few decades, those countries had valued and cherished equality as a basic tenant of their existence, but had interpreted equality as being applicable to the dominant group and not to other minorities and indigenous people in the country. In the last few decades, the model of separate development was abandoned formally but continued to exist as an undercurrent in one form or another. Although the education system in such countries seems to be unified as an equal opportunity public education system, it still has a subsystem in which educational inequities exist. We shall call this subsystem *minority public schools*.

The second category of countries consists of those old Western European former colonial powers whose economic opportunities attracted, over the last half of the past century, a massive movement of emigration from their former colonies. The immigrants sought a better life, mostly in the countries of their former rulers and were encouraged by common cultural ties such as language, and attracted by the demand of those countries for labor. The immigrants, who had cultures different from those of the people in the countries where they had settled, formed minority communities that tried to preserve their cultural identities. These communities had access to the public education system, but nevertheless, formed a de facto undeclared subsystem of the public education system in the country concerned. This subsystem is similar to the aforementioned *minority public schools*, in spite of the fact that the historical reasons for its formation are different from those of the USA model of minority public schools.

Profile of the Public School

In general, the public education system (including all undeclared sub-systems) in countries belonging to the aforementioned models is the largest and the most inclusive educational system in those countries. In such countries, the right to free compulsory pre-university education is protected by law. In those countries, school constituency typically represents the socioeconomic mix in the vicinity of the school, and as such, the middle class normally constitutes the majority in it. Instructional and learning resources are normally adequately provided and oversight by the district or state educational authorities provides a sustainable favorable environment for teaching and learning. With the exception of the minority public education system, which will be discussed in the next section, the use of the national language as a language of instruction does not normally present a pedagogical problem or cultural dissonance. However, there is variation in the developed countries in the degree of autonomy given to schools. For example, the West European countries have traditionally more centralized public education systems than the USA. In general, schools in the public education systems have enough autonomy to be responsive to the learning needs of their students.

The public education system in the developed countries does not necessarily generate systematic inequities in mathematics education. This is the case so long as there is no dominant ethnic, social, or cultural group which tries, by design or by default, to impose its culture or practices on other groups. The next section discusses minority public schools, where dissonance and conflict may arise.

Profile of the Minority Public School

The minority public schools are an integral part of the public education system in developed countries and the term is used simply to refer to those public schools which serve a predominantly minority community in such a country. The defining attribute of the minority public schools is their student constituency, which normally comes from predominantly minority students such as immigrant citizens in Europe or an ethnic group in a North American country. Resources available to minority public schools do not differ from those available to other public schools. In fact, in some countries some minority public school are given extra resources by the government to help them catch up with other schools.

The interaction of the constituency of minority public schools with the language of instruction in mathematics has a direct impact on mathematics education. The minority students in these schools (such as Latinos in the USA or North Africans in France) are learners of a second language, which is the mandated language of instruction of mathematics. One would expect that mathematics education in these schools would have pedagogical and cultural disadvantages similar to those in the multilingual and multicultural schools reviewed in Chapter 4, such as the difficulties students may face in negotiating meaning and hence in effective participation in the mathematics classroom. Cultural alienation may be another disadvantage. These disadvantages may impact negatively the opportunities of minority public school graduates for admission to higher education or access to professional fields.

In summary, it seems that the the two-tier system exists in both developing and developed countries but in different forms. In developing countries, the two-tier system consists of the public and private education systems. The two tiers in the developed countries are the the public education system and the minority public schools. The two-tier systems in the developed and developing countries differ in terms of their history and nature. However, the school constituency and the language of instruction of mathematics seem to account for most of the differences and subsequent inequities in the the educational systems of both developed and developing countries.

5.4 Inequities Related to the Interaction of School and Mathematics Learning Outcomes

5.4.1 School Socioeconomic Cultural Background and Mathematics Achievement

The focus of this section is to identify issues related to inequities in mathematics achievement between schools by reviewing a sample of studies which attempted to account for between-school differences in mathematics achievement in terms of school parameters (school composition, resources, and climate). It is to be noted that the mainstream mathematics education journals rarely addressed the issue of the relationship between differences in mathematics achievement at the school level and school parameters. Resources used will be mainly from school effectiveness research journals.

More than any school parameter, the socioeconomic school composition as it relates to school mathematics achievement has received the greatest attention in the literature. In its report on school factors related to quality and equity, PISA (2005) states that ‘school composition has by far the the greatest impact on student performance’ p. 45. Research on the impact of school composition on performance in mathematics education does not seem to be conclusive in that regard. In a study conducted in a socioeconomically diverse school district in Canada, Ma and Klinger (2000) report that, among other things, socioeconomic school differences are critical in explaining school differences in mathematics achievement. Opdenakkar et al. (2002) reported that class composition was very important for the explanation of between-school differences in mathematics education. Marks (2006), using the 2000 PISA data, studied the extent to which the between school differences in student performance can be attributed to students’ socioeconomic background and concluded that differences in student performance in mathematics (among other things) cannot be accounted for by students’ socioeconomic background. Hook, Bishop, and Hook (2007) studied the mathematics performance of students in the ‘Key Standard’ mathematics program, which was transplanted from the curricula of six leading TIMSS math countries, to some California districts whose cultural and economic backgrounds differ from the six TIMSS countries, but nevertheless are mostly economically disadvantaged. The authors report that performance of the students in the ‘Key Standard’ program was significantly superior to similar control districts. It was argued that it is rather the curriculum and the textbooks that make a difference and not necessarily the economic and cultural background of students.

5.4.2 Other School Factors and Mathematics Achievement

There is also evidence to indicate that the school climate may explain school differences in mathematics achievement (Ma & Klinger, 2000) and Opdenakkar et al., 2002). Part II of this book (Chapter 9) presents the results of an analysis to determine the impact of school level variables derived from TIMSS 2003 principal background questionnaires on between-school mathematics achievement as measured by TIMSS 2003 mathematics test scores. The impact of each variable, which was defined and measured as the proportion of between-school variance in mathematics achievement accounted for by that variable, served also as a measure of inequity between schools in mathematics achievement due to this factor. The school factors that impacted school mathematics achievement and acted as inequity factors include:

1. Principal's perception of school climate (13 out of the 18 countries in the sample)
2. Good school attendance by the students (9 out of 18 countries)

5.5 Inequities Related to the Interaction of State Policies and the Education System

The 'rules' that impact mathematics education in the activity system at the national level are the socioeconomic and cultural factors that exist in the national society as a whole as well as the state policies. Since the former factors were addressed in a previous section, this section concentrates on state policies.

State policies directly impact the attributes of the education system and consequently may be a source of inequity in mathematics education. The degree of centralization in the education system and the location and intensity of mandatory differentiation in the education system are such attributes.

5.5.1 Decentralization of the Education System and Mathematics Achievement

Decentralization of the education system has been addressed from different perspectives. Some have linked the recent decentralization of educational systems to global pressure on countries by funding agencies to promote more democratic political systems and/or to adopt market driven economies. From the perspective of democratization, the decentralization of educational system is supposed to increase school autonomy. From the perspective of free economy, decentralization is perceived as a proxy for the privatization of education.

Few studies, if any, have attempted to study the direct differential effect of the degree of decentralization on mathematics education. In fact the studies that investigated this effect often used mathematics performance as one of many criteria of the effectiveness of this education. For example, Bankov et al. (2006), using TIMSS 2003 data, investigated the effect of a decentralized implementation of a common national curriculum on the level of variation of mathematics proficiency (a measure of equity) in Bulgaria. In the same vein, Darling-Hammond et al. (2003) examined the impact of a reform project which focused on consolidating and centralizing fragmented programs and resources in a San Diego district whose schools had traditionally had an established culture of decentralization. Using mathematics performance as one of many school achievement criteria, they reported that this reform benefited the lowest-achieving schools and benefited less the most bureaucratically organized schools.

Other issues related to decentralization have been addressed. Astiz et al. (2002), conducted a quantitative analysis of data on governance and classroom implementation of eighth-grade mathematics curricula in 39 countries to demonstrate the way economic and institutional globalization have produced mixes of decentralized and centralized educational administration. In the same vein and from a critical perspective, Desmond (2002), focusing on the role of the World Bank in promoting privatization and decentralization, stated that the latter will grant more decision-making to parents and communities, but will reduce the power of the national government and national teacher unions, while ensuring employers an education most useful to their demands. PISA (2005) reported that on average across OECD countries, students in schools with more autonomy perform better in reading literacy than schools with less autonomy. One would hypothesize that the same is true for mathematics performance.

Critics of decentralization of education systems present arguments of the possible negative effects of school autonomy on school education, including mathematics education. One of those arguments is that school autonomy may have negative effects on equity, in the sense that schools will enjoy more freedom in their decisions regarding students and resources which, in the absence of close oversight of a regulatory body such as the government, may lead to inequitable access to education. Another argument is that school autonomy will put extra burden on the school administration, increasing the principal's administrative responsibilities at the expense of educational concerns.

5.5.2 Differentiation of the Education System and Mathematics Achievement

Educational differentiation may occur at the level of the classroom or at the level of the education system. The former has been discussed in Chapter 4 under the theme of student grouping. This section will focus on differentiation in the education system. This differentiation may take one of two forms: (a) Curricular differentiation i.e, channeling students at a certain grade level or age to a curriculum or (b) institutional differentiation i.e channeling students to another specialized institution.

There is hardly any study or discussion of the impact of educational differentiation at the national education system level in mainstream mathematics education journals. This is probably because differentiation is not mathematics-specific since it impacts all school subjects alike. According to

PISA (2005), the research findings indicate that system-wise educational differentiation suggests that education systems with the lowest degree of differentiation have the highest student performance level.

5.5.3 School Privatization and Mathematics Achievement

In the last two decades, privatization of education has taken new meaning. The fall of the Soviet Union has energized an international globalization movement which championed democratization at the political level and free market at the economic level. Democratization reflected itself in education systems in the decentralization of decision-making in schools and in some cases allowing schools to be semi-private, with partial support from the government in exchange for more autonomy in its decision making. In the last two decades, a few countries moved to fully privatize their schools and allow them to compete for students in the market under close government oversight.

Privatization of education may have serious implications for equity in education, including mathematics education. Since privatization follows free market laws, schools try to attract students who can afford the tuition and for that purpose they gear their marketing strategies towards promoting international education, on the assumption that the later will be more valued in the global economy. One of the claims of privatization of education is that, like privatization in economic ventures, it promotes quality improvement through competition. However, if privatization of education is allowed to operate fully according to free market rules, it will engender inequities by creating a divide between the public system and private schools. The public education system, which accommodates the great majority of students, becomes at a disadvantage in providing resources for the bulk of students it serves compared to government-independent schools that can capitalize on the resources of the economically advantaged few. Moreover, privatization may encourage the establishment of schools that serve certain cultural or religious groups having exclusionary practices that may threaten national cohesion.

5.6 Concluding Remarks

Inequities in mathematics education result from complex interactions among the components of the activity system of mathematics education at the national level. This chapter attempted to identify the main interactions and to describe the ways in which they generate system inequities in mathematics education.

The interactions of the school, language of instruction of math, and the structure of the education system are likely to produce many inequities in the opportunities to learn mathematics. In general, these interactions produce inequities which reflect themselves in a two-tier education system, which exists in both developing and developed countries but in different forms.

The differential effect of the interactions of school factors is reflected in between-school differences in math achievement. Specifically, the socioeconomic and cultural student composition of the school accounts, more than any other factor for inequities in mathematics performance. Other school factors which may lead to inequitable mathematics education performance are school climate and school resources.

The structure of the education system is also likely to generate inequities in mathematics education. The factors of school autonomy and curricular and institutional differentiation seem to be important in this regard. However, there is not enough research to support a conclusion regarding their effect in generating inequities in mathematic education.

The activity system suggests a general approach for transforming the math education school activity system in order to address the inequities in the school. The model of expansive cycle in work teams suggested by Engeström (1999) provides a vision of how to transform the national education system to be more equitable in educational provisions and math achievement. The transformation process of the system towards more equity starts with dissatisfaction with equity provisions on the part of decision makers, school principals and math teachers. The commitment to achieving the equity in quality goal has to be translated to awareness and training initiative to target those concerned at all levels. The change starts at the level of the school and math teachers as described in Chapter 4. The process will expand beyond individual schools to reach the decision-makers who have to internalize the input from schools and externalize it in the form of new policies. The successful orchestration of the emerging school experiences and practices constitutes an expansive cycle which transforms the equity practices of the system of math education at the national level.