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Mathematics Achievement of Immigrant Students

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Chapter 1 Introduction

This dissertation examines the mathematics achievement of immigrant students in several countries. An increase of the immigrants and consequently students with an immigrant background is one aspect of the globalization that takes place in our world today. Immigrant students are a quite diverse group of students – some might have highly skilled parents who are looking for job opportunities in another country whereas others might be refugees from war.

Different countries face different challenges in catering and providing a good education for students with an immigrant background. And a good education for all students is question of social justice.

This dissertation aims to contribute to the discussion on immigrant students in educational systems. Differences between and within countries shall be understood. Especially circumstances and policies that might lead to a better education of immigrant students will be searched for. The aim is to find recommendations for policies that promote a better education for students with an immigrant background. For this purpose quantitative research methods will be used and the IEA TIMSS data will be analyzed. After this more in-depth policy studies for countries that turned out to have positive results in terms of the immigrant students' education in the quantitative analysis of the TIMSS data will be conducted. With this approach the aim of this dissertation is also to demonstrate how quantitative analysis of large-scale assessment data can be augmented with more in-depth policy studies.

The structure of the dissertation is as follows. I will start with a general introduction into the topic followed by a review on the current state of research in the areas addressed. It follows a description of data used and method he methods applied. Then the results of the analysis of the TIMSS data follow. First a broader focus on all cycles of TIMSS until 2007 will be kept and the percentages of immigrants and their achievement analyzed. Then the focus will be on the 2007 data only to get more in-depth results. The first focus here will be on students' backgrounds to better understand what the immigrant student population look like in the different countries and to better understand differences within the countries.

Then differences between schools will be examined followed by an analysis of differences between classes. This will be succeeded by two chapters with policy studies on two countries that came out as successful in the quantitative analysis of the TIMSS data. Finally a concluding chapter will bring the different results together and allows for a discussion of these.

Globalization

Today's world is strongly influenced by globalization. But what is globalization? The term globalization is used widely but quite divergently, and often very vague. Mundy even called the term "muddy". She defines globalization as a combination of four effects, which are the mobility and territorial spread of production chains, the concentration of production into the hands of large, multi- or transnational corporations, the financial and capital flow crossing country borders, and the emerging of the new information economy (Mundy, 2005).

Similarly, Blossfeld et al. (2008) understands the process of globalization as an interaction of four structural developments. The first one is an increase of the international exchange of goods, services, and labor: The international trade has increased and workers migrate between countries and regions. The second development is an increase in the business competition between countries and

regions. The boundaries and restrictions of the markets were loosened and international companies open and close branches worldwide depending on what is offered by the countries and the prices for production. The third development is fostered by the developments of modern technologies – especially information technology. The internet and other modern information technologies enable people to cooperate and to exchange information in a formerly unknown speed. The fourth development concerns the internationally linked markets and as a consequence instability and vulnerability of local markets (Blossfeld et al., 2008).

All these definitions focus mainly on the economic aspects of globalization. Burbules and Torres (1999) distinguishes different terms of globalization. He sees globalization in economic terms but also in political and cultural terms. In political terms globalization is the loss of the sovereignty of the nation states. In cultural terms he describes the tension between more cultural homogeneity between countries on one side and more fragmentation or heterogeneity at the same time. He sees all these three aspects influencing the education systems of the countries in the world (Burbules & Torres, 1999, p. 14).

Although Blossfeld et al. (2008) defines the term globalization as described above, he also use the term differently later when addressing the globalization of school systems. In the context of globalization of school systems, he uses the term globalization as the development of a common curriculum across countries or as "importing" a curriculum from another country, which the authors conclude is not new but goes back to the roman term of "septem artes liberals" which influenced the education within Europe up until the middle ages (Blossfeld et al., 2008, p. 67).

This dissertation will focus on the migration of people with a special emphasis on the effect of the school systems around the world. Migration poses challenge to countries. An increasing migration between countries and regions also affects the educational systems. The educational systems have to cater students with different cultural backgrounds, different mother tongues and from more diverse socio economic background. This can be observed in a growing number of countries (Castles, 2009). The increased mobility of employees and the growing demand for work forces in various regions of the world generates a steady flow of immigrants and their families (OECD, 2012a). But economic reasons and seeking for work is only one of the reasons for migration and the term immigrant is used for a heterogeneous group. Also wars, civil disorder and natural disasters and climate changes creates a significant flow of immigrants. The amount of people - and also children – affected is huge.

The United Nations (2014) reported:" In 2010, the Office of the United Nations High Commissioner for Refugees (UNHCR) counted 43.3 million forcibly displaced people worldwide—the highest number since the mid-1990s. This included 27.1 million internally displaced persons (IDPs), 15.2 million refugees and 983,000 asylum-seekers. Of the 15.2 million refugees, 10.4 million were under UNHCR's responsibility, and 4.7 million were Palestinian refugees under the mandate of the United Nations Relief and Works Agency for Palestine Refugees in the Near East" (United Nations, 2014).

Especially these immigrants and in particular the children in this group require special attention. There is a wide range of research around mental and psychological problems of refugee children. It is clear that this population in very vulnerable. Some refugee children need special attention to overcome their traumatic experiences; some are separated from friends and family. These are additional challenges of this special part of the population on immigrant children.

But there are more differences. Some immigrants are highly qualified and educated while others are less so. Some work in highly paid jobs and others in poorly paid jobs. This is for example reflected in the cultural types that Baumannv (2003) specified as tourists and vagabonds where "… the tourists are the privileged 'free consumers', whereas the vagabonds are the underprivileged 'flawed consumers'." (Jacobsen & Poder, 2008, p. 144). Different immigrants have also different perspectives: Some want to become permanent residents while others want, or have to, leave their country of residence after a period of time (OECD, 2010a).

Educational systems are influenced by globalization in several ways. One is the increased number of students with an immigrant background that the educational systems have to cater. Another is the influence of international and transnational organizations such as the United Nations, the European Commission, the World Bank, or the OECD.

Transnational organizations like the European Commission are setting standards for educational systems that countries are trying to achieve. Loans from the World Bank or the Inter-American Development Bank are linking loans to the achievement of educational outcome measures, which impact the educational systems. But also the increased economic competition between countries creates a competition for the educational systems. International companies are moving the production between countries. Their decisions are based on economic considerations.

Green argues that: "Where regional economies come to be dominated by transnational corporations which have no national allegiance and which are beyond national government control, there can be no such thing as a national economy" (Green, 1997, p. 154). Parts of these considerations are also the availability of adequately educated work force.

As an example for this I take a look at the policies of the city of Chicago in the USA. Emanuel (2013), the mayor of Chicago, explained at a symposium of the World Bank the changes in the educational system of Chicago. The mayor mentioned that the city has recently changed its educational policies and linked education more closely to the needs of big companies on the one hand to make the city of Chicago more attractive for the industry and on the other hand to improve the perspectives of graduates from schools in Chicago by increasing the chances on the labor market. Companies are represented in the school boards of some charter schools in Chicago to ensure that the curriculum of the schools match the job requirements in their companies. As a result some big companies have moved their headquarters to Chicago. Moreover the graduation rates at charter schools and the percentage of graduates who find jobs after graduation have increased (Emanuel, 2013).

Although this example can be regarded as a success of the economic and maybe also the educational system of a city it is also an example of the economic competition of regions – in this case within a country – and the impact it can have on educational systems. An educational system that creates a labor force needed by the industry has an economic advantage because it attracts the industrial production. Also Green (1997) describes: "In most countries there have been attempts to reinforce the institutional linkage between education and work, through the development of work-experience, work shadowing, alternance and mentoring programs. Employers have been drawn more systematically into the process of standard-setting under the Commissons Consultatives Professionelles (CPCs) in France, the BIBB in Germany and the Industry Lead Bodies in the UK" (Green, 1997, p. 176).

The globalization process increased significantly in recent years and changed the challenges faced by educational systems around the world (Green, 1997; Rizvi & Lingard, 2010).

Since the 1970s the world has undergone some changes since the globalization affected not only the economics of countries but also the societies, and the educational systems in particular (Green, 1997). Green argues that: "…the dynamics of education within the older nation states have changed. As nationhood has been consolidated and sustained, and with the growing international economic competition in the postwar period, education has partially lost sight of this formative mission and purpose, in the advanced states now, with the possible exception of Japan, education is seen primarily as a means of individual and collective economic advancement" (Green, 1997, p. 4).

One of the most influential organizations on international educational systems for the developed countries is the OECD that develops indicators setting standards for educational systems (Lingard & Grek, 2007). The OECD was originally funded by the USA under the Marshal plan to rebuild the European economy. In the mid-1980s the OECD launched its project on educational indicators (INES) mainly under the influence of the USA (Henry, Lingard, Rizvi, & Taylor, 2001). The collection of key indicators in education and the potential of reducing educational systems to few simple measures was found problematic even before it started and even within the OECD as Heyneman (1993) described: "Those (from CERY staff – addition by the author) whom I interviewed believed it was unprofessional to try and quantify such indicators, and that it would oversimplify and misrepresent OECD systems, ..."(Heyneman, 1993).

Rizvi and Lingard (2006) argue that "... the OECD is ... promoting a policy agenda for reforming educational governance, based on neo-liberal precepts of marketization and privatization on one hand and strong systems of accountability on the other" and that "It highlights the relevance of these governance principles for all its member countries, regardless of their local histories and traditions..." (Rizvi & Lingard, 2006, p. 133).

Rizvi and Lingard's conclusions on the neo-liberalism of the OECD, however, were criticized as being quite counterfactual reasoning and leaving out the globalization process itself (Lauder, Brown, Dillabough, & Halsey, 2006, Chapter 17).

One result of this globalization process on educational systems that some researchers found was a convergence of educational systems. For example Blossfeld (2008) argues that educational systems are becoming much more alike. He concluded: "… seit den 1990er Jahren durchgeführte international Schulleistungsuntersuchungen wie TIMSS, PISA und PIRLS/IGLU dokumentieren universelle Kongruenzen der Bildungssysteme, die durch Prozesse der Internationalisierung und Globalisierung gefördert werden" (Blossfeld et al., 2008). We can see that curricula around the world are becoming much more similar. This has on one hand advantaged for students migrating from one country to another because the subjects taught are more similar and a transfer potentially easier. On the other hand it poses the question if these curricula are adequate for the students in the countries.

For the developing countries the history of external influences on the educational policies goes even further back than the 1990th to the middle of the last century and the influence of the World Bank "...through accountability demands of structural adjustments attached loans and aid" (Lingard & Grek, 2007, p. 2). Loans and aids were - and still are - connected to the implementation of educational reforms. Some of these reforms had positive effects on education. More financial

resources were allocated to education, more teachers employed, more and better-equipped classrooms were built and more learning resources made available to the students. But other changes even had negative impacts on the education in the countries. The education for all initiative increased the percentage of students included in the education systems of several developing countries. Especially for girls who were left out to a greater extent than boys in some countries this was very beneficial. But some developing countries did not have sufficient resources to deal with such an increase in the student population. For example in Uganda school fees were abandoned in 1996. This resulted in an increase of the children attending schools from 2.7 million pupils in 1996 to 5.3 million pupils in 1997. Since the building of new schools and classes as well as the employment of additional teachers was not possible to that extend, the teacher pupil ratio increased from 1:49 to 1:120 (In 1998 additional teachers were employed which resulted in a decrease of the pupil teacher ratio to 1:80) (Tappy, 2008).

These examples show that not all changes imposed by external pressure on educational systems – especially of the developing countries – lead to positive results. Also the international organizations learned from these experiences and the focus has moved from education for all to learning for all. The indicators that were developed in the education for all agenda that focus on participation in primary education are in the process of being changed to more outcome oriented indicators in the post 2015 agenda (UNESCO, 2013b; United Nations, 2013; World Bank, 2013). What these indicators will finally look like and what the impact on educational systems will be still has to be seen.

Coming back to the increased amount of immigrant students and the diversity of the immigrant students I see the following consequences. In Europe several countries' educational systems face major difficulties educating immigrant students or students with different cultural background and have taken various measures to overcome these problems. Moreover dealing with students with a different mother tongue poses a problem that countries have to solve (Eurydice network, 2009). Additionally, there are also traditional immigration countries like the United States, Canada, or Australia where language problems and different background and culture of people existed from the beginning of the foundation of their educational systems. Indeed, Kaestle argues that "In new nations, such as the USA, education also had played a major part in assimilating immigrant cultures" (Alexander, 1983). But does their experience make them better at dealing with these problems?

Globalization and Immigration and the effect that they have on educational systems are global challenges of today's world and it is vital that we get a better understanding of the topic and its' magnitude – and to find solutions that may help policy makers in managing these challenges.

What matters to immigrant students

Students with immigration background face several challenges in their school career. The most obvious is that students with an immigrant background might be challenged by not being fluent in the language of instruction. For example Buchmann and Parrado found that language difficulties are often considered as the main factors for the lower performance of immigrant students (Buchmann & Parrado, 2006). However, also cultural differences between their country of residence and the culture experienced at home, or a low socioeconomic background can disadvantage these students. Schwippert, Hornberg, Freiberg, and Stubbe (2007) found:" Ein nicht unerheblicher Teil des Leistungsrückstandes von Schülern aus Familien mit Migrationshintergrund kann also durch die

soziale Lage der Familien erklärt werden, die in fast allen Staaten im Durchschnitt schlechter ist als in Familien ohne Migrationshintergrund“ (Schwippert, Hornberg, Freiberg, & Stubbe, 2007, p. 63).

Also Sirin (2005) found that a big portion of achievement differences can be attributed to the socioeconomics’ background of students (Sirin, 2005). Another important factor is the distribution of the immigrant students across classes. As shown by A. Netten (2010) for the Netherlands, if immigrant students cluster, this has a significant negative effect on their achievement (Netten, A., 2010). But research based on PISA data found that this more an effect of the students’ language, explaining: “A higher concentration in schools of students who do not speak the test language at home is related to worse outcomes for both non-immigrant and immigrant students” (OECD, 2012b, p. 60).

There is not much research so far focusing on teacher and school factors that influence the achievement of immigrant students. Furthermore regional factors such as immigrant students being more prominent in rural or urban areas are not analyzed at international level. Research on these factors that can influenced by educational policy – in contrast to, for example, the socio economic background of students – is especially important to help policy makers address this challenge adequately.

Research Questions

The research in this dissertation is based on the literature review presented in chapter 2. There is quite an amount of research on immigrant students and their particular challenges. The analysis will be based on the IEA Trends in International Mathematics and Science Study (TIMSS). TIMSS is conducted since 1995 every four years and measures mathematics and science achievement of students in grade four and grade eight. TIMSS does not only include good achievement measures based on representative samples of students but also rich background information from students, teachers and school principals. A growing number of countries is participating in TIMSS. Detailed information about TIMSS can be found in chapter three.

The research presented here partially tries to examine if the results found in previous research can be replicated with this data but will also go beyond by making use of the background data that is very unique in terms of its richness and country coverage. The final aim of the analysis is to find conditions and examples where students with an immigrant background successfully participate in an educational system. Success in education can have a broad range of meanings and different researchers might define success very differently.

For immigrants this might cover socio and emotional well-being, integration in the host country, maintenance of their own culture and language or preparedness for their future lives and participation in the society. Neither the data analyzed here nor the volume of a single dissertation can achieve to reflect on all perspectives of success. Instead the dissertation at hand will focus on achievement and explore in depth related motivation and self-concept as non-cognitive outcomes. Although this is a limitation, these aspects of school success have an impact on chances in future life and well-being and achieving an increase in these aspects can be seen as one step into social justice for immigrant students. The analysis builds upon the following research questions

The first focus is on trends. Based on the previous citations one would expect that the percentage of immigrant students in several if not most of the countries would increase. Consequently, I will evaluate:

R1: Did the percentage of first and second generation immigrant students enrolled in grade four and grade eight increases between 1995 and 2007 based on the TIMSS data?

As described above the focus here is also on achievement outcome and therefore the second research question is:

R2: How does the mathematics and science achievement of immigrant students compare to the achievement of native students in the various countries in TIMSS and how does it change overtime compared to the changes observed for native students in the countries?

After analyzing these trend aspects, the analysis will focus on the most recent TIMSS cycle – 2007 – and more in-depth analysis shall be presented. The basic student demographics like age, age at immigration, sex, language spoken at home, parents' education, SES background and students' attitudes - shall be analyzed. The third research question is:

R3: Are there differences in basic demographical information between immigrant and non-immigrant students in TIMSS 2007 and does the mathematics achievement differ between groups of immigrant students with a different demographical background?

A special emphasize should be put on the students attitudes. As research has shown (see chapter 2) students attitudes are associated to their achievement. Some researchers also regard the students' attitudes as an important outcome in itself. Consequently, the fourth research question is:

R4: Are there differences between immigrant and non-immigrant students in TIMSS 2007 in terms of the attitudes towards the school in general and mathematics in particular as well as their self-esteem in mathematics?

Since the aim of this dissertation is to find conditions under which students with an immigrant background achieve relatively well, the next area of research is the school level perspective. Since school conditions vary substantially between urban and rural schools in many countries the first analysis is on types of community. Basic differences between schools that have shown to be relevant for students' achievement will be analyzed. This includes school attendance, school resources, school climate and school safety. The fifth and sixth research questions are:

R5: Are grade eight immigrant students more often found in rural or urban communities in TIMSS 2007 and are the mathematics achievement differences between immigrant and native students different in the different community types?

R6: Are there differences in basic school characteristics between immigrant and non-immigrant students in TIMSS 2007 and does the mathematics achievement differ between immigrant students attending schools with different characteristics?

Finally, differences at class level shall be analyzed. Characteristics that have shown to be relevant shall be analyzed in terms of achievement differences for immigrant students. The characteristics

examined are class size, homework given and concentration of immigrant students in classes. The seventh research question is:

R7: Are there differences in class level characteristics between immigrant and non-immigrant students in TIMSS 2007 and does the mathematics achievement differ between immigrant students attending classes with different characteristics?

After this quantitative research two countries that have shown somewhat positive results for immigrant students will be analyzed from a policy perspective. The research question here is:

R8: What are the policies leading to positive achievement results for immigrant students in Singapore and in Canada and can these inform the policies in other countries to improve the achievement of immigrant student?

What are the characteristics of immigrant student populations in different countries? Which countries are most affected by immigration and can I find clear trends of immigrant students in the schools systems in terms of population and especially in terms of their mathematics achievement based on TIMSS data? Are the background and mathematics achievement of immigrant students similar in the different countries and across time, and are they similar for first and second generation immigrant students?

Based on IEA TIMSS data, can I find positive examples of countries where the population of students with an immigrant background is less disadvantaged in terms of their mathematics achievement? Can I find these examples at country level or at regional level within countries? Or are there certain conditions that I can find in countries that are related to more positive mathematics achievement of immigrant students?

When finding cases of more positive conditions, are they related to immigration or educational policies in these countries? What are the education and immigration policies in countries with positive outcome of immigrant students? This dissertation aims to carry out policy studies on two countries that are found to have positive achievement trends based on TIMSS results.

Chapter 2 Review

So far, the topic of globalization and the situation of immigrant students was introduced and the research questions that provide the structure of the dissertation were developed. In this chapter the current state of knowledge about the different aspects that will be analyzed later will be reviewed. The order follows the sequence that will also be applied in the research section later.

The number of studies about what causes achievement differences between students is practically endless. Also the number of analyses carried out to find the differences between students with an immigrant background and native students is great since the topic seems to be of special interest in recent years.

The OECD has a strong focus on research related to immigrants and immigrant students. Several books have been published by the OECD that make use of PISA data but also of other large-scale assessment data as well as policy notes from countries (OECD, 2006, 2010a, 2012a, 2012b, 2013b). The main conclusion is that: "With some exception, immigrant students, on average, have weaker education outcomes at all levels of education" (OECD, 2010a, p. 7). Secondary analysis about students with an immigrant background from other researchers on PISA data is also increasing almost on a daily basis. J. Dronkers, for example, has published several papers (Dronkers & Kalmijin, 2013; Dronkers & Kornder, 2013; Heus, Dronkers, & Levels, 2008). One of his foci in research is to include also the country of origin of immigrant students. In his analysis he found: "Migrant students originating from non-Islamic Asian countries experience higher educational achievement than equivalent migrant children who originate from other countries" (Dronkers, van der Velden, & Dunne, 2012, p. 30), and: "Migrant students originating from Islamic countries experience lower educational achievement than equivalent migrant children originating from other countries" (Dronkers et al., 2012, p. 30).

Effects of age and schooling

The students in the different school systems around the world are of different age in different school years and also the variance of the age in the different grade varies. This is partly caused by different policies for school entry but also by other factors.

While in most countries students start school at age six, there are quite a number of countries with different policies. For example in Australia, Cyprus, England, Jordan, Malta, New Zealand, Palestine, and Scotland children start school before the age of six. But also among this group, the policies regarding the school entry age differ. In Australia, school starts for the children in the year that they turn six but there is some variation between the different Australian states and territories. In Cyprus and Palestine children must be five years and eight months old to start school. In England, children start to go to school in the term that follows their fifth birthday. In some other countries children are enrolled in schools with age seven. This is the case for Armenia, Bulgaria, Denmark, El Salvador, Latvia, Malaysia, Mongolia, Romania, and Serbia (see Appendix A of (Mullis, Martin, Kennedy, & Foy, 2007)).

There are also varies forms of policies for grade repetition practiced in the various countries. The UNESCO defines grade repetition as "… students are held in the same grade for an extra year rather than being promoted to a higher grade along with their age peers" (Brophy, 2006, p. 6). The UNESCO distinguishes between five different forms of grade repetition. There are three forms of voluntary grade repetition imposed by the students or their families – either because of a lack of a school that

offers the necessary grade (mostly in rural areas of developing countries) or because of reduced learning outcome which could be caused by irregular school attendance in developing countries, or due to language problems of the students. Grade repetition can, however, also be caused by students not passing required exams or by involuntary repetitions initiated by schools due to low student achievement. The UNESCO concludes that the different forms of grade repetition have different effects also depending on the development level of the country but mostly have a negative impact on the concerned students – especially in terms of motivation, self-esteem, behavioral problems, and finally alienation from schools.

The OECD analyzed the number of grade repetition based on the PISA 2009 data (OECD, 2011c). In turns out that in Macao-China, Tunisia, and Brazil more than 40% of the 15-year- old students in the school have repeated a grade at least once. On the other hand this never occurred in Norway, Korea or Japan. “Across OECD countries, an average of 12% of students reported that they had repeated a grade at least once”(OECD, 2011b, p. 73). While the UNESCO is mainly examining the effects of grade repetition on the students, the OECD is focusing at the costs of grade repetition for the educational system and concluded that “In Belgium, the Netherlands and Spain, the costs [of the grade repetition] is equivalent to 10% or more of the annual national expenditure on primary- and secondary-school education” (OECD, 2011c, p. 2).

As a result the average age in TIMSS 2007 grade eight by country varies between 13.7 years in Scotland and 15.8 years in Ghana. Discussions are on-going on how strongly the maturation of students effects the achievement in different subjects compared to the effect of schooling. For example Cliffordson and Gustafsson argue that it is as strong as the schooling effect in Sweden. Yet, it seems to be undisputable that age affects student achievement independent of the schooling effect. In the analysis special attention must be paid to the age of immigrant students compared to their native peers (Cliffordson & Gustafsson, 2010).

Not only the age of students is important; there are also discussions about the effect of the age of the immigrant students at the time of migration. A widespread hypothesis says that the older immigrants are at the time of migration, the bigger is the obstacle in education. Researchers tried to find a critical age that identifies between students who suffer severely from the immigration.

Heath and Kilpi-Jakonen analyzed this phenomenon by using the PISA 2000, 2003 and 2006 data (Heath, Anthony & Kilpe-Jakonen, Elina, 2012). They defined “early arrivers” as students who immigrated before the age of 5 and “late arrivers” as immigrant students who immigrated after the age of twelve. They found: ”Test scores are typically lower for young people who arrive later in their school careers. In other words there are typically ‘late-arrival penalties’ for the first-generation students, although I also found some examples of ‘late arrival premia’. The size of the penalty is much larger for late arrivers than for mid-arrivers (relative to early arrivers)”(page 27 in (Heath, Anthony & Kilpe-Jakonen, Elina, 2012)). Also the OECD reported that “immigrant students benefit from an early arrival” (page 80 in(OECD, 2013b)).

However, there are difficulties with PISA data when analyzing these achievement differences because PISA samples fifteen year old students. Students at the age of fifteen attend different grades. The analysis of the average age of immigrant students and the comparison to the age of the native students revealed that immigrant students in the same grade are older in a number of countries. This means that immigrant students at the age of fifteen attend lower grades than fifteen

year old native students in a number of countries and consequently have less opportunity to learn. This means that immigrant students in PISA are disadvantaged compared to the native students in the PISA sample because they have less opportunity to learn which enforces the lower achievement of immigrant students in PISA. Analyses of the PISA data that compares the achievement of immigrant students and native students and does not account for the grade differences tend to overestimate the achievement gap between immigrant students and native students.

Myers, Dowell, Xin Gao, and Amon Emeka (2009) used the US 2000 census data. They used a logistic regression analysis and tried different models for different groups of immigrants depending on their country of origin and distinguished between Latino and Asian immigrants. They looked at educational attainment, English language proficiency, and occupation. "The tentative overall conclusion is that young arrival is important to later success, but it helps to know exactly how young. And the effect of young arrival varies substantially across outcomes and groups." (page 6 in (Myers, Gao, & Emeka, 2009)). Interestingly, they found in their models:" As before, adding a dichotomous variable for arrival under the age of 10 adds significantly to the model" (page 8) which suggests that there is a critical age of migration that affects the outcome measures.

Also the OECD found that "in general, first-generation students who arrived in the host country at a younger age outperform those who arrived when they were older. On average across OECD countries, first-generation students who arrived when they were 5-years-old or younger score 42 points higher than first-generation students that arrived after they were 12-years-old. The size of the gaps, however, varies considerably across countries and across groups" (OECD, 2010c, p. 75).
On the other hand Pohl, analyzing the German socio-Economic panel study 2000-2003, found no statistically significant difference in the chances for immigrant students to achieve a higher educational degree in relation to the age of migrating to Germany (Pohl, 2006).

In chapter 4 I will investigate if I can find relationships in TIMSS between the age of immigration and the immigrants' achievement.

Differences between girls and boys

Another basic factor of differentiation regarding student achievement that is examined in research is the sex of the students. The literature about the achievement differences of boys and girls – especially in mathematics and in science – is numerous.

Even at the beginning of the TIMSS cycles, right after the first results from the first cycle were published, the TIMSS 1995 study center at Boston College published a separate report about the differences between girls and boys (Mullis, Martin, Fierros, Goldberg, & Stemler, 2000). They found: "The gender differences in achievement in both curriculum areas widened at the upper grades. Thus, while males in the fourth grade had higher achievement than females in only some countries, by the final year of secondary school gender differences in performance were pervasive – with males having significantly higher achievement than females in both curriculum areas in almost every TIMSS country" (page 30 in (Mullis, Martin, Fierros, et al., 2000)). This is in line with most other research.

But in TIMSS 2007 the picture changed quite substantially. Only in seven participating countries (Lebanon, Australia, Syria, El Salvador, Tunisia, Ghana, and Columbia) and two benchmark participants (British Columbia and Ontario) boys score significantly better than girls. But in 16

countries (Lithuania, Malaysia, Egypt, Bulgaria, Singapore, Botswana, Romania, Cyprus, Jordan, Kuwait, Saudi Arabia, Thailand, Bahrain, Palestine, Qatar, and Oman) girls scored statistically significant higher than boys in mathematics which resulted in even the international average for the girls being statistically significant higher than that of the boys (page 59 in (Mullis, Martin, Kennedy, & Foy, 2008)).

For immigrant students Dronkers found: ”The principal conclusion was that female migrant pupils have higher reading and math scores than comparable male migrant pupils and these gender differences among migrant pupils in reading and math scores are larger than among comparable native pupils.” (Dronkers & Kornder, 2013, p. 1). He sees a major reason for this as “The majority or at least a large minority of migrants to OECD countries move from societies with less gender equality to societies with a more equal power balance between the sexes” (Dronkers & Kornder, 2013, p. 3). Although he researches the achievement differences for the immigrant students, interestingly he did not consider the different percentages of immigrant boys and girls as reported in chapter 4.1 of this dissertation.

Language Difficulties

A pre-condition for students following lessons and effective learning of students is the mastery of the language of instruction. The IEA has stated: ”Reading literacy is one of the most important abilities students acquire as they progress through their early school years. It is the foundation for learning across all subjects, it can be used for recreation and for personal growth, and it equips young children with the ability to participate fully in their communities and the larger society” (Mullis, Kennedy, Martin, & Sainsbury, 2006, p. 1).

But language is not only needed for learning but also almost all assessments of what is learned in school require the mastery of the language of the test. Mullis et al. used the opportunity that in 2012 the PIRLS as well as the TIMSS took place and several countries participated in both surveys. Some countries chose the option of assessing the same students in TIMSS and PIRLS in grade four which lead to a data base that includes mathematics, science and reading scores for the students in these countries. Mullis et al. hypothesized: “Students with high reading ability would not be impacted by the level of reading demand in the items. That is, the best readers would score similarly on TIMSS items regardless of the degree of reading demands” (Mullis, Martin, & Foy, 2013, p. 2). When analyzing the data they found that “The average mathematics achievement of the best readers did not vary much by level of reading demand whereas the average mathematics achievement of the least proficient readers was higher on the items with low reading demands than on the items with medium and high reading demands. While the poorest readers consistently achieved at a lower level in mathematics than the best readers, they were additionally disadvantaged on the mathematics items that required more reading” (Mullis et al., 2013, p. 15). The results for science were similar. From these results I can conclude that especially students with low reading abilities had difficulties answering mathematics and science items correctly and their overall score is impacted by their language difficulties.

Language difficulties are also often considered as the main factors for the lower performance of immigrant students (see for example(Buchmann & Parrado, 2006)). The OECD stated that “Most disadvantaged migrants are those not speaking the host-country language” (page 80 in (OECD, 2013b)) and ”… language support should be a priority in migrant education policy” (OECD, 2010a, p.

46). Furthermore the OECD found: “In most countries, there is a relative under-representation of students that speak the language at home among low achievers, …” (OECD, 2011a, p. 31).

Socio-economic background and parental education

Research showed that a major portion of achievement differences can be attributed to the socioeconomics’ background of the students (see e.g. (Sirin, 2005)). The socio-economic status (SES) is usually defined as the “relative position of an individual or family within a hierarchical social structure, based on their access to, or control over wealth, prestige, and power“ (see e.g. (Mueller & Parcel, 1981)) The SES is usually separated into four domains economical capital, social capital, symbolic capital, and cultural capital (Bourdieu, 1983). SES is measured differently in different international large scale assessment studies. TIMSS and PISA only have student questionnaires whereas PIRLS has also a parent questionnaire that includes questions related to SES. A review on the different measures is done by Brese and Mirazychiyski (Brese, F. and Mirazchiyski, P., 2010).

After the publication of the so called Coleman report (Coleman et al., 1966) it is a well-known fact in educational research that the socio economic background of the parents correlates strongly with the achievement outcomes of their children. Consequently, most educational studies try to measure SES of students and include it in statistical models as control variables. Sirin found:” Of 64 independent student-level studies, 62 reported information about the source of SES data.” (page 434 in (Sirin, 2005)).

In educational research, SES usually measured by different indicators or resources. Hattie wrote:” Such resources refer to the parental income, parental education, and parental occupation as three main indicators of SES” (page 61 in (Hattie, 2008)). Later Hattie refers to the effect sizes that Sirin found :”A weighted ANOVA revealed that the average ES was .28 for parental occupation, .29 for parental income, and .30 for parental education.” (page 434 in (Sirin, 2005)) We see that the parental education has the biggest effect size.

In the TIMSS 2007 data Mullis et al found:” Nonetheless, Exhibit 4.1 makes it clear that higher levels of parents’ education are associated with higher average mathematics achievement in almost all countries.” (page 145 in (Mullis et al., 2008)) So, we can also expect similar findings when I analyze the parental education of immigrant students and their relation to the achievement.

Hansson and Gustafsson investigated the invariance of socio-economic status measures of immigrant and non-immigrant students groups in Sweden (Hansson & Gustafsson, 2010). They found significant differences especially in the number of books at home for the different student groups and suggest to always considering the migration status of the students when analyzing this variable. Also Postlethwaite found when analyzing the data from the IEA Reading Literacy Study: ”The only variable that provided a surrogate measure of socioeconomic level and was positively correlated with reading achievement in all countries was *number of books in the home*” (Postlethwaite & Ross, 1992, p. 22).

For immigrants the OECD found: ”Although immigrants are a very heterogeneous group, significantly proportions of immigrant students come from less advantaged socio-economic backgrounds” (page 37 in (OECD, 2010a)) and also “In general, students with an immigrant background are socio-economically disadvantaged, and this explains part of the performance disadvantage among these students” (OECD, 2010c, p. 71).

Attitudes and aspiration

In the next section I focus on the students' attitudes and aspirations. Students' attitudes and aspirations can be defined as outcome of the educational process similar to achievement. A positive outcome of education is that the students feel comfortable in school, have positive attitudes about the subjects taught in school, and have high educational aspirations. But on the same hand students' attitudes and aspirations can also be seen as process variables that influence the achievement outcome positively. Mullis et al stated: „Positive student attitudes toward reading and a healthy reading self-concept are major objectives of the reading curriculum in most countries. Students who enjoy reading and who perceive themselves to be good readers usually read more frequently and more widely, which in turn broadens their reading experience and improves their comprehension skills" (page 139 in (Mullis et al., 2007)).

Also Alvernini et al. used PIRLS 2006 data to show that the student's attitude towards reading has a moderator effect on school, teacher, and home background on student's reading achievement in Italy (Alivernini, Manganelli, & Vinci, 2010).

Osborne separate the attitude towards science but also mathematics in different components like anxiety toward science; the value of science; self-esteem at science; motivation towards science; and enjoyment of science (page 1054 in (Osborne, 2003)). He also suggests distinguishing between science in general and school science since students' attitudes towards science in general have a tendency to be more positive than school science. Based on their literature review they conclude: „Within all of the literature, there is some disagreement about the nature of the causal link and whether it is attitude or achievement that is the dependent variable. The essential premise permeating much of the research is that attitude precedes behavior"(page 1072 in (Osborne, 2003)). But they also emphasize the importance of students' positive attitudes towards science and mathematics to change the trend of a reduced interest in science related further education and careers ("Its current importance is emphasized by the now mounting evidence of a decline in the interest of young people in pursuing scientific careers" (page 1049 in (Osborne, 2003)).

Martin et al. stated "Developing positive attitudes toward mathematics is an important goal of the mathematics curriculum in many countries" (page 173 in (Mullis et al., 2008)). But also they see that the attitudes are not only a goal in itself but also might lead to higher achievement ("In addition to having a positive attitude toward mathematics, students may be more attracted to mathematics and more motivated to learn it if they perceive mathematics achievement as advantageous to their future education and the world of work" (page 174)). They found that "Average mathematics achievement was highest among students at the high index level [of students' positive attitudes towards mathematics]" (page 174).

Kiamanesh and Mahdavi-Hezaveh have a good literature review on attitudes of students towards mathematics (Kiamanesh & Mahdavi-Hezaveh, 2008).

Mata et al. researched the interconnectedness of students' attitudes towards mathematics and mathematics achievement. They found in a longitudinal study in Portugal that the attitudes of students towards mathematics declined throughout the school career (Mata, Monteiro, & Peixoto, 2012).

Of special interest are the differing attitudes towards mathematics by boys and girls. Meece et al. (2006) found that "In general, boys tend to have positive achievement-related beliefs in the areas of mathematics, science, and sports while girls report show more favorable motivation patterns in language arts and reading"(page 367 in (Meece, Glienke, & Burg, 2006)). They reviewed in their paper also the different motivational theories about acquiring self-expectancies and attitudes towards mathematics and science between girls and boys. Drawing conclusions from the US NEAP assessment they concluded that: "Specifically, girls reported less interest in pursuing mathematics and science careers lower participation in math- and science-related extracurricular activities, and less confidence in their mathematics abilities than did their male counterparts" (page 366).

De Lourdes Mata et al. found in their longitudinal study in Portugal "... a systematic decline in attitudes towards mathematics along schooling." (page 9 in (Mata et al., 2012)) and especially for girls a progressive decline in attitudes which they explain by gender stereotypes.

Differences between country regions

Schools can be located in urban areas or in more rural areas. The situation of the students and also the situation of the schools in the different community sizes can differ significantly. In some countries rural schools are much smaller and offer fewer courses than urban schools. In some countries it is more difficulty to attract good teachers in rural schools. This can also have consequences for quality of education and educational outcome.

For the educational outcome, Beaton et al found interesting results for the Russian Federation. They found in the TIMSS 1995 data: „There are great differences in mean student achievement in relation to school location and student gender. It is important to note that these differences do not occur in relation to mathematics education. The school location factor, in particular, has a significant impact on science achievement in the Russian Federation. The farther a school was from a center of a region, the lower the mean science achievement on TIMSS. The lowest achieving schools were located in rural areas." (page 181 in (Robitaille & Beaton, 2002)).

For the educational outcome in Latvia, Johansone found:" A significant part of the achievement variance can be explained by performance differences between urban and rural school communities." (page 1 in (Johansone, 2010)) and also: "Poor equity of achievement in Latvia's primary education is a problem of segregation by socio-economic status, and the urbanization effect is significant mostly because the segregation is more obvious in the rural areas of the country." (page16 in (Johansone, 2010)).

In an international perspective the educational outcome was addressed with the TIMSS 1995 data in a report about effective schools. Martin et al found: "Although in several countries greater percentages of students in low achieving schools were located in urban areas, which supports the idea that urban schools are often disadvantaged, only for Scotland in science was the difference statistically significant. In contrast, in seven countries, Austria, Cyprus, Hungary, Iran, Korea (mathematics only), and the Russian Federation, significantly greater percentages of students in the high-achieving schools were in schools located in urban areas. Of these countries, both Iran and the Russian Federation have large tracts of remote areas, and the difference between urban and rural can be very marked." (see page 46 in (Martin, Mullis, Gregory, Hoyle, & Shen, 2000)).

And even earlier Postlethwaite et al looked at effective schools in reading with the IEA 1991 Reading Literacy Study data. They found: „The more effective school has a community context that tends to be urban and which features ready access to books through the availability of a public library and a local bookstore. In addition, further education opportunities are offered beyond primary school because of the proximity of a secondary school and a higher education institution." (page 42 in (Postlethwaite & Ross, 1992)).

Also the OECD addressed the issue of rural schools in several projects. They found the education in rural areas a problematic issue. The found: "Education is the cornerstone of rural development but, delivering education to sparsely populated areas presents with some challenges. Some institutions suffer from problems of limited capacity, poor quality, relevance and limited public funding. There is often a mismatch between the education offered and the needs of the rural regions." (see page 91 in (OECD, 2010b)).

Especially the recruitment was found problematic in several countries. The OECD wrote: "In Australia, schools in remote and rural areas have been experiencing difficulties in attracting and retaining teachers. To encourage teachers to teach and remain in those areas beyond the minimum required service period, special incentives and teacher education programmes are offered in most States, as illustrated by Queensland and New South Wales." (see page 51 in (Organisation for Economic Co-operation and Development, 2005)) Some countries pay a special allowance to teachers in rural schools or even make it an obligation for teachers after the initial teacher training to teach in rural communities. This is for example the case in Korea.

But no only the education of the students in rural areas is found problematic in some countries but also the in service training of teachers is found problematic in some countries. This is due to the fact that the offerings are limited in some cases or the funds allocated to rural schools were less generous in some countries. The OECD reported about this: „Participation in continuing education and training is considerably more extensive among teachers in urban municipalities when compared with remote rural municipalities." (see page 70 in(OECD, 2003a)). The lack of participating in in-service training of the teachers can have also an impact on the teaching and consequently on students' outcome.

I conclude that the education in rural areas might have some challenges in some countries. In some countries it is difficulty to fill the teaching positions and keep good teachers in rural schools. In general the infrastructure in rural areas is less developed and for example the access to libraries but also to further education poses difficulties for students.

School attendance

Regular attending school is important for students learning success. As Büchel et al wrote: "Attending school is important for two reasons. First and most obvious, school helps children to acquire learning skills and information on a wide range of subjects. Second, and in many ways Justas important, formal schooling provides the forum through which children develop social skills, learning to be independent and to relate to non-family members in a group-based setting (page 151 in (Büchel, F., Frick, J.R., Krause, P., & Wagner, G.G., 2001)).

In most countries attending school is obligatory for children of a certain age. Although in developing countries regular school attendance for all students is not a given. This is especially true for countries

involved in violence. The UNESCO reported: “Globally, the number of children out of school has fallen, from 60 million in 2008 to 57 million in 2011. But the benefits of this progress have not reached children in conflict-affected countries. These children make up 22% of the world’s primary school aged population, yet they comprise 50% of children who are denied an education, a proportion that has increased from 42% in 2008 (Figure 1). Of the 28.5 million primary school age children out of school in conflict-affected countries, 12.6 million live in sub-Saharan Africa, 5.3 million live in South and West Asia, and 4 million live in the Arab States. The vast majority – 95% – live in low and lower middle income countries.” (page 1 in (UNESCO, 2013a)).

But also in developed countries not all students do attend school always. Büchel et al analyzed longitudinal data from West-Germany and found that regular school attendance is strongly related to the parental income. Especially children socio-economic background have a higher tendency for lower school attendance (Büchel, F. et al., 2001).

Also the OECD has dedicated school attendance a separate report after PISA 2000. In that report the OECD found the relationship between school attendance and achievement somewhat proven. The OECD found: “There is a more distinct, but still weak association between participation and performance among individuals. However, in both cases there is a moderately strong association between schools in which students are engaged and those with good overall student results.“ Page 8 in (OECD, 2003b) So, interestingly, the association between school attendance and students‘ achievement was more prominent on school level than on individual student level.

In the same report the OECD also found some student background characteristics that are associated to the students’ participation in school. They found: „The quarter of students with least favourable backgrounds, measured by parental occupation and education, are:… 26% more likely than students of medium social background to have low participation, on average in OECD countries…” (page 11 in (OECD, 2003b)). Also single-parent families seem to have a more pronounced problem with school attendance. The OECD found also: “Students with single parents are: 40% more likely than other students to have low participation, on average in OECD countries…” (page 13 in (OECD, 2003b)).

Also in TIMSS special emphasize is put on measuring the students’ school attendance. In TIMSS a set of 3 questions is asked to school principals concerning seriousness of students’ absenteeism, arriving late at school and skipping classes. An indicator variable is created that distinguishes between schools with high school attendance, medium school attendance rates and low school attendance (Foy & Olson, 2007). The low category is defined as having at least two out of the three issues as serious problems. In several countries there is a statistically significant higher percentage among the first generation immigrants in the schools with a low school attendance than among the native students. Mullis et al found that school attendance can be a problematic issue in schools and achievement results usually relate positively to school attendance. They found that: Attendance problems appear to be more serious at the eighth grade than at the fourth, with an average of 21percent of the students at the high index level compared with 43 percent at fourth grade, and 20 percent at the low level compared with just7 percent at fourth grade.” (Mullis et al., 2008, p. 326). For the relation to achievement they found: “Average mathematics achievement was highest among students at the high index level (478), next among those at medium level (471 points), and lowest among those at the low level (432 points) (page 326 in (Mullis et al., 2008)).

The effect of school resources

There is a general tendency in recent education policy research to focus on teacher factors when analyzing how to improve education. For example the OECD stated, “The research indicates that raising teacher quality is perhaps the policy direction most likely to lead to substantial gains in school performance” (Organisation for Economic Co-operation and Development, 2005, p. 23). But also school factors play an important role in education. Especially a shortage in teaching materials can impact the teaching negatively. Already in the beginning of the 90s when Postlethwaite and Ross did research on effective schools they found that, “In all cases, the more effective schools had more resources than less effective schools” (Postlethwaite & Ross, 1992, p. 30).

The OECD analyzed the situation of resilient students and tried to find situations that impact the achievement of disadvantaged students positively. They found: ”… resilient students enjoy better resources than disadvantaged low achievers” (OECD, 2011a, p. 59). This is another hint that better resourced schools can impact student achievement – especially in the case of immigrant students who are found by the OECD as being overrepresented in the group of disadvantaged students.

But there is a caveat about the impact of school resources on student achievement and the results based on cross-sectional data. Postlethwaite indicated there is a clear link between students’ background and school resources: Students from privileged areas tend to attend well-resourced schools.

The OECD found from the PISA 2009 data that “… differences in the socio-economic background of schools in many countries make it difficult to provide equity in learning opportunities for students with an immigrant background, inequality in the distribution of resources does not seem to mediate the performance gaps between students with and without an immigrant background except in a small number of countries” (OECD, 2010c, p. 81).

The school climate

A lot of research is already done about school climate and how it relates to student achievement. Although there is no definition of school climate and its dimensions commonly agreed upon, there is a common agreement that a positive school climate has a positive impact on students’ learning. Influencing the school climate positively can be a good measure of risk prevention for students at risk. Freiberg : “The elements that make up school climate are complex, ranging from the quality of interactions in the teachers' lounge to the noise levels in hallways and cafeterias, from the physical structure of the building to the physical comfort levels (involving such factors as heating, cooling, and lighting) of the individuals and how safe they feel. Even the size of the school and the opportunities for students and teachers to interact in small groups both formally and informally add to or detract from the health of the learning environment. The support staff—cafeteria workers, bus drivers, custodians, and office staff—add to the multiple dimensions of climate. No single factor determines a school's climate. However, the interaction of various school and classroom factors can create a fabric of support that enables all members of the school community to teach and learn at optimum levels. Further, making even small changes in schools and classrooms can lead to significant improvements in climate.” (Freiberg, 1998, p. 1).

Cohen defines school climate as:" School climate refers to the quality and character of school life. School climate is based on patterns of students', parents' and school personnel's experience of school life and reflects norms, goals, values, interpersonal relationships, teaching and learning practices, and organizational structures. A sustainable, positive school climate fosters youth development and learning necessary for a productive, contributing and satisfying life in a democratic society. This climate includes: norms, values and expectations that support people feeling socially,emotionally and physically safe. People are engaged and respected. Students, families and educators work together to develop, live and contribute to a shared school vision. Educators model and nurture attitudes that emphasize the benefits and satisfaction gained from learning. Each person contributes to the operations of the school and the care of the physical environment" (Cohen, 2009, p. 1).

Shumov and Lomax found in their research: "The findings demonstrated that positive climate was linked to greater parent involvement and to higher educational aspirations among students, which were, in turn, linked to reports of safer schools. This indicates that improvement of a school's climate might be an effective way to promote parent involvement and to increase school safety" (Shumow & Lomax, 2001, p. 106) This shows the importance of a positive school climate and the effects on other aspects in students' learning environment that has the potential to influence students' academic success as well as further dispositions positively.

A summary of school climate research can be found in (Center for Social and Emotional Education, 2009).

The school climate is assessed in TIMSS in the teacher and also in the school principal questionnaire. The principal as well as the teachers were asked to rate from "very high" to "very low":

- Teacher's job satisfaction
- Teacher's understanding of the school's curricular goals
- Teacher's degree of success in implementing the schools' curriculum
- Teacher's expectations for student achievement
- Parental support for student achievement
- Parental involvement in school activities
- Student's regard for school property
- Student's desire to do well in school

Then an index was calculated with three levels. The highest level was assigned if answers averaged to high or very high. Low was assigned if the average was low or very low and the middle category for answers in the middle (see (Mullis et al., 2008, p. 355)).

On the teacher level Mullis et al. found: „Average mathematics achievement was positively related to teacher's perception of school climate at both fourth and eighth grades, with average achievement higher among students at the high index level and lower among students at the low level of the index."(Mullis et al., 2008, p. 357) and similar for the principal ratings:" At both fourth and eighth grades, average mathematics achievement was highest among students at the high level of principals' perception of school climate index (487 points and 473 points, respectively), next highest at the medium level (471 and 450 points, respectively), and lowest at the low level (441 and 428 points, respectively) (Mullis et al., 2008, p. 356)

Kozina et al. analyzed the TIMSS advance data and found a positive correlation between the school climate and the student achievement in the schools. The highest correlation was found for the school climate reported by the school principal, next to the school climate reported by the teacher and last the school climate reported by the student (Kozina, Rožman, Perše, & Leban, 2010).

School safety

Students' feeling safe in school is a related aspect that has shown to be important for students' academic success.

When Bowen and Bowen did a study of more than 2000 students in the US they found: "The regression results suggest a relationship between environmental danger and school performance that is supported by theory and other research." (Bowen, N.K. & Bowen, G.L., 1999, p. 337).

Chen and colleagues did a longitudinal study with more than 500 students in Shanghai and found a clear connection between the students' experience of safety in the school and their academic success. Interestingly the causality is not uni-directional but both seem to influence each other and Chen and colleagues found: "In summary, it was found in the resent students that academic achievement predicted children's social competence and peer acceptance. In turn, children's social functioning and adjustment, including social competence, aggression-disruption, leadership, and peer acceptance, uniquely contributed to academic achievement" (Chen, Rubin, & Li, 1997, p. 524).

Perse et al. analyzed the TIMSS 2003 data for Slovenia and found: "National analyses for Slovenia show important associations of educational achievement and negative school factors. The results show significant differences in math and science achievement between the following pairs of groups: students whose things were stolen in the last month and students whose things were not stolen; those who were physically harmed and those who were not; those who were forced into activities they did not choose and those who were not; those who were called names and those who were not; those who were left out of activities and those who were not. In all of these groups students who experienced aggressive behavior scored lower in math and science, both in the 4th and 8th grade" (page 6 (Perše, Kozina, & Leban, 2008)).
Also TIMSS 2007 includes an index on safe and orderly schools that is covered on teacher and on student level. This index includes teacher level variables such as, "this school is located in a safe neighborhood", "I feel safe at this school", and "this school's security policies and practices are sufficient" for the teacher level index. Probably more relevant to the students is what is covered in the student level safety and orderly index. This index includes the aspects:

- Something of mine was stolen
- I was hit or hurt by other student(s) (e.g. shoving, hitting, kicking)
- I was made to do things I didn't want to do by other students
- I was made fun of or called names
- I was left out of activities by other students

The index has three values: high, medium, and low. Students were assigned the high value if all five statements were answered negatively. They scored "low" if at least three statements were answered 'yes' and "medium" for all other cases (Mullis et al., 2008, p. 363).

Class size

One of the most discussed factors that can influence student achievement is the class size or, closely related the student-teacher ratio because it is easy to measure and can easily be influenced by policy makers. The question whether class size has an impact on student achievement is discussed in many research and policy papers. The conclusions differ vastly. Economist tend to argue that class size has no or little effect (Wößmann & West, 2006) and that public expenditure can be used in much better ways ("Simple cost-benefit considerations suggest that even in Iceland, where class-size effects are statistically significant, the future income gains induced by increases in educational performance are unlikely to offset the costs induced by reductions in class size" (Wößmann, 2007, p. 17)). The usually large classes common in Asian countries such as Korea, Japan, or Chinese Taipei together with their high achievement in international large-scale assessment studies are used as arguments that class sizes do not matter. On the other hand case studies seem to show that class size does matters (Haimson, 2000). Probably the most influential study in this area is the student/teacher achievement ratio project (STAR) that was conducted in Tennessee in the 1980s. The STAR project was an experimental study that revealed: "There is a consistent and fairly large scaled score difference favoring the small class over the regular class at each grade" (Word et al., 1990, p. 26).

In TIMSS mathematics (and also science) teachers were asked about the class size of the class that they are teaching to the sampled students. Then an indicator was computed. For the grade eight students the indicator distinguishes between small classes with one to 19 students, medium sized classes with 20 to 32 students and large classes with 33 or more students. Regarding the relationship to achievement the TIMSS 2007 mathematics report stated: "Because countries have a variety of policies, practices, and realities determining class sizes, the relationship between class size and achievement is extremely difficulty to disentangle" (Mullis et al., 2008, p. 272), and: "The complexity of this issue is evidenced in the TIMSS 2007 results showing a curvilinear relationship, on average, between class size and mathematics achievement at both the eighth and fourth grades" (Mullis et al., 2008, p. 273).

Homework

The effect of homework on student achievement is widely discussed. Hattie counted 161 studies on this topic (Hattie, 2008, p. 234). He concluded in his meta-analysis that homework has only little impact on student achievement and that the impact depends heavily on the kind of homework. He states: "It is clear that, yet again, it is the differences in the teachers that make the difference in student learning. Homework in which there is no active involvement by the teacher does not contribute to students learning,…" (Hattie, 2008, p. 236).

Similarly also Cooper et al. (Cooper, Robinson, & Patall, 2006) came to the conclusion that homework has only little effect on student achievement and the lower the grades the lesser the effect of homework. On the other hand, Trautwein et al. analyzed a data set with about 200 students regarding homework assignments and its relation to the mathematics achievement of the students. They found that "… our data support the assumption that homework is substantially related to achievement gains in mathematics. In our study, the explained variance after controlling for several entry and system variables was about 8% at the class level" (Trautwein, Köller, O., Schmitz, B., & Baumert, J., 2002, p. 43).

Interestingly Hattie also concluded from his meta-analysis that "The effects [of homework] are greater for higher than for lower ability students…" (Hattie, 2008, p. 235). In contrast, Trautwein found: "This interaction effect indicates that low-achieving students gain more than high-achieving students from extensive homework assignments" (Trautwein et al., 2002, p. 45). In chapter 4,1 we will see that students with an immigrant background are mostly lower achieving students. Consequently, one would expect that the effect of homework would be smaller for students with an immigrant background than for native students following Hattie, or that the effect of homework would be bigger for students with an immigrant background than for native students following Trautwein et al..

In TIMSS students are asked about the frequency of homework in mathematics and in the science subjects and also about how much time they spend on doing the homework. Relating the students' answers on "time on homework spent" to achievement, however, brings the difficulty that even if the assignment of homework had a positive impact on student achievement this is hidden by the effect that lower performing students need more time finishing the tasks. Ronnig analyzed the Norwegian TIMSS 2007 data with respect to homework and especially looked for differences by students with different socio-economic background. He concluded: "At the same time, it is also found that if pupils from lower socio-economic backgrounds spend time on homework, they actually spend more time on it than pupils from higher socio-economic backgrounds" (page23 in (Ronnig, 2010). He hypothesized that: "they may need more time in to complete their homework if they find the homework more difficult than pupils from higher socio-economic backgrounds. Also more time spend on homework can reflect problems related to motivation, frustration and concentration (Trautwein et al., 2002). On the other hand, more time spent on homework may also reflect high educational ambitions, regardless of socioeconomic background" (Ronnig, 2010, p. 23).

All these potential effects make the analysis of the student level data difficult. In TIMSS mathematics teachers are asked how much homework they assign to their students and the answers were transformed into an indicator of "teachers' emphasis on mathematics homework". "Students in the high category had teachers who reported giving relatively long homework assignments (more than 30 minutes) on a relative frequent basis (in about half of the lessons or more). Students in the low category had teachers who gave short assignments (less than 30 minutes) relatively infrequently (in about half the lessons or less). The medium level includes all other possible combinations of responses" (Mullis et al., 2008, p. 302). The results reported in the international TIMSS 2007 mathematics report revealed, "There was little relationship between teacher's emphasis on homework and mathematics achievement" (Mullis et al., 2008, p. 302). As can be seen in chapter 4.4 this looks very different for immigrant students.

Homework does not only relate to student achievement but can also relate to students' attitudes. Cooper investigated effects of homework on non-academic outcome. He concluded, "Five studies that presented correlations between the amount of time students spent doing homework and student attitudes revealed a significant positive relationship using a fixed-error model" (Cooper et al., 2006, p. 52). This means that students who spend more time on mathematics homework have a more positive attitude to mathematics.

Peer effects

There are different peer effects researched and described in the literature. In terms of achievement there are different effects that can be observed when students are grouped together with high or low ability students, respectively. On the one hand there is the "big fish in little pond" effect introduced by Herbert W. Marsh (Herbert W. Marsh & Parker, 1984) which implies that students who are performing better than their peers have a higher self-esteem regarding their own abilities. On the other hand there is the assimilation or "reflected glory effect" that implies the positive effect on self-esteem of students who feel that they are selected together with high performing students. This effect is described by Marsh (Herbert W. Marsh & Parker, 1984).

These two effects occur independent of each other and with different effect sizes dependent of the cultural context as researched by Marsh et al. (H. W. Marsh, Kong, & Hau, 2000). Higher self-esteem then has a positive effect on the achievement as shown for example by Marsh et al (H. W. Marsh et al., 2000), Byrne (Byrne, 1996), or Pajares (Pajares, Britner, & Valiante, 2000). Although Jen and Chien (Jen & Chien, 2008) argue that a relatively high self-concept has a positive effect on the achievement in the same subject but a negative effect on the achievement in other subjects. The academic aspirations of the students as well as the average academic aspirations of the class also have a positive effect on the student's achievement as shown by Martin et al. (Martin, Mullis, Gregory, et al., 2000).

Of particular interest is a public discussion on the effect of non-native peers in a couple of countries. Especially parents are concerned about the number of students with an immigrant background in their children's classes. In Germany the German Foundations' Council of Experts for Integration and Migration found: "Viele Eltern, die ihren Sprösslingen einen erfolgreichen Start ins Schulleben ermöglichen wollen, schicken sie auf eine Grundschule mit möglichst wenigen ausländischen Kindern - und schaden damit dem deutschen Bildungssystem" ("Vorwurf vom Integrationsrat: Eltern treiben Spaltung an Schulen voran," 2013, p. 1). The experts found that parents are choosing the school for their children also based on the percentage of immigrant students in the school which leads to a higher segregation between native and immigrant students in schools than in the neighboring communities. This is a pressing topic from the public's perspective and consequently intense research is on-going about peer effects for immigrant students.

A meta-analysis on this topic is done by Dalit. Dalit found: "The considerable growth of the share of immigrant students which has occurred over the last decade has contributed to raise the concern within large sectors of the public opinion that immigrant children would have a negative influence on the school performance of natives. However, this concern does not seem to be empirically well-founded. The analyses carried out in this paper point to the existence of negative effects of the concentration of immigrant students on peer performance; yet, these effects are small and heterogeneous. As regards Italian language test, the concentration of first generation immigrant students appears to influence immigrants more than natives. Among natives, while low socio-economic background children may somewhat suffer from a large share of immigrant background classmates, children of higher background do not; on the contrary, in some cases they even seem to benefit from the presence of immigrants" (Dalit, 2011, p. 28).

Also Dylon Conger found diverse results when analyzing different cohorts of public high-school student from Florida. In general he also found negative peer effects for tenth graders caused by

immigrant students. But he could also find spillover effects for a subgroup of eighth graders where the immigrant students were included early in their school career. He found: “It turns out that the immigrant peers in the schools attended by the sub-population of students are a high performing group – foreign-born students who arrived to the U.S. when they were younger” (Conger, 2010, p. 20).

On the other hand Yeung found in his dissertation about peer effects of immigrant students from East Asia and the Dominican Republic in New York very clear peer effects disadvantaging students with immigrant peers. He concluded: „The results of both the East Asian and Dominican regressions are conspicuous in their similarity. Both East Asian and Dominican immigrant composition have negative and significant effects on achievement. These findings are consistent with most of the research on immigrant composition effects (e.g. Cho, 2011, DiPaolo, 2010, Friesen and Krauth, in press, Gould, et al., 2005). Bother types of immigrant composition have stronger effects in mathematics. East Asian immigrant composition has negative effects on East Asian immigrant children as well as other children. Likewise, Dominican immigrant composition has negative effects on Dominican immigrant children as well as other children. The results collectively suggest there is a negative effect of immigrant composition that is independent of ethnicity and culture” (Yeung, 2011, p. 158).

Ohinata and van Ours used the IEA TIMSS and PIRLS data for the Netherlands and could not find a negative spillover effect of immigrant students on their native peers. But: “Immigrant children themselves experience negative language spill-over effects from a high share of immigrant students in the classroom but no spill-over effects on maths and science skills.” (Ohinata & van Ours, 2011, p. 21). They suggest relocation of immigrant students to other schools because they “… might benefit from such reallocation as their language skills might improve once they can interact more intensely with the native Dutch children“ (Ohinata & van Ours, 2011, p. 21). Interestingly A. Netten, on the other hand, found negative peer effects when analyzing the IEA PIRLS data from the Netherlands (Netten, 2010).

Andersen and Kjaerggard Tomsen analyzed a data set with 40,000 Danish grade nine students. They even suggested to policy makers to limit the percentage of immigrant students in schools to 50 percent and to relocate students to other schools when this threshold is reached to avoid negative peer effects on native Danish students (Andersen & Thomsen, 2011).

In summary results about peer effects of immigrant students seem to be quite diverse but there seems to be some evidence that a high percentage of immigrant students in a class influences the achievement – especially in language – of the immigrant students in the class negatively. More ambiguity appears to exist with regard to the effects in other subjects and the effect on native students.

Chapter 3 Data and Methods

After the research questions that guide this dissertation and the literature review in the previous chapter are concluded and the current stage of the research is described, this chapter specifies the data and methods used in the analysis that follows in the next chapters.

The quantitative part of this research will make use of the IEA TIMSS data. TIMSS assesses mathematics and science achievement of grade four and grade eight students every four years starting in 1995 in up to 66 countries. An extensive amount of background information from the students, their teachers, and school principals is gathered.

TIMSS

TIMSS is a research project launched by the International Association for the Evaluation of Education Achievement (IEA). The IEA is an international non-profit research organization that was founded in 1958. The members of the IEA are educational research institutes, ministries of education, and universities. The IEA started with the idea of conducting large scale assessments internationally in order to learn from differences and similarities between countries. As A.W. Foshay, one of the founding fathers of the IEA stated: ”If custom and law define what is educationally allowable within a nation, the educational systems beyond one's national boundaries suggest what is educationally possible.” (IEA, 2011). Until today, the IEA has conducted more than 30 international educational studies.

In 1998 the IEA developed the idea of conducting an international study on mathematics and science abilities of students. The study was based on previous IEA studies – namely the first international mathematics study (FIMS) conducted in 1964, the Second International Mathematics Study (SIMS) conducted between 1980 and 1982, the First International Science Study (FISS) conducted in 1970 and 1971, and the Second International Science Study (SISS) conducted in 1983 and 1984. All studies were developed by a designated international study coordination center together with researchers from the participating countries and international experts. For the processor studies the international study centers were established at the University of Stockholm, Sweden, and the University of Hamburg, Germany, respectively. The international study center for the Third International Mathematics and Science Study (TIMSS) was located at the University of Vancouver, Canada, until 1995 and from then on at the Lynch School of Education at the Boston College.

After the initial TIMSS in 1995, a TIMSS-Repeat study (TIMSS-R) was launched in 1995. TIMSS-R’s focus was narrower. Whereas in TIMSS 1995 two adjacent grades were assessed per population (see TIMSS sample below) TIMSS-R assessed only the upper grade of population 2 – the eighth graders. The number of participating countries[1] decreased from the 45 to 38. Many countries and researchers expressed an interest in continuing the TIMSS data collection every four years. As a consequence, the Third International Mathematics and Science Study turned into the Trends in International Mathematics and Science Study and is conducted since then every four years assessing grade four and grade eight students in a growing number of countries.

[1] It must be mentioned here that the IEA defined a country in terms of an educational system. For example the French and the Flemish parts of Belgium have different curricula and educational policies. Consequently from the beginning of the IEA both entities became separate members of the IEA. Results from the Flemish and the French part of Belgium are always reported separately in all IEA reports – including TIMSS. The same is true for England, Ireland, and Scotland.

The TIMSS assessment

TIMSS 1995 was designed to measure mathematics and science abilities at the end of primary education through a sample of grade three and grade four students and at the beginning of secondary education through a sample of grade seven and grade eight students. TIMSS defined these population as "The two adjacent grades with the largest proportion of 9-year-olds at the time of testing (third and fourth grades in many countries)" and "The two adjacent grades with the largest proportion of 13-year-olds at the time of testing (seventh and eighth grades in many countries)" (page 1 in (Martin & Kelly, 1997a)).

The grade three and grade four cohorts were named lower and upper grade of population 1 and the seven and eight grade cohorts were named lower and upper grade of population 2. The concept of TIMSS is a three-strand model that takes the perspective of the intended curriculum, the implemented curriculum and the attained curriculum. (see chapter 1.2 in (Martin & Kelly, 1997a). This concept is taken from the IEA SIMS and investigates "what society would like to see taught", "what is actually taught in the classroom", and "what the students learn" (page 3 in (Martin & Kelly, 1997a). Extensive analysis of all participating countries curricula and text books were performed.

The TIMSS assessment is a curriculum based assessment[2] which means that the assessment is evaluated by experts and matched to the national curricula of participating countries. Based on this idea of assessing what is taught in the various countries in school by the sevens and eighth grade, the TIMSS 1995 assessment includes for population 2 items in six mathematics domains: "fraction and number sense; measurement; proportionality; data representation, analysis and probability; geometry and algebra." (page 1 in (Beaton, Mullis, et al., 1996)). The population 2 science assessment included items from five content dimensions: "earth science, life science, chemistry and environmental issues and the nature of science." (page 1 in (Beaton, Martin, et al., 1996)).

Items were developed by subject matter experts and country representatives of participating countries. The items were piloted, used in a field trial and thoroughly reviewed before entering in the final assessment. (see chapter 2 in (Martin & Kelly, 1997b)). To cover all domains adequately for mathematics 125 multiple-choice items, 19 short-answer items and 7 extended response items were included in the final assessment and for science 102 multiple-choice items, 22 short-answer items and 11 extended response items were included (see tables 3.13 and 3.14 in (Martin & Kelly, 1997b). "The design thus provides 396 unique testing minutes, 198 for science and 198 for mathematics. " (page 16) Since not all items could be given to any single student the items were grouped together into item clusters and the clusters assembled to eight different but overlapping test booklets. Each of the booklets required 90 minutes of testing time.

Also for later cycles the TIMSS assessment is a curriculum based (see "The TIMSS curriculum model" page 4 in (Mullis, Martin, Ruddock, et al., 2005). The assessment design includes for grade four the content domains number, geometric shapes and measures, and data display and for grade eight number, algebra, geometry and data, and chance. The cognitive domains are knowing, applying, and reasoning (see (Mullis, Martin, Ruddock, O'Sullivan, & Preuschhoff, 2009)). In science the content domains life science, physical science, and earth science are assessed and in grade eight the domains

[2] This is a difference to the approached used in OECD PISA where the assessment is set up by experts independent of countries' curricula. In that sense PISA is normative and defines a learning goal that should be reached by students at the age of 15 to be successful in their economic life (OECD, 1999)

biology, chemistry, physics and earth science are assessed; again the assessed cognitive domains are knowing, applying, and reasoning.

The test items in all TIMSS cycles are distinguished in multiple choice items and open ended items where students were asked to answer in an open format. Later a scorer assigned a number of score points which could be zero or one and for some items even up to three score points. In the 2011 cycle of TIMSS 217 mathematics and 217 science items were used in the grade eight assessments. Again, the items were grouped into blocks and the blocks were assembled to booklets using a spiral rotating design. Each student was assigned one test booklet with two testing session each of a length of about 40 minutes of testing time.

The assessments – this includes stimulus material and items – were translated into the language(s) of instruction for each country. A thorough translation verification control took place to ensure that the meaning of the item and in particular the difficulty was not changed in the translation process. Each student was assessed in the language of instruction. In some countries more than one target language was used. For example in Canada English and French were used in the assessment (and also for gathering the background information).

TIMSS questionnaires

Besides the assessment component, TIMSS also administered several background instruments. For each participating country a questionnaire had to be completed that includes questions regarding the curriculum – especially the scope and content, its organization, monitoring and evaluation systems as well as curricular materials and support. (see pages 82 and 83 in (Mullis et al., 2009). The results of these questionnaires were published in encyclopedias (e.g. for TIMSS 2007: (Mullis & Martin, 2008).

Furthermore all sampled schools received a questionnaire that had to be completed by the school principal. This questionnaire included questions about the school demographics, the school organization, the goals of the school, the roles of the principal, school resources, the school climate, the parental involvement, the teacher recruitment and teacher evaluation. (see pages 84 and 87 in (Mullis et al., 2009).

All mathematics and science teachers of the sampled students received a questionnaire about their academic preparation and certification, the assignment, teacher induction, professional development, teacher characteristics, curriculum topics taught, class size, instructional time and activities, assessment in the class and homework assigned, computer and intranet use, calculator use and emphasis on investigation (see pages 88 and 93 in (Mullis et al., 2009). Since majorly mathematics classes were sampled, in countries where students are taught in course systems, different science teachers could be responsible for different subgroups of the students. In countries where science is taught as separate subjects – physics, chemistry, biology and earth science or any combination of those – each of the different science teachers had to complete one questionnaire.

In some countries students also had more than one mathematics teacher responsible for different topics that were taught at the same grade – for example algebra and analysis or algebra and geometry. It also occurred that some students had extra mathematics or science lessons – either extra tuition for lower performing students or special courses for high performing students. Due to this fact the number of mathematics and science teachers varies between but also within

participating countries and there is not necessarily a one to one match between students and mathematics and science teachers. This aspect must be considered when analyzing the TIMSS teacher data.

Another important factor regarding the TIMSS teacher data is that although the school and student data consists of a representative sample of schools and students of each participating country, the teacher data is not a representative sample. "The teachers in the TIMSS 2007 international database do not constitute a representative sample of teachers in the participating countries. Rather, they are the teachers of nationally representative samples of students. Therefore, analyses with the teacher data should be made with the students as the units of analysis and reported in terms of students who are taught by teachers with a particular attribute." (page 11 in (Foy & Olson, 2009)).

Finally all students who took part in the assessment also received a questionnaire to be completed. The student background questionnaire mainly included information about the home background, such as "…number of books at home, availability of study desk, the presence of a computer, the educational level of the parents, and the extent to which students speak the language of instruction …" (page 94 in (Mullis et al., 2009) but also questions about the lessons, the students' learning habits and their attitudes towards the school in general but especially about mathematics and science.

The TIMSS sample

The aim of TIMSS is to analyze what happens in schools and within classes. Consequently, TIMSS uses grade[3] based samples and applies a stratified three-stage cluster sampling approach where students were nested in classes and classes nested in schools – and in some countries even schools in regions.

Before the sampling is carried out, the population was also stratified. There are two different types of stratification: explicit stratification and implicit stratification. Explicit stratification means that the population is split into different groups based on its membership to the stratifying variables and then the sampling is executed separately for each group. If there is for example an interest in comparing rural and urban schools in later analysis one could explicitly stratify by urbanization and sample the same number of rural and urban schools. Given that the variance of the variable of interest in both groups is similar this would result in a relatively smaller sampling error of the difference between the two groups compared with a simple random sample on the expense that the overall sampling would be increased.

Implicit stratification means that the populations are ordered by the characteristics of the implicit stratification variables before a sample is drawn. For example, schools could be ordered by jurisdictions – like states – within a country. Then, with a systematic sampling approach (see below)

[3] In comparison the OECD PISA study applies an age based sample and samples 15 year-old students in each participating country independent of the grade or even ISCED level that the students are enrolled in. For comparing school level factors on achievement the grade based approached seems to be beneficial since the grade distribution of groups of students with different achievement levels differ significantly in some countries. This is probably caused by the policies in some countries of having students not reaching a certain ability level repeat a grade. For the immigrant population another effect might cause that students are enrolled in grades lower than the median grade level in the countries which is the change from one educational system into another with additional potential language problems. This problem will be discussed in more detail in chapter 4B.

all jurisdictions would be represented proportionally to their size. The advantage for this is that one can be sure that the random sample represents the characteristics of the population with respect to the implicit stratum variable adequately. In TIMSS, both - implicit and explicit stratification – is used. The stratification variable for each country are listed in appendix in (Foy & Olson, 2009).

Within each stratum the schools were ordered by the measure of size (MOS) which usually was the number of students either in the target grade (if this figure was available) or the number of students in the school, or ,where both were not available, any other measure of the size of the school. For the school sampling a systematic sampling approach was chosen. This means that from the (stratified) list of schools the first school was chosen randomly and then every *n*th school was selected where *n* is the sampling interval. The sampling interval is calculated as the MOS divided by the intended sample size. If for example the sampling interval was 100, then the school with the hundredth student after the first school was selected as the second school, the school with the two-hundredth student as the third school, and so on. This resulted in schools being sampled proportional to their size (PPS). Within the sampled schools, the classes were sampled randomly.

The aim was to sample 150 schools per country. Some countries selected more schools (up to 413 in Canada in TIMSS 1995) and some small countries had to select fewer schools. In Cyprus only 55 schools and in Kuwait 69 were sampled in TIMSS 1995. (see tables 2.16 and 2.17 in (Martin & Kelly, 1997a). Then one classroom was sampled randomly in each school for each grade. In TIMSS 1995 some countries choose to sample two classes per school, for example Australia, Sweden or the US4. Then all students in the selected class were tested in most countries. For example in the Philippines in TIMSS 1995 32 students were subsampled randomly in each sampled class because of very large classes.

If a school did not participate, the next school on the list of schools was selected as a replacement school. Since the replacement school is in the same explicit stratum and probably also in the same implicit stratum and has a comparable size, it is assumed that the replacement school is similar to the originally sampled school. If a class or a student did not participate no replacement was drawn since it was assumed that this could bias the sample. TIMSS applied rigorous standards for acceptable levels of non-response to avoid serious bias.

Due to the stratification and the sampling proportional to the size weights that were calculated at school level, at class level and at within-class level (which is usually the same since all students in a class were selected). The weight is the inverse of the sampling probability. Consequently, large schools have a smaller weight due to the sample being proportional to size. But since larger schools usually have more classes, each class had a lower sampling probability. Thus, the sampled class within the school had a larger sampling probability. Also weight adjustments were calculated at school and at student level. This means that for each non-replaced non-participating school, the weight of the participating schools within the stratum were increased. Also the weights of the students within a sampled class were increased if there were non-participating students in the class.

[4] This has become more common in pater cycles of TIMSS since more countries were aware of streaming that takes place within schools. This means that students are grouped in different classes by ability levels of the students. This results in significantly higher achieving and lower achieving classes in the concerned schools. To reduce variances between the sampled schools because of different ability classes being selected and to disentangle school and class effects an increasing number of participating countries has chosen to select more than one class per school.

The total student weight is the product of the school weight, the class weights, the student weight, the school adjustment factor, and the student adjustment factor. The student weights are summing up to the total student population in each country. For details about the sampling, the reader is referred to chapter 5 in (Foy & Olson, 2009) and for the weighting to chapter 9 in (Foy & Olson, 2009).

The TIMSS scores

In classical test theory (CTT), it is assumed that examinees have a certain ability or latent trait which we want to measure with a test. The estimate is specific to the particular test or set of items administered to the examinee. The measurement includes some errors; therefore, we are getting only an estimate of the examinees' actual ability. CTT offers different methods to estimate measurement error terms, the appropriateness of items in a test and how well the test measures the ability. In classical test theory, examinees can be ranked by their ability and items can be ranked by their difficulty. The problem is that comparisons across different test forms administered to different populations are difficult.

In contrast to CTT, Item Response Theory (IRT) estimates item properties – as item difficulty – that are expressed not in terms of percentages of correct answers achieved by a given population, but rather in terms of the log of the odds of a person with a certain ability to achieve a particular response to the item. This means that the difficulty of the item is independent of the examinees tested. IRT is a measurement theory that estimates the examinees' probability of answering an item - given certain item characteristics – correctly. We thus want to know the probability for each examinee to answer each item correctly. In mathematical terms this is described by P(x=1).

The simplest IRT model is one that considers only differences in the item difficulty. If I define the difficulty of an item I as b_i and the ability of an examinee ν as $\Theta\nu$, I come to the equation:

$$P(x_{\nu i}=1) = e^{\Theta\nu - bi} \,/\, 1 + e^{\Theta\nu - bi}$$

This is known as the RASCH or one parameter model and was originally developed by the Danish mathematician Georg Rasch (Rasch, 1960).

This model has been extended by psychometricians by including a discrimination or slope parameter. The idea is that different items discriminate better or worse between more and less able students. This can be modeled by the formula:

$$P(x_{\nu i}=1) = e^{ai(\Theta\nu - bi)} \,/\, (1+e^{ai(\Theta\nu - bi)})$$

Especially for multiple-choice questions, respondents have a positive probability for guessing the correct response – even if they do not know the correct response. Examinees who do not know the answer have at least a chance of getting the item correct by marking randomly one of the response options. In IRT this can be modeled by introducing a guessing parameter into the model. To reflect this, a value c_i which indicates the probability of guessing the item i correctly is introduced which results in the formula:

$$P(x_{\nu i}=1) = c_i + (1-c_i)e^{ai(\Theta\nu - bi)} \,/\, 1 + e^{ai(\Theta\nu - bi)}$$

There are also further extensions to these models, for example for items with multiple score points (partial credit models – see (Masters, 1982)), or models for groups of examinees with different response behavior. The methods for estimating the item parameters also differ significantly although all methods are iterative ones that are have more or less intense computational demands (Bock & Aitken, 1981). Further models refer to the examinees' scores which could also be modeled not as discrete values but as distributions of ability measures (Rubin, 2009; von Davier, Gonzalez, & Mislevy, 2009).

And there is always, of course, the debate which model is the more appropriate, or even the best or only one to use. However, one should always examine if the method used is appropriate for the data to be analyzed. Especially the three parameter models require a substantial amount of data.

It should also be noted that in theory some conditions must be met to allow the application of IRT models. The underlying latent trait must be uni-dimensional and the probability to get any item correct must not depend on any other item (local independence). However, also for tests that do not meet these criteria, different models were developed (see e.g. (Brandt, S., 2008)).

In TIMSS IRT is used to analyze the test data and to assign achievement scores to students. Since the TIMSS assessment consists of different item types, different models are used for different items. A two parameter IRT model is used for dichotomous constructed response items. A three parameter model is used for dichotomous multiple-choice items. And since some constructed response items were not only coded to correct or incorrect but partially correct answers were also assigned partially correct codes, a generalized partial credit two parameter model was used to describe them. (see chapter 11.2 in (Olson, Mullis, & Martin, 2008)).

For the calculation of student proficiency scores the data from the current cycle and the previous cycle were scaled together to achieve a common scale and consequently achievement scores for all TIMSS cycles on one common metric. This resulted in student achievement scores on a logit metric with values usually between -3 and 3 – and in extreme cases between -5 and 5 with lower values indicating lower ability levels of students and higher values higher ability levels of students.

As described above, in TIMSS a matrix-sampling design is applied. This means that tested students are assigned only a fraction of the available items. This design is less optimal for estimating the ability of individual students but is very efficient in giving good population proficiency estimates5. To account for the measurement error introduced by the matrix-sampling design and to achieve good estimates for population – and subpopulation – estimates the plausible value are calculated.

Plausible values are drawn from the ability distribution of each student. To achieve this, the background data gathered in TIMSS is analyzed with a factor analysis and as many factors are extracted until 90 percent of the variance in the background data was accounted for. From the multivariate normal distribution of the conditioned ability distribution of the students ($P(\Theta_j \mid y_j, \Gamma, \Sigma)$) five values a randomly drawn. These values are called plausible values and the variance between the plausible values is an estimator for the measurement error. For example, a tested student who gives

[5] This is also the reason why it is not recommended to use the TIMSS test to analyze individual students or to give feedback to individual students or very small groups of students (see for example chapter 3.2.1 in (Mirazchiski, 2013)).

wrong answers to items that are characterized as easy, but answers harder items correctly, with his score being relatively high compared to other students with this background information (e.g. a boy scoring high on a reading scale on which girls usually score higher), then the ability distribution for this student would be relatively wide compared with, for example, a high scoring girl that answered all easy items as well as most of the difficult items correctly would be much narrower. Consequently, also the variance of the five randomly drawn plausible values would be higher for the boy in this example. (see chapters 11.2.3 – 11.2.5 in (Olson et al., 2008)).

Analyzing TIMSS data

When analyzing the TIMSS data the sampling weights must always be considered to ensure that the results are representative for the total population. The other effect of the sampling approach is that the effective sample size is smaller compared to a simple random sample of students. When using the total weight statistical standard software overestimates the sample size and consequently underestimates variances or standard errors. To overcome this challenge TIMSS recommends the use of the Jackknifing procedure (JK2) which is a replication method where the statistics of interest are calculated several times using replication weights. The variance of the results is an estimator for the sampling error (see (Foy & Olson, 2009)).

The other challenge when analyzing the TIMSS data is the correct usage of the plausible value scores. For mean statistics, each of the five plausible values can be used in the analysis. Usually the first plausible value is used or sometimes the results of the analysis of the five plausible values are averaged. The plausible values should be never be averaged before the analysis, and then the average of the plausible values be used in the analysis.

As described above, the variance of the plausible values is an estimation of the measurement error. Consequently, the variance of the results of any analysis conducted five times with each of the plausible values separately is an estimation of the impact of the measurement error on the results.

The total error for a statistic based on the TIMSS data that makes use of the plausible values is then the square root of the sum of the squared sampling error and the squared measurement error since sampling error and measurement error are assumed to be independent.: $SE_{tot} = \sqrt{SE_{mea}^2 + SE_{samp}^2}$

Methods of analysis

To assist researchers, the IEA has developed an international database analyzer (IDB Analyzer) which considers the sampling method as well as the scoring methods when calculating statistics. The IDB Analyzer is a plugin for SPSS. In the analysis, the IDB analyzer is used to calculate the statistics and especially the standard errors of differences. The IDB Analyzer considers the weights, the sampling strategy and the plausible values correctly by applying the Jackknife procedure and by calculating each statistic five times with each plausible value separately, then calculating the variance of the results.

Significance and relevance of differences

With the help of the IDB Analyzer the correct standard errors of the statistics can be calculated. I follow the general approach that is also used in the TIMSS international report and define two statistics as statistically significantly different at a 95 percent confidence level. This means that the probability of assuming a difference of two statistics in the population that we generalize on as significant - although it is not - is 95 percent. In statistic terms this means that the probability for a

type-I error is five percent. (for TIMSS see chapter 12.4.1 in (Martin, Mullis, & Chrostowski, 2004)) However, with a sufficiently large sample size and a test tool that delivers sufficiently accurate measures at individual level, all differences can become statistically significant. This leads to one of the critics towards results from large scale assessment studies – namely that all differences become statistically significant.

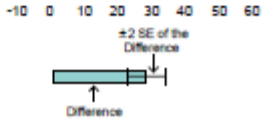
The question then is if the differences are meaningful. Is a difference of five score points in mathematics achievement between boys and girls in TIMSS 2007 in Slovenia relevant? In the interpretation of the results from the quantitative analysis we need to consider if differences are statistically significant because non-significant differences are definitively not meaningful. But I also want to interpret the results by referring to results from TIMSS 1995.

In TIMSS 1995 countries tested students not only in one target grade but tested students in two adjacent grades. This resulted in testing students in grades three and four and in grades seven and eight. The assessments of the adjacent grades were made with the same instruments and the scores were calculated on the same metric with a mean of 500 and a standard deviation of 100 across both grades. Since I am analyzing the grade eight data in this dissertation, I focus on the differences between the grade seven and grade eight results in TIMSS 1995 to evaluate the learning effect. Picture 3.1 (Table 1.3 in (Beaton, Mullis, et al., 1996)) displays the differences between the grades for each participating country in TIMSS 1995.

Picture 3.1

Achievement Differences in Mathematics Between Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Seventh Grade Mean	Eighth Grade Mean	Eighth-Seventh Difference
† Lithuania	428 (3.2)	477 (3.5)	49 (4.7)
France	492 (3.1)	538 (2.9)	46 (4.3)
Norway	461 (2.8)	503 (2.2)	43 (3.6)
Singapore	601 (6.3)	643 (4.9)	42 (8.0)
Sweden	477 (2.5)	519 (3.0)	41 (3.9)
Czech Republic	523 (4.9)	564 (4.9)	40 (7.0)
† Switzerland	506 (2.3)	545 (2.8)	40 (3.6)
Spain	448 (2.2)	487 (2.0)	39 (3.0)
Slovak Republic	508 (3.4)	547 (3.3)	39 (4.7)
New Zealand	472 (3.8)	508 (4.5)	36 (5.9)
† Scotland	463 (3.7)	498 (5.5)	36 (6.6)
Hungary	502 (3.7)	537 (3.2)	35 (4.9)
Russian Federation	501 (4.0)	535 (5.3)	35 (6.6)
Japan	571 (1.9)	605 (1.9)	34 (2.7)
Canada	494 (2.2)	527 (2.4)	33 (3.3)
† Latvia (LSS)	462 (2.8)	493 (3.1)	32 (4.2)
Portugal	423 (2.2)	454 (2.5)	31 (3.3)
Korea	577 (2.5)	607 (2.4)	30 (3.5)
†2 England	476 (3.7)	506 (2.6)	30 (4.5)
Cyprus	446 (1.9)	474 (1.9)	28 (2.7)
Ireland	500 (4.1)	527 (5.1)	28 (6.6)
Iran, Islamic Rep.	401 (2.0)	428 (2.2)	27 (2.9)
Iceland	459 (2.6)	487 (4.5)	27 (5.2)
Hong Kong	564 (7.8)	588 (6.5)	24 (10.2)
† United States	476 (5.5)	500 (4.6)	24 (7.2)
† Belgium (Fr)	507 (3.5)	526 (3.4)	19 (4.9)
† Belgium (Fl)	558 (3.5)	565 (5.7)	8 (6.7)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	498 (3.8)	530 (4.0)	32 (5.5)
Austria	509 (3.0)	539 (3.0)	30 (4.3)
Bulgaria	514 (7.5)	540 (6.3)	26 (9.8)
Netherlands	516 (4.1)	541 (6.7)	25 (7.8)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Slovenia	498 (3.0)	541 (3.1)	43 (4.3)
Romania	454 (3.4)	482 (4.0)	27 (5.3)
†1 Germany	484 (4.1)	509 (4.5)	25 (6.1)
Colombia	369 (2.7)	385 (3.4)	16 (4.4)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Denmark	465 (2.1)	502 (2.8)	37 (3.5)
Greece	440 (2.8)	484 (3.1)	44 (4.2)
South Africa	348 (3.8)	354 (4.4)	7 (5.9)
Thailand	495 (4.8)	522 (5.7)	28 (7.5)



The differences between the two grades differ between the countries. As Beaton et al. concluded: ”Increases in mean performance between the two grades ranged from a high of 49 points in Lithuania to a low of 8 points in the Flemish-speaking part of Belgium and 7 points in South Africa. This degree of increase can be compared to the difference of nearly 30 points between the international average of 513 at eighth grade and that of 484 at seventh grade” (Beaton, Mullis, et al., 1996, p. 27). Although the differences are varying between countries and probably also for subgroups of students and also across time, we might use the 30 point score difference to put some meaning to differences within grade eight groups of students. When interpreting a difference of 25 score points between first generation immigrant students and native students in Latvia in 1995 – as we will see in chapter 4A – we might interpret this as nearly the amount of what students learn on average in one school year. This interpretation should be done with great care and a lot of caveats but it might help judging if a difference is not only statistically significant but also meaningful.

Focus on mathematics

When analyzing the educational outcome for immigrants and native students, a main focus will be the achievement measured in TIMSS. As stated above, TIMSS measured mathematics and science achievement of the assessed students and PIRLS measures reading literacy abilities. Clearly, mathematics, science and reading achievement are only one aspect of educational outcome. And although I will also focus on attitudes towards school and mathematics and on the self-esteem with respect to mathematics, it is clear that this is only a limited focus.

I do not investigate the creativity of the students, their social competencies, their cooperation, their health and well-being and many other aspects that are and should be foci of education. This is clearly a limitation of the study at hand but the limitation was necessary to make the in-depth analysis feasible. And one can also argue that although literacy, mathematics, and science abilities of students are not exhaustive learning outcomes, they are nevertheless basic skills and the ability to be a good and efficient learner in these subjects also show the ability of students learning other subjects. In later life there are strong relationships between these basic skills and other aspects in life.

The OECD PIAAC survey assessed various skills of adult populations and their relationship to other aspects of life. “The Survey of Adult Skills collected information on four dimensions of well-being: the level of trust in others, political efficacy or the sense of influence on the political process; participation in associative, religious, political or charity activities(volunteering); and self-assessed health status. Over all, literacy proficiency has a positive relationship with all four of the outcomes considered, net of the effects of education, socio-economic background, age, gender, and immigrant background.” (Page 234 in (OECD, 2013a)).

And although school education does and should do more than preparing people for work, being employed as an adult is surely also a positive outcome of education – not only in economic aspects but also in a more holistic view. In this respect, the PIAAC survey found: „An individual who score one standard deviation higher than another on the literacy scale (around46 score points) is 20% more likely to participate in the labour market” (page 227 in (OECD, 2013a)).

For students, the mathematics, science, and reading literacy achievement is strongly correlated for the students. As described above, in TIMSS/PIRLS 2011 countries were offered the opportunity to assess the same students in grade four in TIMSS and PIRLS. For the countries that made use of this option, table 3.1 shows the correlations at student level among these three scales. Table 3.1 shows the correlation between reading literacy and mathematics, reading literacy and science and mathematics and science achievement. Also the difference of the correlations between reading literacy and mathematics, reading literacy and science and if this is significant is displayed.

As can be seen from table 3.1 all three scales correlate quite strongly. Internationally, and reading literacy and mathematics score correlate to 0,78, and reading literacy and science correlate to 0,85 and mathematics and science correlate to 0,83. I can conclude that in general and across all countries, students doing well in one of the subjects are usually also doing quite well in the other subjects. Consequently, the results I find when analyzing one of the scales have a high potential also to be valid for the other two subjects.

Table 3.1

Correlation of Reading, Mathematics and Science scores in TIMSS 2011 Grade 4

Country	Reading and Mathematics		Difference R-M vs R-S		Reading and Science		Mathematics and Science	
	Corr	**SE**	**Diff**	**sign**	**Corr**	**SE**	**Corr**	**SE**
Saudi Arabia	0,72	(0,02)	0,12	↑	0,84	(0,01)	0,80	(0,02)
Canada (Quebec)	0,67	(0,01)	0,12	↑	0,79	(0,01)	0,75	(0,01)
Norway	0,74	(0,02)	0,11	↑	0,85	(0,01)	0,79	(0,02)
Sweden	0,73	(0,01)	0,11	↑	0,84	(0,01)	0,78	(0,01)
Spain	0,72	(0,01)	0,10	↑	0,82	(0,01)	0,79	(0,01)
Malta	0,77	(0,01)	0,09	↑	0,86	(0,00)	0,81	(0,01)
Portugal	0,76	(0,01)	0,09	↑	0,85	(0,01)	0,85	(0,01)
Australia	0,81	(0,01)	0,09	↑	0,90	(0,01)	0,86	(0,01)
Finland	0,72	(0,02)	0,09	↑	0,81	(0,01)	0,80	(0,01)
Italy	0,75	(0,01)	0,09	↑	0,84	(0,01)	0,80	(0,01)
Austria	0,78	(0,01)	0,08	↑	0,87	(0,01)	0,82	(0,01)
Germany	0,79	(0,01)	0,08	↑	0,87	(0,01)	0,81	(0,01)
Honduras, Republic of	0,74	(0,02)	0,08	↑	0,83	(0,01)	0,84	(0,01)
Romania	0,79	(0,02)	0,08	↑	0,87	(0,01)	0,86	(0,01)
Slovenia	0,81	(0,01)	0,08	↑	0,89	(0,01)	0,87	(0,01)
Croatia	0,76	(0,01)	0,08	↑	0,84	(0,01)	0,80	(0,01)
Russian Federation	0,73	(0,01)	0,08	↑	0,81	(0,01)	0,83	(0,01)
Hong Kong, SAR	0,69	(0,01)	0,08	↑	0,77	(0,01)	0,77	(0,01)
Botswana	0,84	(0,01)	0,07	↑	0,91	(0,00)	0,90	(0,01)
Georgia	0,76	(0,01)	0,07	↑	0,83	(0,01)	0,85	(0,01)
Slovak Republic	0,81	(0,02)	0,07	↑	0,88	(0,01)	0,88	(0,01)
Singapore	0,84	(0,01)	0,07	↑	0,91	(0,00)	0,86	(0,01)
Ireland	0,79	(0,01)	0,07	↑	0,86	(0,01)	0,84	(0,01)
Iran, Islamic Republic of	0,82	(0,01)	0,07	↑	0,89	(0,01)	0,87	(0,01)
Poland	0,82	(0,01)	0,06	↑	0,88	(0,01)	0,85	(0,01)
Hungary	0,84	(0,01)	0,06	↑	0,90	(0,01)	0,88	(0,01)
United Arab Emirates	0,84	(0,01)	0,06	↑	0,90	(0,00)	0,87	(0,00)
United Arab Emirates (Abu Dhabi)	0,84	(0,01)	0,06	↑	0,90	(0,01)	0,86	(0,01)
United Arab Emirates (Dubai)	0,85	(0,01)	0,06	↑	0,91	(0,00)	0,88	(0,00)
Czech Republic	0,79	(0,01)	0,06	↑	0,84	(0,01)	0,82	(0,01)
Chinese Taipei	0,78	(0,01)	0,05	↑	0,84	(0,01)	0,81	(0,01)
Northern Ireland	0,82	(0,01)	0,04	↑	0,86	(0,01)	0,84	(0,01)
Azerbaijan, Republic of	0,59	(0,02)	0,04		0,63	(0,02)	0,76	(0,01)
Lithuania	0,82	(0,01)	0,04	↑	0,85	(0,01)	0,86	(0,01)
Oman	0,81	(0,01)	0,03	↑	0,84	(0,01)	0,88	(0,01)
Qatar	0,85	(0,01)	0,02	↑	0,87	(0,01)	0,87	(0,01)
Morocco	0,69	(0,01)	0,01		0,71	(0,01)	0,81	(0,01)
Int. Avg.	0,78	(0,00)	0,07	↑	0,85	(0,00)	0,83	(0,00)

Note. Differences R-M vs R-S shows the differences between the Pearson Correlation Coefficients and whether they are statistically significantly different

Due to the results we will see in chapter 4.1 I cannot use the reading scale because PIRLS measures the abilities of grade four students and as we will find in chapter 4.1 the background information – especially with respect to immigration status - are less reliable. Focusing on TIMSS I could analyze the mathematics and science abilities of the students as achievement outcomes.

Consequently, Chapter 4.1 shows the results for mathematics and science for immigrant and native students. But from chapter 4.2 on, I will focus on the mathematics achievement of the students. As

stated above, the results found for mathematics have a high potential to be valid also for science – and also for reading literacy with some caveats. The focus on mathematics for most part of this research has two main reasons.

One reason is the lower influence of language on the achievement results. As can be seen in table 3.1 the correlation between reading literacy abilities and mathematics is statistically significantly lower than for reading literacy abilities and science in all but two countries. As we will see in chapter 4.2 a high proportion of immigrant students is coming with a different language background and consequently their lack in language proficiency impacts their learning and achievement. Consequently, looking at mathematics achievement is less disadvantaging for immigrant students than investigating their science achievement[6].

The second reason is based on the TIMSS design. In TIMSS, mathematics classes – one or more – were sampled randomly in each sampled school because in most countries mathematics classes were identified as exhaustive and mutually exclusive groups of students. The mathematics teachers of the sampled students also completed a questionnaire and the data is used in the analysis presented, too.

For science, the situation is more complicate. First, in some countries science is taught as one subject whereas in other countries, science is separated into different subjects – physics, biology, chemistry, earth science, and others. This is the case in for example Germany, Austria, or Slovenia. Moreover in some countries there is a different emphasize on the different science domains in different school years, although all are taught in one subject called science. Consequently science is taught by different teachers in different grades in the participating countries. This makes it difficult to obtain reliable information from the current teacher in any grade about all science subjects.

Furthermore, as also described above, in several countries students are taking more than one science course per grade, which was probably the main reason for sampling mathematics classes rather than science classes. This results in sampled students being linked to more than one science teacher in some countries. In other countries some students from several science courses – but not all students of any of those classes - being included in the international database which results in small subsamples of a number of science classes per school. This makes it very difficult when analyzing science classes in the TIMSS data.

For the analysis of science teacher data an additional obstacle is that in cases where there is more than one science teacher the different impacts from the different teachers can hardly be disentangled. For example, if I talk about students taught by a male or female mathematics teacher, in science I have to distinguish between students being taught by only male science teachers, only female science teachers and a combination of male and female science teachers – and again the influence of each is hardly to disentangle.

[6] One caveat here is that the correlations shown in table 3.1 are based on grade four students' data whereas the data analyzed mainly in this study in about students in grade eight.

Chapter 4A Immigrant students in TIMSS

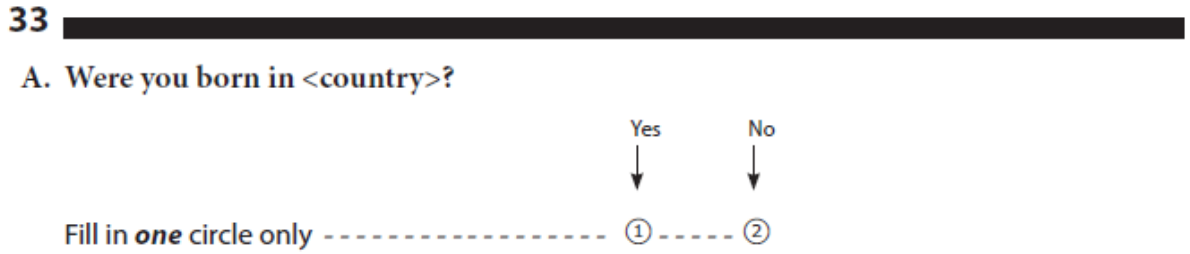
I have so far given an introduction into the topic outlined the research questions that guide this dissertation. A literature review on the topics that will be analyzed starting in this chapter is conducted and the following analyses will build on what was found there. The previous chapter has introduced the data and methods that will be used in this and the following three chapters.

In this chapter the trends in percentages and the achievement trends in mathematics and science for immigrant students are analyzed. The aim is to get an overview before more in-depth analysis of the TIMSS 2007 data will be performed.

Trends for percentages of first generation immigrant students in grade eight

The percentages of students with an immigrant background enrolled in schools vary substantially between countries – and in most countries also within the country. First I will analyze the percentages of first generation immigrant students in the school systems. The focus is on the grade eight students. In the analysis the TIMSS grade eight data is used.

In the TIMSS cycles 1995, 1999, 2003, and 2007 the students were asked if they were born in the country of residence. For example in TIMSS 2007 the following question was included at the end of the student questionnaire.



(Source: (Foy & Olson, 2007, p. 226))

The participating countries had to adapt this international version of the question by replacing "<country>" with their country name. Table 4.1 shows the percentage of students in grade eight for each of the TIMSS cycles who reported not to be born in the country of residence for each of the country participating in at least one of the TIMSS cycles.

Table 4.1.1: TIMSS grade 8: Trends in percentages of first immigrant students

	1st generation immigrants								trends							
	1995		1999		2003		2007		95->99		99->03		03-> 07		95->07	
Country	Perc.	SE	Perc.	SE	Perc.	SE	Perc.	SE	%	sign	%	sign	%	sign	%	sign
Armenia					4	0,5	11	0,9					7	↑		
Australia	11	0,8	14	1,3	15	1,3	11	0,9	3	→	1	→	-4	↓	0	→
Austria	6	0,5														
Bahrain					10	0,5	14	0,7					4	↑		
Belgium (Flemish)	3	0,5	4	0,9	7	0,8			1	→	3	↑				
Belgium (French)	9	0,9														
Bosnia and Herzegovina							24	1,2								
Botswana					4	0,8	5	0,4					1	→		
Bulgaria			3	1,0	5	0,6	10	0,7			2	↑	5	↑		
Canada			10	0,7												
Canada (British Columbia)							16	1,3								
Canada (Ontario)					16	1,6	13	1,3					-3	→		
Canada (Quebec)					6	1,1	8	0,7					1	→		
Chile			3	0,3	5	0,4					2	↑				
Chinese Taipei			1	0,1	2	0,3	6	0,4			1	↑	4	↑		
Colombia	3	0,3					5	0,5							2	↑
Cyprus	10	0,4	8	0,4	12	0,5	10	0,5	-1	→	4	↑	-2	↓	1	→
Czech Republic	1	0,2	1	0,3			3	0,3	0	→					1	↑
Denmark	6	0,5														
Egypt					26	1,8	43	1,9					17	↑		
El Salvador							5	0,5								
England	5	0,5	5	0,6	7	0,9	8	0,7	0	→	1	→	1	→	3	↑
Estonia					4	0,4										
Finland			3	0,5												
France																
Georgia							6	0,6								
Germany	10	0,8														
Ghana					31	1,8	18	1,4					-13	↓		
Greece	6	0,4														
Hong Kong, SAR	13	0,9	18	1,2	27	1,0	26	1,3	5	↑	9	↑	-1	→	13	↑
Hungary	2	0,2	2	0,3	3	0,3	3	0,4	0	→	1	→	0	→	1	↑
Iceland	7	0,5														
Indonesia			1	0,2	13	1,0	16	1,2			12	↑	3	↑		
Iran, Islamic Republic of	2	0,3	1	0,2	1	0,2	1	0,1	-1	↓	1	↑	-1	↓	-1	↓
Ireland	3	0,3														
Israel	14	2,1	16	1,7	14	1,0	13	1,2	2	→	-3	→	-1	→	-1	→
Italy			3	0,3	5	0,4	5	0,4			2	↑	0	→		
Japan			1	0,1	1	0,2	1	0,2			0	→	0	→		
Jordan			16	0,9	25	1,3	13	1,3			8	↑	-11	↓		
Korea, Republic of			2	0,2	1	0,2	0	0,1			0	→	-1	↓		
Kuwait	7	0,8					16	0,8							9	↑
Latvia	1	0,2	7	1,8	4	0,4			6	↑	-3	→				
Lebanon					12	1,4	21	1,4					8	↑		
Lithuania	2	0,3	2	0,3	4	0,3	5	0,4	0	→	2	↑	0	→	3	↑
Macedonia			3	0,3	8	0,8					5	↑				
Malaysia			2	0,2	5	0,6	8	0,7			3	↑	3	↑		
Malta							7	0,4								
Moldova			9	1,1	13	1,0					4	↑				
Mongolia							14	0,8								
Morocco			6	0,7	12	1,3	7	0,7			6	↑	-5	↓		
Netherlands	5	0,5	7	1,0	7	0,6			2	→	0	→				
New Zealand	12	0,6	14	0,8	14	1,3			1	→	1	→				
Norway	5	0,4			8	0,6	6	0,4					-1	→	1	↑
Oman							15	1,2								
Palestinian National Authority					24	1,2	21	1,2					-3	→		
Philippines	2	0,1	21	1,4	3	0,3			19	↑	-18	↓				
Portugal	8	0,7														
Qatar							26	0,5								
Romania	4	0,6	3	1,0	2	0,2	4	0,5	-1	→	-1	→	2	↑	0	→
Russian Federation	6	0,8	7	0,7	9	0,6	8	0,7	0	→	2	↑	-1	→	2	→
Saudi Arabia					9	0,7	17	1,1					9	↑		
Scotland	8	0,5			5	0,4	6	0,6					1	→	-1	→
Serbia					10	0,8	7	0,5					-3	↓		
Singapore	8	0,4	9	0,6	13	0,6	11	0,5	1	→	4	↑	-2	↓	3	↑
Slovak Republic	2	0,2	2	0,3	3	0,4			1	↑	1	↑				
Slovenia	3	0,3	4	0,4	4	0,4	5	0,4	0	→	0	→	1	→	2	↑
South Africa	13	1,1	12	1,0	33	1,7			-1	→	20	↑				
Spain	3	0,3														
Spain (Basque Country)					3	0,5	6	0,7					3	↑		
Sweden	8	0,6			9	0,9	8	0,6					-2	→	0	→
Switzerland	12	0,6														
Syria, Arab Republic of							24	1,1								
Thailand	1	0,2	4	0,6			1	0,1	3	↑					-1	↓
Tunisia			5	0,7	0	0,1	5	0,4			-4	↓	4	↑		
Turkey			4	0,4			1	0,2								
Ukraine							7	0,6								
United Arab Emirates (Dubai)							52	1,4								
United States	7	0,6	8	0,8	8	0,5	10	0,6	1	→	1	→	1	→	2	↑
United States (Indiana)					5	0,7										
United States (Massachusetts)							9	0,9								
United States (Minnesota)							7	1,8								

As can be seen from table 4.1 out of 22 countries who participated in TIMSS 1995 and TIMSS 1999 in two countries the percentage of immigrant students decreased statistically significantly (Iran and Philippines), in four countries the percentage increased (Hong Kong, Latvia, Slovak Republic, and Thailand) and in the other countries the percentages did no change statistically significantly.

When comparing the TIMSS 1999 results with the TIMSS 2003 results I observe that out of 32 countries who participated in both cycles there is a decrease for one country (Tunisia) but an increase in 21 countries. The trend between TIMSS 2003 and TIMSS 2007 shows a decrease in ten countries and an increase twelve countries.

Obviously, the percentage of first generation immigrant students in the educational system increased in a large number of countries with the major increase between 1999 and 2003. In some of the countries the increase is quite significant. For example the percentage of first generation immigrants in South Africa increased from 13 to 33 percent between 1999 and 2003. In Saudi Arabia we see an increase from nine to 17 percent between 2003 and 2007. In Lebanon we observe an increase from twelve to 21 percent between 2003 and 2007, in Kuwait from seven to 16 percent between 1995 and 2007. Also Bulgaria showed an increase between 2003 and 2007 from five to ten percent. Of course this data refers to the student responses in TIMSS and is subject to response errors. Consequently, these figures do not always match the official statistics. But although considering an error margin, the general increase is evident. Yet it is quite obvious that these increases pose a challenge to the educational systems of the concerned countries.

I can answer the first part of the first research question clearly with a “Yes, the percentage of immigrant students increased in general for grade eight in TIMSS”.

Trends for percentages of first generation immigrant students in grade four

The fourth grade students in TIMSS as well as in PIRLS were asked the same question regarding their immigration status. TIMSS assessed fourth grade students in 1995, 2003 and 2007 and PIRLS assessed fourth grade students in 2001 and in 2006. It would be interesting to examine the reading achievement of immigrant students which was only measured for grade four students in PIRLS and also the achievement differences and other factors for immigrant students at the end of primary education. The problem is, however, that the information on the immigrant status is not very reliable for grade four students. Table 4.1.2 shows the percentages of first generation immigrants as reported by the grade four students for all countries that participated in more than one of the assessments.

Table 4.1.2: Trends of percentages of students not born in the country of schooling										
	TIMSS 1995		PIRLS 2001		TIMSS 2003		PIRLS 2006		TIMSS 2007	
Country	pct	SE	pct	SE	pct	SE	pct	SE	pct	SE
Armenia					4	0,4			30	1,7
Australia	9	0,8			16	0,9			16	0,8
Austria							6	0,5	16	0,6
Belgium (Flemish)					7	0,7	5	0,4		
Bulgaria			7	0,7			1	0,2		
Canada (British Columbia)							12	1,0	19	1,0
Canada (Ontario)			22	1,4			10	1,1	22	1,9
Canada (Quebec)			21	1,2	7	0,7	8	0,8	14	1,2
Cyprus	12	0,6	14	0,8	12	0,7				
Czech Republic	2	0,2	5	0,5					4	0,4
Denmark							5	0,4	10	0,8
England			15	1,3	15	1,0	8	0,7	14	0,7
Georgia							2	0,3	14	1,2
Germany			21	0,8			5	0,5	10	0,5
Hong Kong, SAR	19	1,7	30	2,0	27	1,5	18	0,9	25	1,6
Hungary	4	0,3	11	0,8	7	0,6	2	0,3	7	0,7
Iceland	12	1,9	16	0,5			7	0,4		
Iran, Islamic Republic of	11	0,8	3	0,4	3	0,4	3	0,4	2	0,4
Israel	16	1,5	25	1,2			7	0,6		
Italy			5	0,4	4	0,3	5	0,4	5	0,4
Japan					2	0,2			1	0,2
Kuwait	13	1,0	26	0,9			8	0,6	41	1,7
Latvia	4	0,4	9	1,4	10	0,8	26	1,3	8	0,7
Lithuania			5	0,7	6	0,4	1	0,2	8	0,7
Moldova			40	3,8	20	1,3	6	0,6		
Morocco			6	0,9	26	2,4	5	0,6	12	1,2
Netherlands	11	1,0	8	0,7	7	0,8	4	0,4	18	1,0
New Zealand	10	0,7	18	1,0	16	0,9	14	0,8	26	0,9
Norway	5	0,4	9	0,7	9	0,6	4	0,4	5	0,4
Qatar							18	0,4	58	0,5
Romania			4	0,9			1	0,2		
Russian Federation			9	0,7	14	0,9	5	0,4	7	0,8
Scotland	10	0,8	39	4,4	17	1,0	4	0,4	13	0,8
Singapore	8	0,6	21	1,0	21	1,2	10	0,4	10	0,4
Slovak Republic			9	1,3			1	0,2	3	0,4
Slovenia	4	0,4	11	0,9	3	0,4	2	0,3	12	0,5
Sweden			12	0,9			5	0,5	11	0,8
Tunisia					0	0,1			12	1,2
United States	9	0,7	19	1,0	20	0,8	8	0,6	19	0,7
Yemen					56	3,0			44	2,3

As can be seen in table 4.1.2 the percentages vary quite substantially even in cycles where the measurement was made almost at the same time. We can also see that the figures go up and down substantially between the different points in time. If we focus only on the percentages of immigrants in PIRLS 2006 and TIMSS 2007 – assessments that took place in two adjacent years – we see for

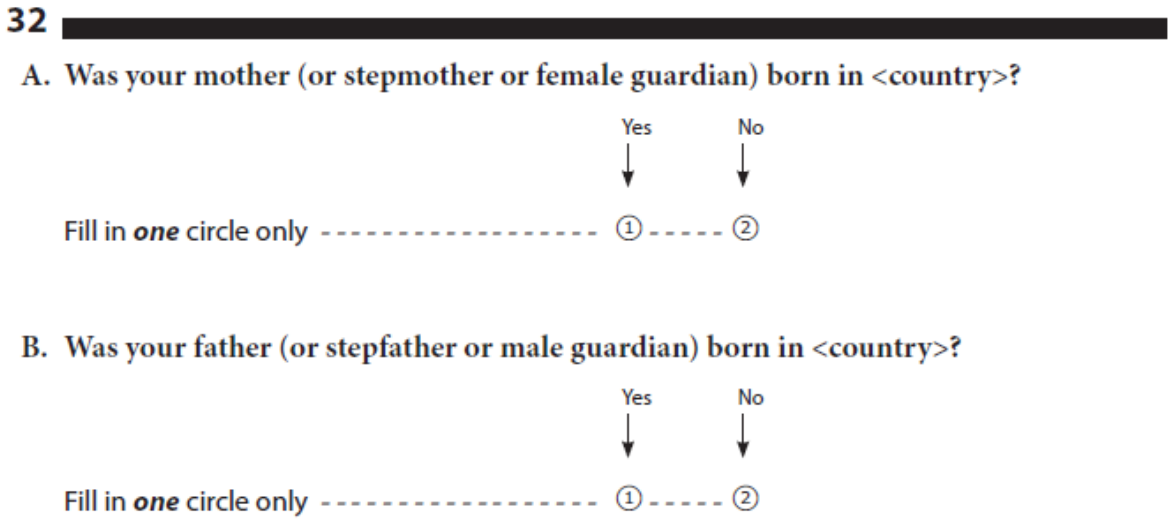
example in Austria six percent of immigrants in 2006 reported by PIRLS grade-four students and 16 percent in 2007 reported by TIMSS grade-four students. Although the percentages might have increased, it is very unlikely that such a dramatic change occurred.

The largest difference between the percentages of immigrant students based on PIRLS 2006 and TIMSS 2007 grade four students can be observed for Kuwait. In Kuwait eight percent of the grade four students in PIRLS answered to be immigrants in 2006 but 41 percent of the grade four students in TIMSS 2007 indicated to be immigrants. In contrast to the quite stable estimates for the percentage of immigrants in grade eight, these percentages are neither in line with each other nor with the trends that we can observe for the grade eight students. Consequently, the further analysis will focus only on the grade eight data since it proves to be a more solid base.

In terms of the first research question, I cannot answer the trends in percentages of immigrant students reliably for the grade four students.

Trends for percentages of second generation immigrant grade eight students

The TIMSS data also allows for identifying second generation immigrant students. The students were asked about where their parents were born: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A. Was your mother (or stepmother or female guardian) born in <country>?

Yes No

Fill in ***one*** circle only ---------- ① ----- ②

B. Was your father (or stepfather or male guardian) born in <country>?

Yes No

Fill in ***one*** circle only ---------- ① ----- ②

(Source: (Foy & Olson, 2007, p. 226))

These questions were asked independently of the question about the students' place of birth. Again, the participating countries had to adapt this international version of the question by replacing

“<country>” with their country name. Consequently, students could have responded that their father or mother was not born in the country but they are or both of their parents are born in the country but they are not. Also they could have responded that they were not born in the country but both of their parents are.

There are different approaches how to define second generation immigrants. They mostly deviate in defining a child as a second generation immigrant if the father, or the mother, or both parents were born outside the country of residence.

This dissertation follows the definition used by the OECD (OECD, 2010c) and EC (Eurydice network, 2009), defining second generation immigrants as students who were born in the country of residence but at least one of their parents was not born in the country of residence. This seems to be the most common used definition. When applying this definition to the TIMSS data I get the results displayed in table 4.1.3.

Table 4.1.3: TIMSS grade 8: Trends in percentages of second immigrant students

	2nd generation immigrants								trends							
	1995		1999		2003		2007		95->99		99->03		03-> 07		95->07	
Country	Perc.	SE	Perc.	SE	Perc.	SE	Perc.	SE	%	sign	%	sign	%	sign	%	sign
Armenia					8	0,5	7	0,5					-1	⇨		
Australia	28	0,9	28	1,0	31	1,6	29	0,8	0	⇨	3	⇨	-2	⇨	2	⇨
Austria	9	0,5														
Bahrain					14	0,5	12	0,5					-1	⇨		
Belgium (Flemish)	10	0,8	8	0,8	12	1,0			-1	⇨	4	⇧				
Belgium (French)	27	1,2														
Bosnia and Herzegovina							5	0,5								
Botswana					7	0,4	10	0,6					4	⇧		
Bulgaria			3	0,4	2	0,2	2	0,2			-1	⇨	0	⇨		
Canada			20	0,7												
Canada (British Columbia)							29	1,3								
Canada (Ontario)					29	1,4	30	1,5					1	⇨		
Canada (Quebec)					13	1,1	16	1,6					2	⇨		
Chile			2	0,3	2	0,2					0	⇨				
Chinese Taipei			4	0,3	3	0,3	2	0,3			-1	⇩	0	⇨		
Colombia	3	0,4					2	0,3							0	⇨
Cyprus	5	0,3	5	0,4	8	0,4	10	0,4	1	⇨	2	⇧	3	⇧	6	⇧
Czech Republic	8	0,6	7	0,8			7	0,4	0	⇨					-1	⇨
Denmark	7	0,5														
Egypt					9	0,6	4	0,3					-6	⇩		
El Salvador							3	0,3								
England	14	1,5	17	1,8	13	1,6	14	1,1	3	⇨	-4	⇨	1	⇨	0	⇨
Estonia					23	1,0										
Finland			1	0,2												
France																
Georgia							4	0,6								
Germany	10	0,7														
Ghana					6	0,4	5	0,4					-1	⇨		
Greece	5	0,3														
Hong Kong, SAR	45	1,0	40	1,1	32	0,9	35	1,0	-6	⇩	-7	⇩	3	⇧	-11	⇩
Hungary	2	0,3	2	0,3	2	0,3	4	0,4	0	⇨	0	⇨	2	⇧	1	⇧
Iceland	4	0,4														
Indonesia			1	0,3	2	0,2	1	0,2			1	⇧	-1	⇩		
Iran, Islamic Republic of	3	0,4	3	0,4	3	0,4	2	0,3	-1	⇨	1	⇨	-1	⇨	-1	⇨
Ireland	8	0,4														
Israel	45	2,3	34	1,1	27	1,1	26	0,9	-11	⇩	-7	⇩	-1	⇨	-19	⇩
Italy			5	0,4	6	0,4	7	0,5			1	⇨	1	⇨		
Japan					1	0,1	1	0,2					1	⇧		
Jordan			32	1,3	22	1,0	22	1,0			-9	⇩	0	⇨		
Korea, Republic of			0	0,1	0	0,1	0	0,1			0	⇨	0	⇨		
Kuwait	28	2,1					14	0,8							-14	⇩
Latvia	12	0,5	13	0,9	25	1,0			1	⇨	13	⇧				
Lebanon					6	0,5	6	0,5					0	⇨		
Lithuania	9	0,5	9	0,6	9	0,7	6	0,5	1	⇨	0	⇨	-3	⇩	-2	⇩
Macedonia			9	0,9	8	0,8					-2	⇨				
Malaysia			4	0,3	5	0,5	5	0,4			0	⇨	0	⇨		
Malta							12	0,5								
Moldova			12	1,1	12	0,9					0	⇨				
Mongolia							11	0,8								
Morocco			3	0,3	6	0,7	6	0,5			3	⇧	0	⇨		
Netherlands	11	1,2	13	1,6	13	1,1			2	⇨	1	⇨				
New Zealand	20	0,8	20	1,0	23	1,2			0	⇨	2	⇨				
Norway	6	0,4			9	0,6	11	0,7					2	⇧	4	⇧
Oman							9	0,6								
Palestinian National Authority					6	0,4	7	0,5					1	⇨		
Philippines	3	0,3	3	0,3	2	0,3			0	⇨	0	⇨				
Portugal	7	0,6														
Qatar							25	0,5								
Romania	15	1,1	6	2,1	1	0,1	1	0,2	-10	⇩	-5	⇩	0	⇨	-15	⇩
Russian Federation	12	1,0	11	0,7	10	0,6	10	0,7	-1	⇨	-2	⇨	0	⇨	-2	⇨
Saudi Arabia					12	1,0	12	0,8					0	⇨		
Scotland	14	0,7			5	0,4	7	0,5					2	⇧	-7	⇩
Serbia					12	0,6	16	0,8					4	⇧		
Singapore	25	0,6	23	0,7	19	0,5	19	0,6	-2	⇩	-4	⇩	1	⇨	-6	⇩
Slovak Republic	7	0,4	7	0,6	7	0,5			0	⇨	0	⇨				
Slovenia	17	0,7	18	1,2	17	1,1	15	1,0	1	⇨	-1	⇨	-1	⇨	-2	⇨
South Africa	7	0,4	4	0,3	6	0,5			-3	⇩	1	⇧				
Spain	12	0,7														
Spain (Basque Country)					4	0,4	5	0,5					2	⇧		
Sweden	13	0,8			16	1,1	17	1,0					2	⇨	5	⇧
Switzerland	22	0,8														
Syria, Arab Republic of					0	0,1	6	0,4					6	⇧		
Thailand	1	0,2	1	0,2			2	0,3	0	⇨					1	⇧
Tunisia			3	0,3	1	0,2	4	0,3			-2	⇩	3	⇧		
Turkey			3	0,3			2	0,3								
Ukraine							17	0,9								
United Arab Emirates (Dubai)							31	1,4								
United States	13	1,1	15	0,9	13	0,8	18	1,1	2	⇨	-2	⇩	5	⇧	5	⇧
United States (Indiana)					5	0,6										
United States (Massachusetts)							17	1,5								
United States (Minnesota)							10	1,2								

Table 4.1.3 shows substantial changes in the number of second generation immigrant students in several countries. Especially between 2003 and 2007 there were quite a number of countries with significant increases in the number of second generation immigrant students in the school population, with statistically significant increases in Botswana, Cyprus, Hong Kong, Hungary, Japan, Norway, Scotland, Serbia, Basque Region of Spain, Syria, Tunisia, and the United States of America. Between 1999 and 2003 the number of second generation immigrant students decreased rather than increased. This trend could be due to reduced immigration or to changing immigration policies that e.g. do not permit spouses to accompany their partners. Another explanation might be that children of immigrants are not attending school in the immigrant country. This effect can be only analyzed by further in-depth research separately for each country and based on supplementary information.

In terms of the research questions, with this information I can answer the last part of the research question one. I cannot say that the percentage of second generation immigrant students increased in all countries but I find a decent number of countries where the percentage of second generation immigrant students increased between the first cycle of TIMSS in 1995 and the TIMSS cycle of 2007.

The increase of second generation immigrant students can pose a challenge to the educational system. As previous research has shown, in general immigrant students tend to perform less well than native students (Martin, Mullis, Foy, Arora, & Stanco, 2012; Mullis, Martin, Foy, Arora, & Stanco, 2012; OECD, 2010c). But I will analyze this in more detail in the following.

Trends in Mathematics achievement for immigrant students

Now I want to come to the next research question and analyze the achievement differences between immigrant students and native students. TIMSS does not only deliver background information that enables us to identify first and second generation immigrant students and also some of their background characteristics. But TIMSS also delivers reliable achievement measures for mathematics and science. The mathematics and science scales are calculated using the current as well as the previous study cycle which leads to measures that cannot only be compared within one cycle but also across study cycles as also explained in the method chapter.

Table 4.1.4 shows the trends in performance for immigrant students in TIMSS in mathematics. The table shows the mean mathematics achievement for the native students in each TIMSS cycle for all countries who participated in the cycle. Next to these mean achievements, the difference for the first and second generation immigrant students is displayed. A negative number indicates that the immigrant students were performing below the native students. If the field is colored then the difference is statistically significant.

Table 4.1.4: Trends of immigrant mathematics achievement

	1995				1999				2003				2007			
	native		difference of immigrants		native		difference of immigrants		native		difference of immigrants		native		difference of immigrants	
Country	Math	SE	1st gen	2nd gen	Math	SE	1st gen	2nd gen	Math	SE	1st gen	2nd gen	Math	SE	1st gen	2nd gen
Armenia									481	3,1	-12	-11	498	2,9	9	5
Australia	512	3,7	9	3	524	5,3	4	3	502	4,5	16	11	496	3,8	1	4
Austria	530	2,6	-55	-22												
Bahrain									405	1,9	-27	5	403	1,9	-26	3
Belgium (Flemish)	565	4,2	-16	-25	562	2,9	-44	-19	549	2,6	-64	-51				
Belgium (French)	527	3,4	-36	-21												
Bosnia and Herzegovina													457	2,9	-4	5
Botswana									369	2,5	34	-9	369	2,3	-22	-28
Bulgaria					511	6,1	8	-4	481	4,1	-66	-3	473	4,8	-65	-10
Canada					533	2,9	-10	-5								
Canada (British Columbia)													499	2,7	35	18
Canada (Ontario)									519	2,7	11	3	512	4,5	22	9
Canada (Quebec)									546	3,2	-30	-7	531	3,2	-17	-1
Chile					394	4,3	-12	-11	390	3,3	-48	-24				
Chinese Taipei					587	4,0	-42	-16	589	4,4	-109	-42	606	4,3	-111	-15
Colombia	376	3,0	16	3									385	3,5	-67	-41
Cyprus	461	1,6	-2	0	478	1,9	-2	-13	465	1,6	-26	-1	472	1,7	-44	-6
Czech Republic	545	3,9	-15	-24	522	3,9	-19	-23					505	2,5	-19	-14
Denmark	488	2,1	-31	-9												
Egypt									423	3,5	-40	-34	427	3,3	-76	-67
El Salvador													344	2,9	-47	-3
England	492	2,4	-19	4	497	4,6	-5	4	502	5,4	-23	9	515	5,1	-20	13
Estonia									534	3,4	-29	-6				
Finland					522	2,7	-38	-21								
France																
Georgia													418	6,0	-47	-55
Germany	503	4,3	-40	-22												
Ghana									298	4,9	-59	-16	324	4,3	-60	-24
Greece	464	2,7	-14	-20												
Hong Kong, SAR	570	7,5	12	13	578	4,7	2	12	590	3,9	-15	4	579	5,9	-26	4
Hungary	520	3,1	-19	8	533	3,7	-27	-9	531	3,2	-22	20	519	3,3	-58	4
Iceland	474	2,6	-1	0												
Indonesia					405	4,7	-60	-64	422	4,9	-58	-50	409	3,7	-58	-61
Iran, Islamic Republic of	415	1,8	-14	-21	423	3,5	-16	-4	414	2,3	-43	-26	405	4,1	-29	-38
Ireland	514	3,4	8	-4												
Israel	532	8,3	-16	-14	462	3,3	5	16	500	4,0	-18	5	469	4,1	-27	11
Italy					481	3,9	-25	-6	486	3,2	-29	-11	481	3,2	-30	-1
Japan					579	1,7	-37		571	2,1	-35	-25	571	2,4	-34	-10
Jordan					412	4,0	34	35	433	3,8	-36	13	430	4,7	-45	21
Korea, Republic of					587	2,0	-4	-46	591	2,2	-91	-63	598	2,7	36	-66
Kuwait	387	2,7	22	12									362	2,7	-33	2
Latvia	478	2,5	-23	-7	506	3,7	-9	-6	509	3,3	-16	6				
Lebanon									436	3,1	-6	-7	459	4,0	-36	-6
Lithuania	454	2,8	4	0	480	4,4	-25	16	504	2,7	-48	4	510	2,3	-64	-1
Macedonia					450	4,2	-24	-15	446	3,6	-63	-19				
Malaysia					520	4,4	-1	-12	511	4,2	-21	-24	479	5,0	-50	-27
Malta													494	1,5	-62	-2
Moldova					467	4,0	15	13	463	4,1	-17	8				
Mongolia													448	3,8	-58	-52
Morocco					340	3,2	-30	-12	395	2,5	-38	-27	388	2,9	-65	-28
Netherlands	533	5,7	-37	-15	546	6,9	-25	-24	544	3,9	-39	-32				
New Zealand	489	3,0	7	1	488	5,0	19	4	493	5,2	27	3				
Norway	484	2,0	-28	-3					467	2,4	-40	-9	474	2,2	-29	-12
Oman													387	3,4	-70	-20
Palestinian National Authority									401	3,1	-32	-16	380	3,5	-51	-12
Philippines	394	2,2	-26	-12	362	6,0	-72	-60	383	5,2	-71	-51				
Portugal	438	2,2	-2	6												
Qatar													305	2,1	-9	26
Romania	469	3,8	4	-1	477	5,9	-61	-24	478	4,8	-50	-50	466	4,1	-85	-94
Russian Federation	518	4,0	-6	8	529	5,9	-20	-11	511	4,0	-14	4	515	3,9	-15	-12
Saudi Arabia									333	4,9	-14	11	335	3,0	-37	16
Scotland	477	3,6	19	21					501	3,7	-36	10	491	3,6	-41	8
Serbia									483	2,5	-36	0	488	3,5	-31	8
Singapore	620	5,1	11	6	600	6,2	23	9	607	3,6	-18	7	588	3,9	34	9
Slovak Republic	527	2,8	4	-4	535	3,7	-45	-2	512	3,0	-64	-18				
Slovenia	520	2,7	-24	-4	534	3,1	-27	-15	498	2,4	-19	-21	509	2,3	-61	-21
South Africa	353	3,5	-19	0	283	7,2	-59	-9	292	7,3	-78	-19				
Spain	470	2,0	-17	-8												
Spain (Basque Country)									491	2,7	-48	-12	505	2,8	-57	-13
Sweden	523	2,3	-44	-13					507	2,6	-48	-18	499	2,2	-41	-16
Switzerland	557	2,1	-56	-22												
Syria, Arab Republic of									334	17,8	21	-11	409	3,4	-45	-23
Thailand	509	5,0	-38	4	469	5,2	-33	9					443	4,9	-62	-28
Tunisia					448	2,4	2	-4	411	2,2	-16	13	423	2,5	-17	-29
Turkey					429	4,2	-1	-1					434	4,8	-29	-30
Ukraine													466	3,6	-69	12
United Arab Emirates (Dubai)													397	5,7	91	65
United States	490	4,1	-18	-10	510	3,7	-44	-18	512	3,0	-53	-17	517	2,8	-49	-19
United States (Indiana)									510	5,0	-35	14				
United States (Massachusetts)													558	4,0	-61	-25
United States (Minnesota)													539	4,1	-53	-24

As can be seen in the table 4.1.4, the number of countries where the immigrant students are statistically significantly outperformed in mathematics by the native students increases from 1995 to 2007. This is not only an effect of increased country participation but also of increased differences in participating countries. In TIMSS 1995 in 17 out of 37 participating countries the first generation immigrant students achieved statistically significantly below the native students and in 10 out of the 37 countries the second generation immigrant students were outperformed by the native students. In TIMSS 1999 the number of countries where the first generation immigrant students achieved statistically significantly below the native students decreased to 12 out of 37 countries and in only 6 out of the 37 participating countries the second generation immigrant students were outperformed by the native students. In TIMSS 2003 the number of countries where the first generation immigrant students achieved statistically significantly below the native students increased to in 39 out of 51 countries and only in 12 countries there was no statistically significant difference. The number of countries where the second generation immigrant students were outperformed by the native students increased to 16 out of 51 countries. In TIMSS 2007 in even 42 out of 55 countries the first generation immigrant students were outperformed statistically significantly by the native students. And in 21 out of the 55 countries the second generation immigrant students were outperformed statistically significantly by the native students.

In terms of trend this means that for the first generation immigrant students the situation worsened from about 46 percent of the participating countries showing statistically significant lower achievement in mathematics in TIMSS 1995 with a slight improvement in 1999 to about 76 percent of the participating countries showing statistically significant lower achievement in mathematics in TIMSS 2003 and 2007. Also for the second generation immigrant students the situation improved between 1995 and 1999 from 27 percent of the participating countries showing a statistically significant lower achievement of second generation immigrant students to only 16 percent in 1999 but worsened to 31 percent in 2003 and even 41 percent in 2007.

Another perspective that could be taken is to compare the average achievement differences for immigrant and native students instead of the pure number of countries with statistically significant differences. When doing this, I find that across all 37 participating countries in TIMSS 1995, the first generation immigrant students were outperformed in mathematics by the native students by 14 score points. This average increased to 19 score points in 1999, 33 in 2003 and to 35 in 2007. For the second generation immigrant students I find an average difference across all countries of five score points in TIMSS 1995, nine in 1999, 11 in 2003 and 12 in 2007. This means for both groups of immigrant students the average difference across all countries increases between the different TIMSS cycles.

When comparing the achievement differences one could also focus only on the countries where there is a statistically significant difference between immigrant students and native students. In TIMSS 1995 I observe an average difference between native students and first generation immigrant students among those 17 countries that have shown statistically significant differences for these two groups of 31 score points. In TIMSS 1999 this average difference for the 12 countries that show a statistically significant difference increased to 41 score points. In 2003 the difference for the 39 countries with statistically significant differences increased to 43 score points and in TIMSS 2007 even to 49 score points for the 42 countries with statistically significant differences.

For the second generation immigrant students the trends are similar. In TIMSS 1995 I find an average difference between native students and second generation immigrant students among those 10 countries that have statistically significant differences between native and second generation immigrant students of 20 score points. In TIMSS 1999 this average difference for the 6 countries that show a statistically significant difference increased to 38 score points. In 2003 the difference for the 16 countries with statistically significant differences decreased then to 31 score points but in TIMSS 2007 increased to 34 score points for the 21 countries with statistically significant differences.

I conclude that when looking at the percentage of countries that show statistically significant lower achievement for first and second generation immigrant students compared to native students I see an increase of these among TIMSS participants. Also when looking at the actual average differences these increase for first generation immigrant students as well as for second generation immigrant students in the TIMSS cycles – independently of the way that I use for calculating these differences.

Now, I want to look more in-depth into the results and investigate the results for individual countries.

In Belgium (Flemish) there is a steady decline of the mathematics achievement of the first generation immigrant students. In 1995, they achieved 16 score points below the native students, in 1999 44 score points and in 2003 64 score points. Together with the increase of the percentage of the first generation immigrants between 1995 and 2003 from three percent to four percent to seven percent this indicates a clear challenge for the educational system. The situation for the second generation immigrant students is somewhat similar. They were lacking behind the native students by 25 score points in 1995, by 19 score points in 1999 and by 51 score points in 2003. Other countries with a clear increase of the achievement gap of first generation immigrant students are Chile, Chinese Taipei, Colombia, Cyprus, Egypt, Hong Kong, Hungary, Jordan, Lebanon, Lithuania, Macedonia, Malaysia, Morocco, Philippines, Romania, Saudi Arabia, Scotland, Slovak Republic, Slovenia, South Africa, Spain, Syria, Thailand, Tunisia, Turkey, and United States.

For some other countries the results for the different years is changing quite substantially. This can be a result of a very small Immigrant group that was assessed. An example for this is Korea where the first generation immigrant students were lacking behind by 4 points in 1999, by 91 in 2003 and that outperformed the native students by 36 points in 2007. But as seen in table 4.1.1, the percentage of first generation immigrant students in Korea was 1.9 percent in 1999, 1,4 percent in 2003 and 0,5 percent in 2007. The results for countries with such a small percentage of immigrants in the population and consequently in sample should be interpreted very carefully. Even large differences can be caused by the results for very few observations. In this case, also large differences should not be over interpreted.

But there are also positive examples of countries where the achievement of immigrant students was more equal to the native students or at least shows a positive trend. In Australia both immigrant student groups are performing at about the same level as the native students in Australia – even slightly above the native students. Considering that there between 10 and 15 percent of first generation immigrant students and about 30 percent of second generation immigrant students, in terms of delivering equal opportunities Australia seems to be a quite successful. Further research on the background of this and the potential reasons for this is necessary and will be conducted below.

But also in the Canadian province of Ontario both groups of immigrant students are achieving statistically significant better than the native students in both TIMSS cycles where they participated. The same is true for the Canadian province of British Columbia in TIMSS 2007 but interestingly the opposite for Quebec.

In Hong Kong the second generation immigrants achieved similar to the native students and also the first generation immigrants achieved similar to the native students in 1995 and 1999. In 2003 and 2007 the achievement of the first generation immigrant students became statistically significant lower than that of the native students. At the same time, the percentage of the immigrants decreased. Overall a slight achievement increase of the native students can be seen between 1995 and 2007. But on the other hand I observe a decrease of about 30 score points for the first generation immigrant students.

In New Zealand the second generation immigrant students achieved at the same level as the native student. The first generation immigrant students achieved seven points above the native students in 1995, 19 points in 1999 and 27 points in 2003 – the last means a statistically significant difference favoring the immigrant students.

Also Singapore is a case where the immigrant students achieved were positively. Only in 2003, the first generation immigrant students achieved statistically significant below the native students. In all other cycles and also for the second generation immigrant students in all cycles the immigrant students achieved at the same level as the native students or even outperformed the native students.

In terms of our second research question I have to admit that overall the immigrant students are performing less well than the native students in mathematics. This is in particular true for the first generation immigrant students. Also in terms of the trends I observe in TIMSS that there is an increasing number of countries with statistically significantly lower performance of immigrant students in mathematics. Also the magnitude of the differences increases over time. However, I find some countries with rather positive results –also when examining achievement trends. The countries with rather positive results for immigrant students are the Canadian provinces British Columbia and Ontario, Singapore, and Dubai and to a certain extent Australia.

Trends in science achievement for immigrant students

TIMSS assesses not only mathematics but also science performance of students. After looking at the trends in mathematics achievement, the science achievement shall be investigated. As for mathematics, also for science scores on student level are provided in TIMSS. And also as for mathematics, the scaling approach enables to compare differences not only within one study cycle but also across study cycles. Table 4.1.5 shows the trends in science achievements for native students and first and second generation immigrant students.

Table 4.1.5: Trends of immigrant science achievement

	1995				1999				2003				2007			
	native		difference of immigrants		native		difference of immigrants		native		difference of immigrants		native		difference of immigrants	
Country	Science	SE	1st gen	2nd gen	Science	SE	1st gen	2nd gen	Science	SE	1st gen	2nd gen	Science	SE	1st gen	2nd gen
Armenia									465	3,5	-18	-10	487	5,3	17	16
Australia	526	3,4	-9	0	544	4,7	-15	-6	528	4,1	-6	6	517	3,5	-10	-3
Austria	545	2,6	-73	-31												
Bahrain									441	2,2	-26	5	474	1,8	-40	7
Belgium (Flemish)	541	2,8	-8	-22	539	2,6	-31	-25	527	2,3	-55	-51				
Belgium (French)	466	2,9	-23	-19												
Bosnia and Herzegovina													467	2,9	-1	-3
Botswana									367	2,7	46	-9	362	3,1	-46	-39
Bulgaria					519	5,5	6	-11	482	5,2	-41	16	480	5,6	-56	-24
Canada					540	2,7	-36	-13								
Canada (British Columbia)													526	2,6	1	1
Canada (Ontario)									538	2,4	-15	-8	526	4,8	1	3
Canada (Quebec)									538	2,9	-55	-22	512	2,9	-21	-13
Chile					422	3,7	-30	-16	416	2,9	-51	-28				
Chinese Taipei					570	4,2	-46	-10	574	3,3	-90	-26	568	3,4	-95	-12
Colombia	399	3,6	2	-17									422	3,5	-64	-40
Cyprus	442	1,6	1	9	460	2,3	9	5	445	2,1	-11	-1	456	2,1	-30	-5
Czech Republic	555	2,9	-9	-21	541	4,4	-25	-22					541	2,0	-31	-11
Denmark	464	2,4	-36	-10												
Egypt									442	3,8	-48	-42	446	3,7	-80	-65
El Salvador													391	3,0	-46	-5
England	536	2,9	-23	-3	542	5,0	-12	-11	549	4,5	-33	-2	546	4,5	-32	2
Estonia									559	2,6	-45	-17				
Finland					538	3,3	-70	-29								
France																
Georgia													431	4,6	-60	-65
Germany	526	4,1	-59	-34												
Ghana									287	5,9	-82	-46	321	5,1	-73	-36
Greece	474	2,2	-12	-15												
Hong Kong, SAR	504	5,1	10	9	527	4,5	5	7	556	3,3	-8	8	533	5,4	-15	5
Hungary	535	2,7	-27	8	553	3,7	-8	-15	545	2,9	-23	16	541	2,7	-56	2
Iceland	478	2,5	-2	-2												
Indonesia					437	4,4	-61	-51	429	4,0	-45	-47	437	3,2	-55	-50
Iran, Islamic Republic of	454	2,3	-24	-32	449	3,7	-25	-18	455	2,3	-47	-23	460	3,6	-16	-41
Ireland	515	3,0	20	0												
Israel	542	8,1	-29	-20	464	4,7	4	18	493	3,5	-16	4	476	4,5	-32	6
Italy					494	3,8	-29	-5	494	3,1	-35	-13	497	3,0	-33	1
Japan					550	2,2	-26		553	1,7	-38	-17	555	1,9	-45	-9
Jordan					436	4,8	33	31	484	4,0	-41	15	487	4,2	-54	16
Korea, Republic of					549	2,6	-9	-11	560	1,6	-77	-54	553	2,0	52	-27
Kuwait	423	4,6	19	17									428	2,9	-45	-2
Latvia	461	2,2	-29	-4	503	4,8	-4	-4	513	2,6	-9	3				
Lebanon									397	4,5	-4	-8	425	6,1	-41	0
Lithuania	442	3,0	-5	-5	488	4,3	-39	12	521	2,3	-36	2	522	2,5	-64	-3
Macedonia					460	5,6	-36	-9	461	3,5	-62	-22				
Malaysia					492	4,5	11	-2	513	3,7	-21	-20	479	5,8	-82	-25
Malta													462	1,5	-54	-4
Moldova					457	4,4	29	3	475	3,4	-15	12				
Mongolia													463	3,0	-54	-42
Morocco					327	3,9	-33	-37	404	2,6	-37	-13	408	3,0	-51	-33
Netherlands	544	4,7	-45	-13	555	6,2	-47	-43	544	3,2	-41	-34				
New Zealand	505	3,2	-6	1	511	4,9	-11	4	521	4,8	10	2				
Norway	508	1,7	-41	-11					501	1,8	-56	-16	493	2,4	-45	-23
Oman													437	2,9	-70	-17
Palestinian National Authority									448	3,0	-37	-21	420	3,5	-62	-24
Philippines	391	3,4	-40	-26	366	7,8	-89	-74	384	5,8	-88	-60				
Portugal	453	2,2	-2	5												
Qatar													310	3,0	3	40
Romania	472	4,6	-5	-8	474	5,8	-32	6	472	4,9	-26	-25	466	3,8	-68	-94
Russian Federation	509	3,8	-1	10	532	6,1	-15	-10	517	3,9	-17	3	532	3,8	-16	-9
Saudi Arabia									402	4,0	-38	6	411	2,5	-44	10
Scotland	487	3,6	30	27					514	3,3	-36	15	499	3,2	-44	11
Serbia									471	2,7	-18	5	473	3,4	-32	7
Singapore	573	5,5	8	10	563	8,1	24	11	580	4,2	-25	9	563	4,7	19	12
Slovak Republic	527	2,8	1	0	536	3,2	-41	3	520	3,0	-51	-18				
Slovenia	547	2,3	-25	-15	539	3,5	-33	-22	526	2,1	-18	-25	545	2,2	-61	-23
South Africa	328	5,1	-32	-6	253	8,7	-75	-3	279	8,6	-96	-20				
Spain	498	2,0	-8	-4												
Spain (Basque Country)									492	2,8	-43	-16	503	3,1	-50	-7
Sweden	539	2,3	-62	-14					535	2,5	-62	-27	521	2,4	-56	-27
Switzerland	534	2,0	-66	-23												
Syria, Arab Republic of									388	17,1	21	-10	467	2,5	-49	-22
Thailand	510	3,2	-25	-6	483	4,1	-27	16					472	4,3	-58	-32
Tunisia					430	3,5	-2	1	405	2,1	-17	-9	447	2,2	-24	-27
Turkey					433	4,4	-5	-9					456	3,8	-28	-29
Ukraine													490	3,4	-70	7
United Arab Emirates (Dubai)													433	5,7	78	60
United States	528	4,2	-37	-25	527	4,1	-68	-30	537	2,8	-63	-27	532	2,8	-60	-33
United States (Indiana)									534	4,4	-47	-3				
United States (Massachusetts)													569	4,2	-74	-33
United States (Minnesota)													548	4,1	-71	-43

The same tendency observed for the mathematics achievement can also be observed for the science achievement. In 1995 in 17 out of 37 participating countries the native students outperformed the first generation immigrant students statistically significant. In 12 countries the native students outperformed the second generation immigrant students statistically significant. In 1999 the situation is very similar and in 16 out of 38 participating countries the native students outperformed the first generation immigrant students statistically significant and in nine the second generation immigrant students were outperformed statistically significant. In 2003 the statistics change negatively for the immigrant students and in 41 out of 51 countries the first generation immigrant students were outperformed statistically significant and in 20 the same is true for the second generation immigrant students. Quite similar to this in 2007 in 44 out of 56 countries the first generation immigrant students were outperformed statistically significant and in 23 the second generation immigrants.

Percentagewise this means an increase in the number of countries where statistically significant disadvantages for first generation immigrants among the native students could be observed from about 46% in 1995 to 79% in 2007. For the second generation immigrants the trend is less negative and the increase of the number of countries with statistically significant lower achievement of the second generation immigrant students is only from 32% to 41%.

When looking at the trends in absolute numbers I can see that the average number of score points that the first generation immigrant students are performing below the native students across all countries increased from 18 score points in 1995 to 23 in 1999 to 35 in 2003 up to 39 in 2007. For the second generation immigrant students the trend shows an increase of the difference to the native students from 8 to 10 to 13 to 14 score points.

And also the trends for the maximum number of score points that the immigrant students are behind the native students is alarming. In 1995 the maximum difference was found for Austria with a difference of 73 score points followed by Switzerland (66 score points) and Sweden (62). In 2007 the maximum difference increased to 95 in Chinese Taipei followed by 82 in Malaysia and 80 in Egypt. The trend for the maximum differences for the second generation immigrant students is more pronounced. In 1995 the maximum difference was observed for Germany with 34 score points followed by Iran with 32 and Austria with 31 score points differences. In 2007 the maximum difference was 94 for Romania followed by Georgia and Egypt each with 65 score points difference.

There are only few cases where the immigrant students performed statistically significant better than the native students. In 1995 these were Scotland and Kuwait for bother immigrant groups and Ireland for the first generation immigrant students. In 1999 these were Moldova and Singapore for the first generation immigrants, Jordan for both immigrant groups and Israel for the second generation immigrant students. In 2003 there were only Jordan and Scotland where the second generation immigrant students performed statistically better than the native students but none of the first generation immigrant groups. In 2007 in Singapore and Korea the first generation immigrant students performed statistically significant higher than the native students, in Dubai both immigrant groups performed above the native students and in Qatar and Jordan the second generation immigrant students outperformed the native students statistically significant.

Answering the final aspects of research question two I see that the situation for science is similar to what I found in mathematics. Overall the immigrant students are performing less well than the native

students in science. Again, this is especially true for the first generation immigrant students. Also for the trends I find an increasing number of countries with statistically significant lower performance of immigrant students in science. Again, also the magnitude of the differences increases over time. And again, there are some countries with rather positive results. These are again Singapore and Dubai. Australia and the Canadian provinces show less positive statistics in science than in mathematics. But Jordan, Scotland and Qatar show partially good results for the immigrant students.

Summary

I found in this chapter that the percentage of immigrant students increased in several countries analyzed. The data for grade eight appears to be very reliable and further analyses can be performed. On the other hand the grade four data seems not to be reliable and no further investigation would seem sensible. The achievement of immigrant students in mathematics and science lags behind the achievement of native students in most countries. The overall trend is that the immigrant students are increasingly lagging behind. The results for mathematics and science are very similar in terms of these outcomes. Consequently, for future analysis I can focus on mathematics only.

With respect to the research questions, I answered the first research question and saw that the percentage of first generation immigrant students in grade eight increased in several countries between 1995 and 2007 – especially between 1999and 2003 I identify a substantial number of countries with increases in the first generation immigrant population. For the second generation immigrant students I cannot observe such a trend for grade eight students. And for the fourth grade students the data seems not to be sufficiently reliable to investigate this question.

I could also answer the second research question. I found that overall the immigrant students – and especially the first generation immigrant students - are performing below the native students in mathematics and in science. This is in particular true for the first generation immigrant students. I also found that the trends for the immigrant students compared to the native students are quite discouraging. In general, the immigrant students seem to increasingly lag behind compared to the native students. However, there are some countries where I find positive results and trends for immigrant students. For example in Canada, Singapore and Dubai I find more positive achievement results for the immigrants.

Chapter 4B Immigrant students' background in TIMSS 2007

In the previous chapter I have analyzed the trends in percentages of immigrant students between 1995 and 2007 as well as their mathematics and science achievement compared to native students also in a trend perspective. I have found that there are several countries with an increase in immigrants. I also found that in general immigrant students are performing below native students in mathematics and science and that the gap is even increasing. Now I want to analyze the TIMSS 2007 data more in depth.

In this chapter attention should be paid to the background of the immigrant students in the countries that participated in TIMSS 2007 in comparison to the native students. The students are grouped as native students, first generation immigrant students and second generation immigrant students. Also the achievement levels in mathematics are analyzed for some subgroups of the immigrant students in contrast to the native students.

Students' age

As discussed in chapter 3, the TIMSS samples consists of grade eight students in all countries, one important characteristic of the students is their age. In general the mean age of the student vary between countries because of different school starting age and different policies on promotion and retention of students.

Consequently the age of the immigrant students compared to the native students in TIMSS is an important topic to look at. But due to the differences in policies regarding school entry age and grade repetition comparing the mean age of immigrant students and native students makes only sense within the countries. A higher mean age of immigrant students compared to the mean age of native students in a country might have different reasons. The immigrant students could have started school in a country where the school entry age was higher. It could also happen that the student was enrolled in a lower grade when migrating into the country for example due to language problems or administrative problems when enrolling into the school. But it could also be caused by an immigrant student having to have repeated a grade.

In TIMSS 2007 the students were asked about the month and year of birth and also the month and year of the test was tracked by the test administrators. With this information I calculate the student's age at the time of the test. Table 4.1.1 shows the mean age for each of the immigrant and native student groups for each country.

Table 4.2.1 Age of students by immigration status								
Country	first generation immigrant			native		second generation immigrant		
	Mean	SE	sig	Mean	SE	Mean	SE	sig
Armenia	14,9	0,03		14,9	0,01	14,8	0,04	
Australia	13,9	0,03		13,9	0,01	13,9	0,02	↓
Bahrain	14,3	0,04	↑	14,0	0,01	14,1	0,04	↑
Bosnia and Herzegovina	14,7	0,02		14,7	0,01	14,8	0,03	
Botswana	15,0	0,07	↑	14,8	0,02	14,9	0,07	
Bulgaria	15,0	0,04		14,9	0,01	15,0	0,12	
Canada (British Columbia)	13,9	0,03		13,9	0,01	13,8	0,01	
Canada (Ontario)	13,9	0,01		13,8	0,01	13,8	0,01	↓
Canada (Quebec)	14,3	0,05	↑	14,2	0,02	14,2	0,04	
Chinese Taipei	14,2	0,02		14,2	0,01	14,2	0,04	
Colombia	14,8	0,15	↑	14,4	0,05	14,9	0,15	↑
Cyprus	14,1	0,03	↑	13,8	0,01	13,8	0,02	
Czech Republic	14,7	0,07	↑	14,4	0,01	14,5	0,03	↑
Egypt	14,1	0,03		14,0	0,06	14,0	0,06	
El Salvador	15,3	0,12	↑	15,0	0,03	15,1	0,07	↑
England	14,3	0,02		14,2	0,01	14,2	0,01	
Georgia	14,3	0,05	↑	14,2	0,02	14,2	0,06	
Ghana	16,0	0,08	↑	15,8	0,05	15,7	0,14	
Hong Kong, SAR	15,0	0,05	↑	14,1	0,01	14,2	0,02	↑
Hungary	14,9	0,10	↑	14,6	0,01	14,5	0,04	
Indonesia	14,4	0,06	↑	14,2	0,02	14,6	0,18	↑
Iran, Islamic Republic of	14,5	0,21		14,2	0,02	14,6	0,09	↑
Israel	14,2	0,03	↑	14,0	0,01	14,0	0,02	↑
Italy	14,3	0,05	↑	13,9	0,01	13,9	0,03	
Japan	14,4	0,04		14,5	0,00	14,5	0,04	
Jordan	14,0	0,03	↑	13,9	0,01	13,9	0,02	
Korea, Republic of	14,5	0,16		14,3	0,01	14,3	0,13	
Kuwait	14,7	0,05	↑	14,3	0,02	14,4	0,03	↑
Lebanon	14,6	0,07	↑	14,3	0,03	14,5	0,14	
Lithuania	15,0	0,05		14,9	0,01	14,9	0,04	
Malaysia	14,4	0,04		14,3	0,01	14,3	0,02	
Malta	14,2	0,04	↑	14,0	0,01	14,0	0,02	
Mongolia	15,0	0,04	↑	14,8	0,03	15,0	0,04	↑
Morocco	15,1	0,16		14,8	0,04	14,9	0,10	
Norway	13,9	0,02	↑	13,8	0,01	13,8	0,01	
Oman	14,5	0,06	↑	14,2	0,02	14,3	0,05	
Palestinian National Authority	14,0	0,03		14,0	0,02	14,0	0,04	
Qatar	14,1	0,03	↑	13,9	0,01	13,9	0,02	
Romania	15,1	0,05		15,0	0,01	14,9	0,14	
Russian Federation	14,6	0,07		14,6	0,03	14,5	0,04	
Saudi Arabia	14,6	0,07	↑	14,3	0,03	14,3	0,04	
Scotland	13,8	0,04		13,7	0,01	13,7	0,03	
Serbia	14,9	0,04		14,9	0,01	14,9	0,01	
Singapore	15,1	0,05	↑	14,3	0,01	14,3	0,01	
Slovenia	13,8	0,04		13,8	0,01	13,8	0,02	
Spain (Basque Country)	14,5	0,08	↑	14,1	0,01	14,2	0,06	↑
Sweden	14,9	0,04		14,8	0,01	14,8	0,01	↓
Syria, Arab Republic of	14,1	0,04	↑	13,9	0,02	14,0	0,05	
Thailand	14,6	0,10	↑	14,3	0,01	14,5	0,10	↑
Tunisia	14,5	0,09		14,5	0,03	14,7	0,10	
Turkey	14,6	0,19	↑	14,0	0,02	14,0	0,06	
Ukraine	14,2	0,04		14,2	0,03	14,1	0,04	
United Arab Emirates (Dubai)	14,1	0,04	↓	14,4	0,04	14,1	0,04	↓
United States	14,3	0,02		14,3	0,01	14,2	0,02	↓
United States (Massachusetts)	14,3	0,04	↑	14,2	0,02	14,2	0,03	
United States (Minnesota)	14,3	0,05		14,3	0,01	14,3	0,03	

In table 4.2.1 I can see the mean age of first generation immigrant students, native students and second generation immigrant students for each country. Also two indicators are displayed that show whether the mean age of the first and second generation immigrant students is statistically significant different from the mean age of the native students.

In summary, I can see that in 29 out of the 56 countries the first generation immigrant students are statistically significant older than their native peers in TIMSS 2007 grade eight. Only in Dubai, the first generation immigrant students are statistically significant younger than their native peers. In 12 out of 56 countries, the second generation immigrant students are statistically significant older than their native peers. In five countries the second generation immigrant students are statistically significant younger than their native peers.

Due to the large sample sizes also small differences can appear as statistically significant different. For example the mean age of natives in Sweden of 14,84 appears to be statistically significant different from the mean age of the second generation immigrants of 14,77. But this difference is probably not meaningful.

As described in more detail in the method chapter, in TIMSS 1995, two adjacent grades, grade seven and eight, were tested and scaled on the same metric. The difference in mathematics achievement between the two grades varied between seven points in South Africa and 49 points in Lithuania but was on average 32 points. (Table 1.3 in Beaton et al 1996)

I want to use this information to identify thresholds for meaningful differences in mean age. The assessment experts in TIMSS defined a difference of 5 points as relevant and designed the study based on this assumption (see chapter 5 in (Olson et al., 2008)).When following Cliffordson and Gustafsson (Cliffordson & Gustafsson, 2010) that half of the achievement gain stems from students aging, one could conclude that an age difference of 0,3 years and more should be considered as significant (32 points / 2 / 5 points).

With that definition I conclude that in Bahrain the first generation immigrant students are meaningfully older than the native students. The same is true for Colombia, El Salvador, Hong Kong, Hungary, Italy, Kuwait, Singapore, Basque, and Turkey. For the second generation immigrants the same holds for Colombia, Indonesia, and Iran. An interesting case is Dubai where both immigrant groups are meaningfully younger than the native students.

Regarding research question 3 I conclude that in more than half of the countries' first generation immigrant students are statistically significantly older than their native peers. In more than 20 percent of the countries that participated in TIMSS 2007 second generation immigrant students are statistically significant older than their native peers. This result is not very surprising since I know from chapter 4.1 that immigrant students are performing below native students in many countries and from the review in chapter 2 I know that in some countries grade repetition of lower performing students is applied. One could also hypothesize that the transfer from one educational system into another – in some cases also in a different language of instruction – could lead to grade repetition of the students concerned.

Age at immigration

As stated in chapter 2, not only the age of immigrant students compared to native students is relevant but there is also some discussion about the effect of age of immigration on the immigrants'

achievement. Next, I will analyze the age of immigration to the country and effects of achievement. The TIMSS assessment asked the students not only is they were born in the country of residence but also if they are not born in the country of residence when they came to the country.

B. If you were not born in <country>, how old were you when you came to <country>?

*Fill in **one** circle only*

Older than 10 years old ---------- ①
5 to 10 years old ---------- ②
Younger than 5 years old ---------- ③

(Source: page 196 in Foy and Olson, 2009)

Table 4.2.2 shows the percentages of students checking each of the three categories for each country. Of course this information is only available for first generation immigrants. Also the mean mathematics achievement for the three groups of first generation immigrants is shown in the table.

I can see that there are big differences between the countries in terms of the distribution of the age groups when the students came to the country. In 15 countries more than 50 percent of the students came to the country before the age of five. Based on the review in chapter 2 where several references were found that an early arrival into the country is beneficial for later success in school the immigrants in these countries would have an advantage. On the other hand I find eight countries where more than 40 percent of the students arrived after the age of 10. I conclude that the situation of immigrants with respect to the age when they came to the country is quite diverse between countries.

Table 4.2.2 Immigrant students' age when coming to country of residence and their Mathematics Achievement

Country	OLDER THAN 10 YEARS OLD				5 TO 10 YEARS OLD				YOUNGER THAN 5 YEARS OLD			
	perc.	SE	Math Ach	SE	perc.	SE	Math Ach	SE	perc.	SE	Math Ach	SE
Armenia	38	2,6	508	18,0	26	2,9	552	20,0	37	3,5	475	8,8
Australia	32	2,8	500	11,7	35	3,0	489	10,2	33	2,2	505	10,2
Bahrain	33	2,1	369	6,9	27	1,6	384	8,1	40	2,2	379	6,7
Bosnia and Herzegovina	13	1,5	405	7,8	23	1,9	465	7,0	65	2,5	458	6,7
Botswana	22	3,1	370	25,3	42	3,6	329	13,9	36	3,6	373	15,8
Bulgaria	43	3,4	403	15,8	15	2,5	422	18,7	42	3,4	411	11,6
Canada (British Columbia)	35	2,9	531	8,9	32	2,3	549	12,1	33	2,7	524	8,9
Canada (Ontario)	27	3,8	547	10,1	42	4,3	539	7,9	32	2,9	520	8,8
Canada (Quebec)	26	3,8	493	10,5	30	3,1	519	10,9	44	3,8	525	9,5
Chinese Taipei	27	2,9	486	15,3	20	2,4	490	21,4	54	3,5	500	14,2
Colombia	25	4,7	334	17,3	13	3,0	279	15,5	62	6,5	314	12,2
Cyprus	25	2,3	402	11,7	29	2,4	419	10,7	46	2,6	450	7,4
Czech Republic	22	3,3	488	15,4	29	4,6	508	11,9	49	5,0	475	9,9
Egypt	34	1,4	352	6,5	32	1,8	345	7,6	35	2,3	359	5,5
El Salvador	31	4,6	279	17,4	16	2,8	299	21,7	53	4,8	309	14,3
England	31	3,0	487	15,3	33	2,8	517	11,2	36	3,2	477	15,8
Georgia	28	4,3	377	19,2	17	3,5	351	24,9	55	4,9	384	20,3
Ghana	42	2,4	255	9,2	30	1,9	269	8,8	29	1,9	277	8,5
Hong Kong, SAR	26	2,2	550	14,7	35	1,9	552	8,0	39	1,9	558	7,5
Hungary	22	6,6	433	26,6	26	6,0	508	29,7	53	5,8	454	18,5
Indonesia	40	3,3	361	7,9	20	1,8	335	10,7	40	3,1	354	7,3
Iran, Islamic Republic of	22	9,7	403	57,0	40	10,8	353	30,7	38	10,0	415	39,4
Israel	14	1,7	412	15,9	35	3,2	435	10,3	51	3,1	458	10,9
Italy	25	3,3	446	12,6	35	3,5	457	12,4	39	3,1	450	9,4
Japan	14	5,6	469	39,6	19	7,5	487	46,9	68	8,2	572	24,8
Jordan	35	6,1	405	19,8	22	2,6	372	12,2	44	4,5	375	10,2
Korea, Republic of	13	8,0	537	15,8	26	10,1	658	45,1	61	11,4	644	35,9
Kuwait	26	2,1	305	10,3	15	1,5	323	11,8	59	2,3	336	7,2
Lebanon	49	3,0	408	6,4	21	2,3	416	6,9	30	2,7	457	7,0
Lithuania	48	4,1	448	10,5	15	4,0	412	25,8	37	4,3	452	15,0
Malaysia	49	2,3	442	8,0	19	2,5	419	14,5	32	2,7	422	10,8
Malta	37	3,0	419	10,1	19	2,2	418	16,7	44	3,4	449	9,0
Mongolia	50	2,3	391	7,4	18	1,7	369	10,1	32	1,8	397	7,0
Morocco	41	5,1	316	9,0	18	2,6	317	20,0	41	5,7	330	11,7
Norway	21	2,1	429	12,6	25	2,5	428	9,8	54	2,8	458	6,1
Oman	33	2,2	298	9,3	25	2,0	288	10,1	42	2,8	344	9,0
Palestinian National Authority	26	1,8	314	11,6	31	2,1	335	12,9	43	2,1	339	7,6
Qatar	27	1,0	280	5,3	24	1,1	294	5,6	49	1,1	305	4,2
Romania	38	3,9	362	17,3	21	4,1	340	30,2	41	5,1	420	16,1
Russian Federation	15	2,8	486	20,1	28	4,0	486	12,1	57	4,1	511	9,0
Saudi Arabia	33	2,1	280	10,8	24	1,8	316	9,7	43	2,1	303	7,9
Scotland	32	3,2	436	15,0	19	3,0	452	18,4	49	3,7	454	12,1
Serbia	19	3,3	436	20,1	23	3,5	424	16,5	57	4,1	477	11,7
Singapore	38	2,5	631	6,3	24	2,1	609	9,3	38	2,4	624	9,3
Slovenia	52	4,0	440	11,0	12	2,3	441	21,7	36	3,7	456	10,4
Spain (Basque Country)	35	4,5	437	13,2	38	5,1	457	13,7	27	3,7	450	15,5
Sweden	33	3,3	442	9,3	25	2,5	463	10,3	43	2,8	466	7,9
Syria, Arab Republic of	35	1,8	354	8,0	20	1,4	359	8,2	44	2,0	370	6,2
Thailand	37	10,0	373	36,0	26	8,9	407	78,3	37	10,3	385	45,1
Tunisia	22	3,7	401	11,4	20	3,6	415	17,5	58	5,1	414	9,4
Turkey	27	5,1	460	30,4	33	6,1	377	35,9	40	6,5	394	27,2
Ukraine	23	3,0	371	18,2	19	2,6	382	16,4	58	2,9	411	9,2
United Arab Emirates (Dubai)	35	2,0	492	5,5	23	1,2	489	6,7	42	1,9	486	4,9
United States	19	1,4	459	9,3	32	1,9	480	6,8	49	2,3	465	6,0
United States (Massachusetts)	21	2,9	469	18,3	39	3,3	512	10,4	41	4,6	494	13,2
United States (Minnesota)	30	5,9	453	8,4	29	6,0	484	15,7	42	7,3	510	16,3

Based on the literature review one would expect that the immigrant students who arrived at a younger age would outperform the immigrant students that arrived later. Interestingly this cannot be clearly confirmed. There are countries that follow the hypothesis like Quebec, Chinese Taipei, Cyprus, El Salvador, Ghana, Hong Kong, Israel, Japan, Kuwait, Lebanon, Morocco, Palestine, Qatar, Scotland, Slovenia, Sweden, Syria, Ukraine, and Minnesota – not all countries with a statistical significant pattern. Interesting cases are Ontario and Dubai that show the opposite pattern with students being older when coming to the country performing better in mathematics than students arriving at a younger age. Most countries show an amorphous pattern sometimes with the immigrant students in the middle category performing best sometimes with the immigrant students in the middle category performing below the immigrant students in the other two categories.

With respect to the third research question, I cannot find a clear pattern for the age when students came to the country of residence and their mathematics achievement. But I find a tendency in that sense that in 19 countries the mathematics achievement of the immigrants declined with age when migrating to the country – sometimes only slightly and far below any statistical significance. There are only two countries with the opposite pattern but none of them statistically significant.

Differences between girls and boys

After looking at the age of the students I will look at the other obvious variable, the sex of the student. As stated in chapter 2, differences between girls and boys are not only a permanent topic in educational research but also a matter of change especially in recent years where more attention is paid to social justice and adequate schooling for boys and girls (see chapter 1).

First I want to look at the participation of boys and girls in the school system. Table 4.2.3 shows the percentage of girls in the school system for the first generation immigrants, the native students and the second generation immigrants. Only the percentage of girls is shown because the percentage of boys is simply 100 minus the percentage of the girls since the missing values are not considered in the analysis. It is also indicated if the percentage of girls is significantly higher than the percentage of boys for each group. But also here we need to be cautious. Due to the huge sample sizes, very small deviations appear as statistically significant. Even less than one percent difference can be statistically significant different.

When looking first at the group of native students I can see that in several Arabic countries the girls are overrepresented in the schools. In the Kuwait 59 percent of the native students are girls and consequently only 41 percent are boys. Also in Dubai I find 57 percent girls and in Lebanon I find 56 percent girls. In Oman, Morocco and Palestine there are 56 percent girls and in Syria there are 55 percent girls. Also Israel which has percentage of Arabic population has 55 percent girls in the school population. Interestingly, in Iran which is neighboring country to the Arabic countries that shares with them the Islamic religion, the case is different and I can find 54 percent boys and only 46 percent girls. Another interesting case is Ghana and Botswana. In Botswana I find 54 percent of girls and 46 percent of boys and in Ghana I find 45 percent of girls and 55 percent of boys. For most other countries, the percentages of boys and girls are within a plus/minus two percent range around the fifty-fifty.

For the immigrant populations, we see much more fluctuation. In several countries I observe a relative low percentage of first immigrant girls. In Iran only 26 percent of the first generation immigrant students are girls. In Saudi Arabia only 28 percent are girls. Other countries with less than 40 percent of girls in this group are Bahrain, Bulgaria, Chinese Taipei, Georgia, Hungary, Japan, Jordan, Kuwait, Lithuania, Morocco, Oman, Palestine, Romania, Slovenia, Thailand and Tunisia. This is a very surprising result and definitively a matter of policy concern. The list of countries where the participation of first immigration girls in the school system is seriously lower than that of boys includes developing as well as developed countries. It includes countries in all regions of the world. Further research is necessary to uncover if the girls are taught differently – for example by private tutors and why they are not integrated in the school systems of the respective host country. Whatever the reasons behind might be we observe that in 34 out of 56 countries there are statistically significant fewer first generation immigrant girls enrolled in the education system in grade 8 and not a single country where first generation immigrant boys are underrepresented in the educational system due to the TIMSS 2007 data. I can probably conclude that the first generation girls are discriminated and their chances for integration in the host countries are reduced. Policy implications could be to focus on this group and implement initiatives to include them into the educational system.

For the second generation immigrant students, the picture is much more diverse. I can find countries where the girls are underrepresented in the educational system – for example Georgia, Chinese Taipei, Morocco or Thailand. But I find also countries where the boys are underrepresented – for example Bahrain, Lithuania or Malaysia. But this underrepresentation of the boys is in general smaller than that of girls.

What I can conclude here is that there are substantial differences in the participation of immigrant boys and girls in the educational systems. Mostly, I find countries where the girls are underrepresented in the educational system.

Table 4.2.3: Percentage of girls in the schools for the different immigration groups									
	first generation immigrant			native			second generation immigrant		
IDCNTRY	Perc.	SE	sig	Perc.	SE	sig	Perc.	SE	sig
Armenia	42	3,1	↓	52	1,0	↑	52	3,1	
Australia	46	4,1		50	1,7		47	3,1	
Bahrain	30	2,1	↓	52	0,7	↑	58	2,3	↑
Bosnia and Herzegovina	44	1,8	↓	51	0,9		50	4,4	
Botsw ana	44	3,7	↓	54	0,8	↑	47	2,8	
Bulgaria	34	3,5	↓	52	1,3	↑	56	5,6	
Canada (British Columbia)	49	3,3		52	1,3	↑	51	1,5	
Canada (Ontario)	46	2,7	↓	52	1,4		49	2,0	
Canada (Quebec)	48	3,7		49	1,5		53	3,3	
Chinese Taipei	31	2,7	↓	50	1,4		39	5,6	↓
Colombia	45	3,7	↓	51	1,6		48	6,2	
Cyprus	50	2,4		50	0,7		49	2,7	
Czech Republic	52	5,1		48	0,9	↓	50	3,6	
Egypt	45	3,6	↓	53	2,8		51	4,4	
El Salvador	46	4,1		53	1,5	↑	49	5,3	
England	46	3,4		52	1,9		49	4,6	
Georgia	30	4,8	↓	52	1,1	↑	37	3,5	↓
Ghana	47	2,0	↓	45	0,9	↓	49	3,8	
Hong Kong, SAR	49	2,0		49	1,8		51	1,8	
Hungary	37	5,8	↓	50	1,2		50	4,8	
Indonesia	46	2,5	↓	52	1,2	↑	51	8,1	
Iran, Islamic Republic of	26	9,1	↓	46	1,5	↓	44	6,2	
Israel	49	3,2		55	1,8	↑	55	2,4	↑
Italy	47	3,3		48	0,7	↓	49	2,9	
Japan	35	7,7	↓	51	1,0		41	6,2	
Jordan	37	4,7	↓	50	1,9		49	3,7	
Korea, Republic of	50	9,2		48	2,7		42	14,2	
Kuw ait	39	3,1	↓	59	2,4	↑	52	3,4	
Lebanon	48	3,0		57	1,9	↑	46	4,4	
Lithuania	29	4,1	↓	51	1,1		57	3,9	↑
Malaysia	40	2,8	↓	54	1,5	↑	57	4,7	↑
Malta	42	2,6	↓	51	0,5	↑	54	2,2	↑
Mongolia	45	1,9	↓	53	1,4	↑	50	2,6	
Morocco	38	4,6	↓	56	1,7	↑	33	4,8	↓
Norw ay	47	2,9		50	0,8		51	2,3	
Oman	33	4,0	↓	56	2,1	↑	50	3,4	
Palestinian National Authority	32	2,2	↓	56	1,7	↑	55	3,6	↑
Qatar	43	0,9	↓	54	0,7	↑	54	1,1	↑
Romania	39	4,8	↓	50	0,9		29	10,0	↓
Russian Federation	51	3,5		52	0,9	↑	54	2,4	↑
Saudi Arabia	28	2,8	↓	53	2,3		50	3,8	
Scotland	42	3,1	↓	52	1,1	↑	53	3,5	
Serbia	50	3,9		50	0,8		48	2,0	
Singapore	50	2,8		48	1,0	↓	50	1,7	
Slovenia	33	3,7	↓	52	0,9	↑	49	1,9	
Spain (Basque Country)	41	3,3	↓	49	1,7		48	5,5	
Sw eden	40	2,7	↓	48	1,0	↓	51	2,0	
Syria, Arab Republic of	46	2,7		55	2,0	↑	48	3,9	
Thailand	36	10,4		50	1,3		38	5,3	↓
Tunisia	34	3,2	↓	53	0,9	↑	45	4,5	
Turkey	44	6,7		47	0,8	↓	43	5,1	↓
Ukraine	39	2,8	↓	54	1,0	↑	52	1,7	
United Arab Emirates (Dubai)	47	5,8		57	4,8	↑	52	6,5	
United States	47	2,2	↓	51	0,8	↑	52	1,6	
United States (Massachusetts)	46	3,3		50	1,3		51	3,7	
United States (Minnesota)	46	4,9		54	1,3	↑	44	4,7	

Table 4.2.4 Mathematics achievement of immigrant boys and girls

	first generation immigrant				native				second generation immigrant			
	BOY		GIRL		BOY		GIRL		BOY		GIRL	
IDCNTRY	Math Ach	SE	Math Ach	SE	Math Ach	SE	Math Ach	SE	Math Ach	SE	Math Ach	SE
Armenia	501	12,2	515	18,5	497	3,5	500	3,3	501	12,3	506	15,6
Australia	505	10,0	487	11,1	503	5,4	488	3,9	508	7,6	492	11,9
Bahrain	362	5,6	413	6,0	390	2,6	416	2,6	401	6,3	410	4,4
Bosnia and Herzegovina	449	5,2	457	4,9	458	2,8	456	3,7	460	11,0	464	8,4
Botswana	334	13,4	364	12,9	362	3,4	374	2,4	330	6,0	353	6,7
Bulgaria	409	10,6	406	13,6	467	6,2	478	4,6	444	24,9	476	21,4
Canada (British Columbia)	535	7,7	533	9,1	501	3,4	497	3,0	523	4,9	511	3,9
Canada (Ontario)	543	7,4	523	8,4	515	5,0	510	5,3	525	5,1	517	4,7
Canada (Quebec)	514	12,1	514	8,0	532	3,9	531	3,5	533	9,9	527	8,0
Chinese Taipei	498	12,3	489	15,3	608	5,0	604	4,5	600	17,6	578	16,4
Colombia	325	9,4	309	17,3	402	3,9	369	4,0	367	18,4	319	16,0
Cyprus	417	6,9	439	7,8	460	2,7	482	2,1	464	6,5	467	6,4
Czech Republic	480	12,5	493	8,4	504	2,9	507	2,6	493	7,1	491	9,0
Egypt	347	5,0	357	7,6	426	5,1	428	4,6	351	9,7	369	12,8
El Salvador	311	12,3	280	13,1	355	4,0	335	3,9	352	10,3	330	10,7
England	499	11,9	490	12,9	519	6,4	511	5,2	528	7,5	528	8,6
Georgia	371	15,1	371	14,8	418	6,9	417	6,0	356	14,9	374	25,5
Ghana	271	6,9	256	6,4	334	4,5	311	5,0	308	13,2	292	11,8
Hong Kong, SAR	546	11,6	560	7,4	573	8,5	584	5,3	579	7,7	586	6,1
Hungary	459	22,9	463	26,5	519	3,4	519	4,0	538	14,7	508	14,7
Indonesia	353	6,6	349	7,2	406	4,7	412	4,1	357	18,9	340	28,2
Iran, Islamic Republic of	355	18,6	436	34,5	402	6,1	408	5,3	351	13,4	386	18,7
Israel	437	7,7	447	12,3	471	5,4	468	5,0	486	8,1	475	6,4
Italy	455	8,3	447	7,6	485	3,6	477	3,6	475	8,6	486	7,1
Japan	519	24,9	569	33,6	573	3,4	569	3,1	559	15,3	562	21,0
Jordan	376	13,1	399	12,2	420	6,5	439	6,7	446	6,7	455	7,4
Korea, Republic of	655	26,9	612	43,0	600	3,0	595	3,3	523	37,5	543	57,1
Kuwait	313	8,6	352	7,0	356	4,4	366	3,0	352	8,7	374	4,5
Lebanon	429	6,8	416	6,6	469	4,7	451	4,3	449	11,2	457	9,4
Lithuania	439	8,8	461	19,0	508	2,4	511	3,1	508	10,0	509	6,2
Malaysia	422	9,3	439	9,2	475	5,0	483	5,6	438	15,0	462	9,9
Malta	424	9,0	442	8,4	495	2,0	492	1,9	494	5,1	489	5,4
Mongolia	393	6,6	385	7,2	453	4,4	443	4,0	399	5,2	393	6,2
Morocco	326	8,5	318	10,4	396	4,8	381	3,7	362	11,6	357	12,6
Norway	442	5,8	447	6,6	473	2,9	475	2,3	459	5,5	465	5,3
Oman	296	7,0	358	8,8	362	5,3	406	3,7	348	7,6	385	6,5
Palestinian National Authority	317	9,0	354	10,4	367	5,3	390	4,3	341	12,1	389	8,8
Qatar	274	3,2	323	5,2	287	3,0	319	2,7	317	4,2	341	3,3
Romania	379	12,9	386	20,5	459	4,7	474	4,1	337	36,7	458	13,6
Russian Federation	495	11,3	504	9,2	514	4,7	516	4,1	501	8,6	505	9,5
Saudi Arabia	289	7,6	320	9,1	327	3,9	342	4,0	342	8,2	359	6,5
Scotland	448	12,1	453	13,6	493	4,2	489	3,7	505	9,1	494	9,0
Serbia	445	12,7	468	10,2	486	4,3	490	3,9	490	5,7	501	6,2
Singapore	610	8,2	634	6,2	581	4,8	596	4,1	594	7,2	600	6,8
Slovenia	441	8,5	461	12,3	512	3,0	505	2,8	491	6,8	484	5,5
Spain (Basque Country)	446	11,7	451	10,0	508	3,7	502	3,6	498	12,4	485	11,7
Sweden	452	7,1	466	8,6	497	2,5	500	2,6	485	5,1	480	4,0
Syria, Arab Republic of	370	7,7	357	7,0	422	4,5	398	3,9	385	10,1	387	8,8
Thailand	351	48,9	433	26,7	432	5,5	454	5,3	395	20,7	448	19,2
Tunisia	414	8,0	391	10,0	435	2,6	412	2,8	398	8,8	389	9,0
Turkey	383	17,8	432	32,2	434	5,1	433	5,4	398	26,5	410	21,2
Ukraine	396	9,6	400	10,2	465	3,9	467	3,9	479	6,0	478	5,6
United Arab Emirates (Dubai)	490	7,8	486	6,3	392	10,3	401	7,8	469	6,5	456	7,0
United States	469	5,9	467	6,5	520	3,0	514	3,0	499	5,1	497	4,6
United States (Massachusetts	498	11,1	495	14,4	560	5,1	555	4,2	540	8,9	525	12,5
United States (Minnesota)	483	13,0	489	15,4	542	5,1	536	4,2	519	11,6	510	8,1

But inclusion into the educational system is one aspect but the achievement of the immigrant boys and girls in the educational system also needs some evaluation.

Table 4.2.4 displays the mathematics achievement of grade eight boys and girls in TIMSS 2007 for immigrant boys and girls separately. As for the percentages of boys and girls in the system, I can also observe substantial differences for the achievement of boys and girls that participate in the educational systems. Although in most countries the first generation as well as the second generation immigrant students are lacking behind independent of their sex. But I find quite a number of countries where the difference is less pronounced for the girls. In Iran – a country where I have seen significantly lower participation of first generation immigrant girls - the first generation immigrant boys are 47 score points behind the native boys but the first generation immigrant girls are 28 score points ahead of the native girls. So, the first generation immigrant girls that are included in the educational system are performing quite well and much better than their male peers. In Japan I can see a similar pattern of lower participation of girls but higher achievement of the first generation immigrant girls than their male peers.

Turkey is also a very interesting case where the participation of girls was slightly lower – but not statistically significant – but the first generation immigrant boys are lacking behind the native boys by 52 score points whereas the first generation immigrant girls are about the same as the native girls and boys. On average the first generation immigrant boys were lacking behind the native boys by 39 score boys and the girls by 29 score points.

In 42 out of the 56 countries the first generation immigrant boys are performing statistically significant below the native boys. The first generation immigrant girls perform statistically significant below the native girls in 35 countries. In contrast to this in five countries the first generation immigrant boys performed statistically significant better than the native boys and in three countries the first generation immigrant girls outperformed the native girls statistically significant.

For the second generation immigrants the situation is similar although not that extreme. On average the second generation immigrant boys are lacking behind the native boys by 14 score points and the girls behind their native peers by 10 score points. A very pronounced case is Romania where the second generation immigrant boys are lacking behind their native peers by 122 score points whereas the second generation immigrant girls are lacking behind the native girls by 15 score points which is even not statistically significant.

The second generation immigrant boys are performing statistically significant below the native boys in 16 out of the 56 countries. The second generation immigrant girls perform statistically significant below the native girls in 13 countries. As for the first generation immigrant boys I find five countries where the second generation immigrant boys performed statistically significant better than the native boys but four countries where the second generation immigrant girls outperformed the native girls statistically significant.

For achieving improved situations for immigrant children policy makers need to address boys and girls differently in a good number of countries. In some countries the major requirement for the immigrant girls seems to be to include them into the educational system. For the immigrant boys the emphasis should be more on the educational outcome. But these hypotheses need further research before final conclusions can be drawn and policy recommendations can be given.

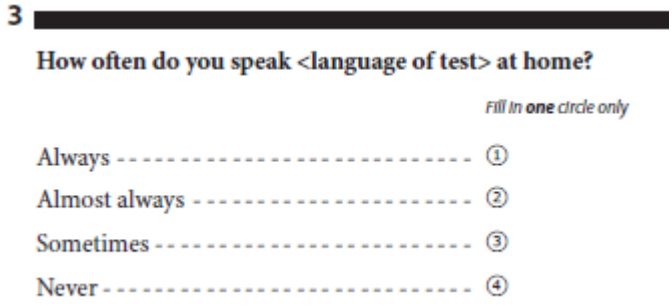
In terms of research question 3 I can conclude that there are different situations for boys and girls in a number of countries. Especially for the first generation immigrant students I find in the majority of countries fewer girls enrolled in the schools. For the first generation immigrant boys I find that they are lagging behind in mathematics more often and to a greater extent than the first generation immigrant girls. For the second generation immigrant boys and girls the picture is less pronounced but also there immigrant boys tend to lag behind native boys more often and to a greater extent.

Interestingly, in the Canadian provinces British Columbia and Ontario as well as in Singapore I could not observe that immigrant girls are underrepresented in the schools nor that immigrant girls perform less well than the immigrant boys.

Language spoken by immigrant students

After investigating the situation of immigrant students' age and for immigrant students of different ages of immigration and for boys and girls separately I come to the students' home background starting with the language spoken at home. Language difficulties are often considered as the main factors for the lower performance of immigrant students (see for example Buchmann and Parrado 2006). As shown in chapter 2 also other researchers see language difficulties of immigrant students as one of the main factors for lower achievement.

In TIMSS the students were asked how often they speak the language of the test at home.


3

How often do you speak <language of test> at home?

*Fill in **one** circle only*

Always ---------- ①
Almost always ---------- ②
Sometimes ---------- ③
Never ---------- ④

(Source: page 181 in Foy and Olson, 2009)

Table 4.2.5 shows the percentage of the students who answered that they never or only sometimes speak the language of test at home separately for native students and first and second generation immigrant students. It should be noted again that the TIMSS test design requested the countries to administer the test in the language of instruction used in the school. Consequently, students who do not speak the language of the test at home are the students who do not speak the language of instruction used in the schools at home.

Table 4.2.5: Percentages of students with the language spoken at home is different than the language of the test

	1st Gen not speaking the language			Natives not speaking the language			2nd Gen not speaking the language		
	percent	SE	sig	percent	SE		percent	SE	sig
United States (Massachusetts)	44	3,7	↑	1	0,4		17	2,7	↑
Norway	38	2,9	↑	0	0,1		14	1,9	↑
United States (Minnesota)	37	4,8	↑	1	0,2		17	3,6	↑
Czech Republic	37	5,3	↑	1	0,3		5	1,3	↑
Canada (British Columbia)	42	2,3	↑	6	2,1		15	2,2	↑
United States	36	2,6	↑	2	0,3		24	1,6	↑
Sweden	33	2,8	↑	0	0,1		15	1,8	↑
Canada (Ontario)	37	3,9	↑	4	1,4		10	1,4	↑
Canada (Quebec)	35	3,4	↑	3	0,5		23	2,9	↑
Israel	33	2,7	↑	2	0,3		7	1,0	↑
Japan	29	8,1	↑	1	0,2		5	3,0	↑
Iran, Islamic Republic of	63	10,8	↑	37	2,2		34	6,7	
Slovenia	32	3,8	↑	7	1,1		20	2,8	↑
England	23	3,0	↑	1	0,2		5	1,4	↑
Thailand	51	10,6		33	1,9		33	10,6	
Australia	18	2,1	↑	1	0,2		7	1,2	↑
Scotland	20	3,1	↑	3	0,4		6	1,7	↑
Singapore	67	2,5	↑	51	1,0		56	1,8	↑
Cyprus	21	2,0	↑	6	0,5		16	1,5	↑
Malaysia	51	4,2	↑	35	2,1		29	4,2	↓
Hungary	16	5,8	↑	1	0,2		5	2,5	↑
Italy	12	2,3		0	-		3	1,0	
Bulgaria	19	3,2	↑	10	1,6		11	3,9	
El Salvador	10	2,3	↑	3	0,3		3	1,4	
Spain (Basque Country)	14	2,6	↑	6	0,5		8	2,4	
United Arab Emirates (Dubai)	44	1,5	↑	37	2,8		38	2,7	
Lithuania	8	2,3	↑	1	0,4		7	1,7	↑
Georgia	11	4,7		5	0,8		14	4,0	↑
Palestinian National Authority	17	2,0	↑	11	1,5		10	2,8	
Russian Federation	12	4,1		6	1,8		6	2,5	
Hong Kong, SAR	13	2,7	↑	8	0,6		8	1,0	
Colombia	9	2,4	↑	4	0,4		7	2,5	↑
Syria, Arab Republic of	18	1,5	↑	13	1,1		13	2,5	
Mongolia	8	1,6	↑	4	0,5		6	1,2	↑
Bahrain	22	1,9	↑	17	1,0		23	1,7	↑
Chinese Taipei	21	3,4		16	1,2		15	3,5	
Ukraine	33	3,7		30	2,7		38	3,8	↑
Bosnia and Herzegovina	4	0,8	↑	1	0,4		2	1,0	
Serbia	5	2,1		2	0,7		2	1,1	
Jordan	12	1,3		10	1,0		11	1,4	
Armenia	5	1,1		2	0,5		6	1,8	↑
Turkey	12	3,9		10	1,2		9	3,0	
Romania	3	1,2		2	0,3		0	-	
Egypt	17	1,3		16	1,2		14	3,2	
Indonesia	62	4,2		64	2,9		57	9,8	
Oman	22	2,3		25	2,3		19	2,4	↓
Saudi Arabia	26	2,6		29	2,6		22	2,3	↓
Morocco	45	5,9		48	1,8		37	4,2	↓
Qatar	25	0,9	↓	29	0,7		27	0,9	↓
Korea, Republic of	0	-		5	0,4		0	-	
Tunisia	72	2,9	↓	78	1,0		75	3,8	
Kuwait	27	1,9	↓	35	1,5		30	2,3	↓
Ghana	61	2,0	↓	70	1,3		67	3,9	
Lebanon	70	2,9	↓	81	1,2		78	3,5	↓
Botswana	50	4,6	↓	67	1,1		57	2,1	↓
Malta	66	2,6	↓	87	0,5		67	2,0	↓

In 32 out of the 56 countries the percentage of first generation immigrant students is that do not speak the language of the test is significantly higher than the percentage of native students who do not speak the language of the test at home. Interestingly, I find also seven countries with a smaller percentage of first generation immigrant students who do speak the language of instruction never or only sometimes at home than the percentage for the native students. These are the Arabic countries Qatar, Tunisia, Kuwait and Lebanon, the African countries Ghana and Botswana and Malta.

When looking at the achievement results tabulated in table 4.1.3 for the countries with a higher percentage of native students that speak the language of instruction never or only sometimes at home none of them shows positive mathematics achievement results for the immigrant students compared to the native students. Except in Botswana where the achievement difference between native students and first generation immigrant students was not significant, all other countries show statistically significant lower mathematics achievement of immigrant students compared to the native students. In Ghana the first generation immigrant students achieved 60 score points less than the native students. In Malta the difference was even 62 points. On the other hand all of the countries that showed in table 4.1.3 a more positive mathematics achievement of first generation immigrant students are showing in table 4.2.5 a statistical significant higher percentage of first generation immigrant students that speak the language of the test never of only sometimes at home compared to the native students. These countries are Australia, the Canadian provinces British Columbia and Ontario, Singapore and Dubai.

For the second generation immigrant students I find 25 countries with a higher percentage of second generation immigrant students that speak the language of instruction never or only sometimes at home compared to the percentage among the native students. Again, I find also examples where the percentage of the students speaking the language of instruction never or only sometimes at home is lower than the percentage of these students among the native students. Here I find nine countries where this is the case. This group of countries consists again of Arabic countries like Oman, Saudi Arabia, Morocco, Qatar, Kuwait and Lebanon as well as Malaysia, Botswana and Malta.

After looking at the percentages of students who speak the language of the test never or only sometimes at home for the native students and the two groups of immigrant students, I want to look at the achievement for these students and especially the achievement difference for students speaking the language of the test at home and those who don't. The table 4.2.6 displays the mathematics achievement of the students who answered that they speak the language of the test never or sometimes at home and those who answered that they speak the language of the test always or almost always at home based on the TIMSS 2007 results. Also the difference between these groups of students is calculated together with an indicator of statistical significance of the difference. These results are tabulated for the native students and the first and second generation immigrant students separately.

Table 4.2.6 Mathematics Achievement of native and immigrant students for students speaking the language of the test never or only sometimes at home and students speaking the language of the test always or almost always at home

	first generation immigrant					native					second generation immigrant				
	speaking language at		not speaking language at		difference	speaking language at		not speaking language at		difference	speaking language at home		not speaking language at		difference
Country	Math Ach	SE	Math Ach	SE		Math Ach	SE	Math Ach	SE		Math Ach	SE	Math Ach	SE	
Armenia	506	13,3	525	23,9	-19,0	499	3,0	472	10,6	26,4	502	12,0	523	22,1	-20,8
Australia	500	6,9	484	17,2	15,6	496	3,8	419	25,5	77,5	500	6,1	500	22,8	0,4
Bahrain	372	4,5	395	7,8	-23,1	403	2,2	407	4,9	-4,5	402	3,8	421	9,1	-18,2
Bosnia and Herzegovina	454	4,6	422	15,1	31,8	457	3,0	442	19,6	15,1	461	7,5	498	42,1	-36,6
Botswana	379	12,7	316	12,6	62,9	370	3,2	368	2,5	2,5	353	7,1	332	5,5	21,6
Bulgaria	414	10,1	380	20,9	34,6	479	4,5	414	15,2	65,0	465	18,3	439	55,6	26,4
Canada (British Columbia)	526	7,8	546	9,4	-19,9	498	2,8	511	6,6	-12,5	518	3,8	514	7,0	3,5
Canada (Ontario)	528	6,7	544	11,6	-16,5	515	3,7	450	25,9	65,4	520	4,1	529	8,6	-8,8
Canada (Quebec)	510	8,0	521	13,8	-11,3	531	3,2	527	13,2	4,8	529	6,6	532	14,2	-3,1
Chinese Taipei	511	10,4	434	19,1	77,0	616	4,1	556	7,6	60,1	603	12,5	528	37,3	74,3
Colombia	320	8,1	296	16,1	24,2	386	3,6	346	6,9	40,4	344	14,4	341	21,4	3,0
Cyprus	432	5,8	415	12,6	16,9	474	1,8	438	7,1	35,3	467	5,4	457	11,2	10,1
Czech Republic	477	7,6	503	13,9	-25,4	506	2,5	466	14,8	39,7	492	5,6	492	18,7	-0,7
Egypt	349	5,4	363	8,8	-14,0	425	3,5	440	6,2	-15,1	357	9,3	378	21,7	-20,9
El Salvador	298	11,3	286	19,4	12,6	346	2,9	294	9,7	51,1	343	7,7	288	22,7	54,8
England	489	10,0	514	21,7	-24,8	515	5,1	465	18,8	49,4	526	6,2	566	14,6	-40,4
Georgia	367	12,2	404	57,5	-37,2	418	6,0	408	21,2	10,2	366	16,6	344	28,2	21,2
Ghana	254	6,4	270	6,8	-16,3	327	5,7	323	4,3	4,1	301	17,0	299	10,3	1,6
Hong Kong, SAR	566	6,0	468	16,4	97,5	582	5,9	535	13,2	47,6	588	5,8	516	17,1	72,5
Hungary	463	16,1	451	51,5	11,1	519	3,3	476	32,2	43,8	524	11,1	508	32,3	15,8
Indonesia	350	8,8	352	6,1	-2,5	409	6,0	409	4,5	-0,4	351	30,9	346	17,4	5,1
Iran, Islamic Republic of	395	33,8	364	22,8	30,7	424	4,8	372	4,4	51,6	388	12,8	325	17,8	62,8
Israel	441	9,6	445	10,9	-4,3	471	4,1	411	19,6	60,1	481	6,0	465	19,4	15,6
Italy	452	6,8	445	14,6	7,3	481	3,2				482	5,9	427	38,8	55,3
Japan	560	22,8	478	28,0	81,9	572	2,5	527	11,0	44,4	568	13,6	418	74,3	150,5
Jordan	385	8,1	384	19,3	1,1	431	4,6	416	11,0	14,8	451	4,8	445	14,1	5,5
Korea, Republic of	633	28,4				600	2,7	551	7,8	49,1	531	33,7			
Kuwait	328	6,6	329	9,8	-1,3	364	2,9	358	4,4	5,9	364	5,8	362	7,6	1,7
Lebanon	428	10,7	421	5,4	7,3	466	7,6	457	3,9	9,3	473	11,2	447	8,9	25,3
Lithuania	444	9,1	463	20,1	-19,7	510	2,3	476	12,5	33,9	507	5,7	538	16,3	-31,2
Malaysia	421	8,8	437	13,0	-16,2	469	5,5	498	6,9	-28,5	441	11,8	477	12,7	-36,2
Malta	476	9,8	407	7,6	68,9	516	4,2	490	1,7	25,3	490	5,7	492	5,2	-2,1
Mongolia	393	5,7	348	14,1	45,4	449	3,8	411	13,9	37,7	398	4,1	366	20,5	31,0
Morocco	322	7,9	324	11,7	-2,5	383	4,1	393	4,3	-9,4	352	12,4	373	10,8	-21,0
Norway	451	5,6	435	7,2	15,5	474	2,2	445	25,0	29,1	467	3,9	429	11,2	38,8
Oman	316	6,6	318	9,5	-1,6	386	3,5	389	5,1	-3,4	365	7,0	373	11,2	-7,6
Palestinian National Authority	331	7,7	321	13,4	9,2	380	3,7	382	7,8	-2,5	365	8,2	389	21,9	-23,8
Qatar	302	3,3	275	6,9	26,8	308	2,2	296	3,4	12,1	335	3,0	317	5,6	18,0
Romania	381	11,8	399	62,9	-18,1	467	4,1	408	15,1	58,9	372	30,4			372,2
Russian Federation	499	8,0	506	30,2	-6,9	516	3,8	501	12,8	14,9	506	6,4	452	20,5	54,7
Saudi Arabia	299	6,2	295	10,1	3,5	333	3,5	339	4,3	-6,0	348	5,7	359	9,7	-10,4
Scotland	445	11,7	471	15,2	-25,5	493	3,5	432	9,9	60,9	500	7,3	481	21,4	19,3
Serbia	457	9,6	437	40,8	20,1	489	3,5	426	17,0	63,5	497	4,3	420	22,3	76,8
Singapore	632	7,6	617	7,3	15,2	614	3,7	563	4,8	50,3	621	6,2	578	7,4	43,4
Slovenia	454	8,1	434	12,6	20,3	511	2,1	474	8,3	37,0	495	4,3	458	8,9	37,4
Spain (Basque Country)	446	9,2	461	16,5	-15,2	505	2,9	505	5,2	0,1	490	9,3	509	20,7	-18,5
Sweden	460	6,3	453	10,2	7,3	499	2,2	455	18,6	43,5	485	3,3	469	9,1	15,9
Syria, Arab Republic of	365	5,6	360	11,4	4,8	410	3,6	400	5,6	9,4	385	7,1	395	17,6	-10,1
Thailand	438	39,5	327	34,3	110,6	458	5,9	413	7,7	44,5	427	17,6	392	50,9	34,6
Tunisia	388	10,8	413	6,8	-25,6	410	3,8	426	2,5	-16,6	373	10,9	401	7,2	-27,7
Turkey	414	16,8	334	34,1	80,4	441	5,0	370	6,0	71,1	413	20,4	297	31,3	116,4
Ukraine	391	9,8	409	13,1	-18,0	465	4,4	469	4,5	-3,8	473	6,4	487	6,5	-13,8
United Arab Emirates (Dubai)	496	4,7	478	5,1	18,9	377	6,6	431	9,0	-53,6	460	3,9	465	6,4	-4,4
United States	467	5,7	470	7,1	-2,5	518	2,8	457	6,4	61,4	504	4,3	479	6,1	25,2
United States (Massachusetts)	504	10,3	488	14,4	16,0	558	4,0	528	16,6	29,5	542	8,5	488	13,0	54,0
United States (Minnesota)	492	10,6	476	15,9	16,6	539	4,1	487	26,1	52,1	516	7,5	510	11,7	6,1

For the native students I observe that for 29 countries the mathematics achievement of the students who speak the language of the test never or sometimes is statistically significant lower than that of the students who speak the language of the test always or almost always. Interestingly, in Egypt, Malaysia, Tunisia and Dubai the opposite is the case and the students who speak the language of the test never or sometimes is statistically significant higher than that of the students who speak the language of the test always or almost always.

For the first generation immigrant students there are only 11 countries where the mathematics achievement of the students who speak the language of the test never or sometimes is statistically significant lower than that of the students who speak the language of the test always or almost always. In Bahrain and Tunisia the achievement of the students who speak the language of the test never or sometimes is statistically significant higher than that of the students who speak the language of the test always or almost always.

This smaller number of countries with a statistically significant higher mathematics achievement of students who speak the language of the test always or almost always is of course partially an effect of the group sizes. Since there are more native students in the sample and fewer first generation immigrant students, the sampling errors for the subgroups within the first generation immigrant students is bigger than for the native students. This can also be seen in the columns labeled "SE" in table 4.2.6. But this is not the only reason. The average achievement difference between the students who speak the language of the test never or sometimes and the students who speak the language of the test always or almost always is for the native students 26.7 score points. For the first generation immigrant students this difference is only 14 score points. Based on this data one might conclude that the effect of not speaking the language of the test (and consequently the language of school instruction) at home makes bigger difference for native students than for first generation immigrant students.

But we should not forget also to look at the results for the second generation immigrant students. For the second generation immigrant students there are 15 countries where the mathematics achievement of the students who speak the language of the test never or sometimes is statistically significant lower than that of the students who speak the language of the test always or almost always. On the other hand, in England, Malaysia and Tunisia the mathematics achievement of the students who speak the language of the test never or sometimes is statistically significant higher than that of the students who speak the language of the test always or almost always. Again, the group sizes for the second generation immigrant students are smaller than for the native students and consequently the error terms bigger. But also for the second generation immigrant students we see on average a smaller difference than for the native students – in this case the average difference is 15.5 score points.

With respect to the research question three I conclude that there are in many countries with more students who do not speak the language of instruction at home among the immigrant students than among the native students. Interestingly, the difference in mathematics achievement for students speaking the language of instruction at home and those who don't is bigger for native students than for first and second generation immigrant students.

Parents' education

But there are more factors of the home background that might be related to the students' achievement and that might be different for native and immigrant students. As reflected on in chapter 2 the socioeconomic background of the students plays a major role in predicting students' achievement. Consequently, the next analysis will investigate the relationship between the socioeconomic status of the students and their immigration status. Not all domains are covered in the analyzed data. For example there is no indication of symbolic capital. Also measures of economic, cultural capital and social capital are not operationalized in an optimal way and variables are measuring a mixture of them. In comparison for example to PIRLS that includes also parent questionnaires only information from the students are available in TIMSS on the individual level. Questions that can be used to describe the socioeconomic background of the student are questions about the highest level of education of the parents, the number of books in the home, and a set of nine home possessions, of which 5 are internationally defined (calculator, computer, study desk, dictionary, and internet connection) and four that were supposed to be defined by each participating country considering items that would discriminate well between students from low and high socio-economic background. However due to (Brese, F. and Mirazchiyski, P., 2010) these possession items seem not to work as good as the parental education and the number of books at home.

First, I want to look at the parent education. The TIMSS 2007 includes two questions about the highest level of education that is completes by the mother and by the father. The question in the international version of the questionnaire refers to the different ISCED levels. ISCED stands for the "international standard classification of education" and is defined by the UNESCO originally in 1997 (see (UNESCO, 2006)). In 2011 the classification was revised byte UNESCO but since TIMSS followed the ISCED definition from 1997 also for this dissertation I will follow the 1997 definition.

The ISCED level two is defined as the lower secondary or second stage of basic education which is defined by the criteria: "entry is after some 6 years of primary education (see paragraph 35) ; the end of this level is after some 9 years of schooling since the beginning of primary education (see paragraph35); the end of this level often coincides with the end of compulsory education in countries where this exists; and often, at the beginning of this level, several teachers start to conduct classes in their field of specialization" (page 24 in (UNESCO, 2006)).

ISCED level five is defined as the first stage of tertiary education with the criteria: "normally the minimum entrance requirement to this level is the successful completion of ISCED level 3Aa or 3B or ISCED level 4A; level 5 programmes do not lead directly to the award of an advanced research qualification (level 6); and these programmes must have a cumulative theoretical duration of at least 2 years from the beginning of level 5" (page 34 in (UNESCO, 2006).

The participating countries were required to translate the definitions into terms that are familiar to students in their country. The TIMSS 2007 question in the student questionnaire was:

6

A. What is the highest level of education completed by your mother (or stepmother or female guardian)?

*Fill in **one** circle only*

- Some <ISCED Level 1 or 2 > or did not go to school ①
- <ISCED 2> ②
- <ISCED 3> ③
- <ISCED 4> ④
- <ISCED 5B> ⑤
- <ISCED 5A, first degree> ⑥
- Beyond <ISCED 5A, first degree> ⑦
- I don't know ⑧

B. What is the highest level of education completed by your father (or stepfather or male guardian)?

*Fill in **one** circle only*

- Some <ISCED Level 1 or 2 > or did not go to school ①
- <ISCED 2> ②
- <ISCED 3> ③
- <ISCED 4> ④
- <ISCED 5B> ⑤
- <ISCED 5A, first degree> ⑥
- Beyond <ISCED 5A, first degree> ⑦
- I don't know ⑧

(source page 183 in Foy and Olson 2009).

In the style of Mullis et al (2004) – see page 126ff. - the highest level of education of the parents was calculated and the analysis based on this derived variable.

First, the percentage of students was calculated with at least one of the parents having an education of ISCED level five or above. The percentages were calculated for tentative students and the first and second generation immigrant students separately. Table 4.2.7 shows these statistics for the TIMSS 2007 countries together with an indicator showing if the percentage for one of the immigrant population groups was statistically significant different from the percentage for the native students.

Tables 4.2.7: Percentage of students with highest education of the parents being ISCED 5 and above								
Country	first generation immigrant			native		second generation immigrant		
	Percent	SE	sig	Percent	SE	Percent	SE	sig
Korea, Republic of	83	9,6	↑	52	1,4	11	11,5	↓
Singapore	64	2,4	↑	33	1,1	36	1,8	
United Arab Emirates (Dubai)	75	1,6	↑	46	2,9	56	2,2	↑
Canada (British Columbia)	76	2,7	↑	49	2,1	53	2,3	
Canada (Quebec)	71	3,7	↑	44	1,8	50	3,2	
Canada (Ontario)	73	3,0	↑	48	2,4	54	3,3	
Cyprus	61	2,5	↑	41	0,9	61	2,3	↑
Czech Republic	40	5,3	↑	24	1,0	36	3,6	↑
Australia	56	4,5	↑	41	1,7	42	2,0	
Japan	58	11,3		44	1,3	69	7,7	↑
Palestinian National Authority	36	1,8		23	1,1	26	2,7	
Bahrain	36	2,1	↑	24	0,9	22	2,7	
Morocco	33	3,8	↑	21	1,5	24	3,7	
Italy	40	4,7	↑	29	1,4	34	3,4	
Jordan	40	3,6	↑	28	1,3	37	2,0	↑
Botswana	38	4,2	↑	27	1,0	33	2,6	↑
Romania	30	5,6		20	1,3	20	8,1	
Oman	26	2,2	↑	15	1,0	32	3,4	↑
Turkey	19	4,8		10	1,0	12	3,4	
Malta	32	3,2	↑	23	0,8	29	2,6	↑
Tunisia	29	3,8		21	1,6	27	3,6	
Bosnia and Herzegovina	32	1,9	↑	24	1,2	36	3,9	↑
Sweden	61	3,1		55	1,7	57	2,6	
Egypt	20	1,5	↑	13	0,8	20	3,2	↑
El Salvador	25	4,0		18	1,3	29	4,6	↑
Georgia	63	6,3		57	2,8	61	4,4	
Saudi Arabia	37	2,6	↑	31	1,4	36	2,7	
Kuwait	48	2,3		44	1,6	39	2,6	
Thailand	20	7,9		16	1,4	13	3,6	
Lithuania	36	4,3		33	1,2	32	3,4	
Russian Federation	45	4,3		42	1,5	46	2,4	
Israel	52	3,8		49	1,8	56	2,4	↑
Lebanon	38	2,8		35	1,9	50	4,2	↑
Ghana	18	1,7		16	1,2	21	3,0	
Qatar	55	1,3		54	0,8	47	1,4	↓
Chinese Taipei	36	4,5		35	2,0	36	5,1	
Syria, Arab Republic of	26	1,9		25	1,4	29	3,3	
Iran, Islamic Republic of	16	6,6		16	1,4	13	3,3	
Malaysia	20	2,5		21	1,6	20	3,1	
Hungary	31	5,1		32	1,4	47	4,6	↑
Colombia	19	3,2		21	1,2	28	5,3	
Indonesia	9	1,2	↓	14	1,2	16	6,6	
Ukraine	63	3,6		68	1,4	75	2,4	↑
Serbia	31	3,3		38	1,8	44	2,5	
Bulgaria	35	3,6		42	1,8	58	7,2	↑
Slovenia	39	4,3		47	1,3	40	2,8	↓
Norway	78	3,5		85	1,0	85	2,6	
Hong Kong, SAR	16	1,8	↓	26	1,6	10	0,9	↓
United States (Massachusetts)	60	3,1	↓	74	1,9	59	3,0	↓
United States	46	2,6	↓	62	1,4	43	2,5	↓
United States (Minnesota)	52	6,0	↓	67	2,4	50	3,9	↓
Mongolia	26	2,1	↓	42	1,9	33	2,8	↓
Armenia	38	3,9	↓	58	1,8	61	4,4	

We can see in table 4.2.7 that especially for the first generation immigrant students there are more countries with a statistically significant higher percentage of students with one of the parents having completed an ISCED level five education compared to the native students. In 19 countries this was the case. Whereas only in seven countries there were statistically significant more native students than first generation immigrant students with at least one of their parents having completed an education of ISCED level five or above.

Apart from Korea which has – as stated already above – very few first generation immigrant students and consequently no reliable information on this, the countries with the biggest differences of the percentages between native students and first generation immigrant students are exactly those that have shown more positive mathematics achievement results. These are Singapore, Dubai, and the Canadian provinces British Columbia, Quebec and Ontario. Interestingly, also Quebec is included here although the mathematics achievement of the immigrant students compared to the native students was not as positive as in the other two Canadian provinces. Since I know already from the literature review but also from the TIMSS 2007 international results that a higher educational background of the parents and the achievement level of the students are correlated might suspect that the higher education levels in these countries are contributing to the relatively positive achievement outcomes of the immigrant students in these countries. One might also suspect that the differences in the educational background are somewhat caused by the immigration policies of the different countries. I will investigate this in more detail in the country research in chapter 5.

On the other side of the spectrum, I see the United States and both U.S. states as well as Hong Kong and Indonesia, Mongolia and Armenia where there are statistically significant fewer students among the first generation immigrant students than among the native students with at least one of the parents having achieved an ISCED level five education or above. As we have seen in table 4.1.3 the mathematics achievement trend of the first generation immigrant students compared to the natives in Hong Kong is rather negative. It would be interesting to look if there are changes in the educational background of the parents of the immigrant students.

But one of the important outcomes of this analysis is that in all but seven countries the percentage of immigrant students with at least one of their parents having completed an ISCED level five education or above is statistically not different from the native students or even statistically significant higher. Consequently, I cannot support the thesis that a lower educational background of the immigrant students is a factor that influences the – in general – lower achievement of first generation immigrant students.

When looking at the situation for the second generation immigrant students compared to the native students, I find eight countries with a statistically significant higher percentage of native students with at least one of their parents having completed an education of ISCED level five or above than second generation immigrant students. The list of concerned countries is very similar to the one for the first generation immigrant students but also Korea, Slovenia, and Qatar are concerned – Korea again with the caveat that due to the small number of cases this statistic in not reliable.

But on the other hand there are 16 countries where I find a statistically significant higher percentage of the second generation immigrant students with one of the parents having completed an ISCED level five education compared to the native students. This means that also for the second generation

immigrant students it is not true that overall there are more students among them with the parents being educated less well compared to the native students.

After having looked at the percentage of the students with at least one of the parents having finished an ISCED level five education, I want to look at the percentage of students where both parents have a rather low educational level. Table 4.2.8 shows the percentage of the native students and the first and second generation immigrant students with none of the parents having completed an education above ISCED level 2. As can read above, an ISCED level two education can be regarded as a very minimal education that corresponds to the compulsory education in many countries. As for table 4.2.7 also the countries with statistically significant differences for the immigrant students compared to the native students are indicated.

From table 4.2.8 I can see that in 13 countries there are statistically significant more students among the first generation immigrants compared to the native students with both parents not having completed any education beyond ISCED level two. The list of concerned countries is of course quite similar to the above list of countries whit a statistically significant higher percentage of native students with at least one of the parents having completed an ISCED level five education or above. Again, I see countries like the United States and both U.S. states as well as Hong Kong, Mongolia, and Armenia. But I find also Hungary, Slovenia, Norway, Chinese Taipei, Serbia, and Bahrain among these countries.

On the other side there are seven countries where there are statistically significant more students among the group of native students compared to the first generation immigrant students with both parents not having completed any education beyond ISCED level two. The group of countries concerned is quite diverse. These countries are Dubai, Turkey, Botswana, Oman, Palestine, Singapore and Cyprus. As for the countries with statistically significant more students among first generation immigrants than natives with at least one of the parents having completed an education of ISCED level five or above we find Singapore ad Dubai in the list – two countries with relatively good achievement results of immigrant students.

I also want to look at the results for the second generation immigrant students. Here, I find 10 countries with a statistically significant higher percentage of native students with at none one of their parents having completed an education of ISCED level two compared to the second generation immigrant students.

But on the other hand there are 13 countries where I find a statistically significant higher percentage of the second generation immigrant students with none of the parents having completed an ISCED level two education compared to the native students.

Compared to the statistics for the second generation immigrant students related to the parents with a high educational background, this result looks very ambiguous. But also in terms of the percentage of parents with a very low educational level, I cannot say that there is a general tendency of more second generation immigrants being affected than native students.

Tables 4.2.8: Percentage of students with highest education of the parents being ISCED 2 and below								
	first generation immigrant			native		second generation immigrant		
	Percent	SE	sig	Percent	SE	Percent	SE	sig
United Arab Emirates (Dubai)	5	0,7	↓	21	1,7	13	1,6	↓
Turkey	53	7,1	↓	69	1,8	60	5,7	
Botswana	31	4,0	↓	41	1,1	31	2,8	↓
Oman	49	2,4	↓	58	1,6	43	4,1	↓
El Salvador	51	5,1		58	1,8	43	5,0	↓
Palestinian National Authority	16	1,4	↓	23	1,2	19	2,5	
Singapore	10	1,2	↓	15	0,9	19	1,3	↑
Iran, Islamic Republic of	55	10,0		60	1,9	70	5,3	
Cyprus	10	1,5	↓	15	0,7	11	1,3	↓
Australia	18	2,9		22	1,4	19	1,7	
Korea, Republic of	-	-		4	0,4	-	-	
Morocco	54	7,1		58	2,1	49	4,9	
Tunisia	38	3,8		41	1,7	43	4,3	
Italy	27	3,6		30	1,4	24	3,2	
Qatar	20	1,0		22	0,6	25	1,0	↑
Bosnia and Herzegovina	12	1,6		14	1,1	11	2,8	
Saudi Arabia	41	3,1		43	1,8	37	3,1	
Malta	50	3,1		52	0,9	44	3,1	↓
Canada (Quebec)	4	1,4		5	0,5	6	1,2	
Canada (British Columbia)	3	1,0		4	0,6	4	0,8	
Syria, Arab Republic of	36	2,0		37	1,6	31	2,7	
Canada (Ontario)	3	1,3		3	0,7	4	0,9	
Jordan	20	1,8		20	1,3	15	1,7	↓
Lebanon	37	3,3		37	2,4	24	4,9	↓
Malaysia	30	2,6		28	1,7	37	3,9	↑
Kuwait	15	1,9		14	1,0	20	2,0	↑
Lithuania	7	2,1		6	0,6	6	2,0	
Ukraine	7	1,9		6	0,5	4	1,0	
Egypt	49	1,9		47	1,6	48	4,9	
Russian Federation	8	2,2		6	0,6	6	1,7	
Israel	15	2,4		12	1,0	13	1,6	
Georgia	5	1,8		3	0,4	3	1,4	
Romania	18	6,2		13	1,3	32	12,0	
Bahrain	27	2,0	↑	22	1,0	39	3,0	↑
Sweden	13	2,3		10	0,9	14	1,8	↑
Ghana	45	3,0		41	1,5	36	3,9	
Indonesia	60	2,7		55	2,0	67	8,4	
Thailand	68	8,9		62	1,6	68	6,1	
Bulgaria	15	3,2		9	1,4	9	4,2	
Czech Republic	9	3,4	↑	2	0,3	2	1,0	
Serbia	14	3,3	↑	7	1,0	7	1,3	
Japan	9	5,6		2	0,3			↓
Chinese Taipei	26	3,6	↑	18	1,4	27	5,0	
Norway	11	3,0	↑	3	0,5	8	1,9	↑
Slovenia	13	3,1	↑	5	0,5	9	1,4	↑
Mongolia	26	2,2	↑	17	1,1	22	2,1	↑
Colombia	57	4,4		48	1,6	46	4,5	
United States (Massachusetts)	12	1,9	↑	3	0,5	12	2,9	↑
United States (Minnesota)	17	5,1	↑	3	0,7	15	2,7	↑
Armenia	16	3,7	↑	1	0,3	4	1,3	↑
Hungary	24	6,2	↑	8	0,8	3	1,3	↓
United States	26	2,3	↑	6	0,5	28	2,3	↑
Hong Kong, SAR	45	1,8	↑	25	1,4	46	2,0	↑

For this group of students with none of the parents having completed more than an ISCED level two education the picture is not that clear. In 14 countries the percentage of second generation immigrant students with parents who have an education of ISCED 2 or below is significant higher than the percentage for the native students. And on the opposite in 12 countries the percentage of second generation immigrant students with parents who have an education of ISCED 2 or below is significant lower than the percentage for the native students.

Looking at the first generation immigrants, I find that In 14 countries the percentage of first generation immigrant students with parents who have an education of ISCED 2 or below is significant higher than the percentage for the native students. And on the opposite in only in 8 countries the percentage of first generation immigrant students with parents who have an education of ISCED 2 or below is significant lower than the percentage for the native students.

With respect to the research question three I conclude that neither for the first generation immigrant students nor for the second generation immigrant students do I find in general their parents being less educated than the parents of the native students. Consequently, I cannot support the thesis expressed by the OECD that immigrant students are performing below native students because of lower SES background (see (OECD, 2010a, 2010c)) – at least not with respect to the education of the parents. It is rather the case that for the first generation immigrant students I find a strong tendency that they have parents with a very high level of education. In 19 countries, first generation immigrant students have a significantly higher percentage of at least one of their parents having completed an education of ISCED level five or higher than native students. And in only seven countries I find a significantly higher percentage of native students with at least one of their parents having completed an ISCED level five education or above compared to first generation immigrant students. One might suspect that immigration policies in some countries favor immigrants with a higher education which results in a higher percentage of immigrants with high educational levels. This will be investigated further in chapter five.

After examining the education of the parent as one aspect of the socio-economical background, I want to focus also on other SES aspects. As explained in the review chapter two another aspect of the SES background that was found to discriminate quite well between students with higher SES background and lower SES background is the number of books at home (see (Postlethwaite & Ross, 1992)). This will be the next focus.

Home possessions

The students in TIMSS were asked about the number of books at home with 5 response options.

About how many books are there in your home? (Do not count magazines, newspapers, or your school books.)

*Fill in **one** circle only*

None or very few (0-10 books) ①

Enough to fill one shelf (11-25 books) ②

Enough to fill one bookcase (26-100 books) ③

Enough to fill two bookcases (101-200 books) ④

Enough to fill three or more bookcases (more than 200 books) ⑤

For the following analysis this ordinal scale was transferred into an interval scale by recoding all categories to the average number of books that is covered in each category. The responses to the last category were recoded to the minimum amount plus the difference to the mean of the second last category following the traditional approach as for example Elley (Elley, 1994). This results in the following recodings: 1->5, 2-> 18, 3->63, 4->150, 5->250.

Table 4.2.9 shows the average number of books at home for native students and for the first and second generation immigrant students. It is also indicated if the average for one of the immigrant student groups is statistically significant higher or lower than the average for the native students. As can be seen in table 4.2.9 there are 23 countries where the number of books for first generation immigrant students is statistically significant lower than for the native students. In five countries the average for the first generation immigrant students is significantly higher than for the native students.

For the second generation immigrant students the results are not that unambiguous. Only in 12 countries the number of books at home is statistically significant lower than for the native students and in 6 countries the number of books is statistical significant higher than for the native students.

If we accept the number of books at home as an indicator for socioeconomic capital of the students family – although probably a weak one – we can conclude that in nearly half of the countries the first generation immigrant students come from less affluence background than the native students. But as also cautioned by Hansen and Gustafsson (Hansson & Gustafsson, 2010) the number of books at home might work differently for different immigration groups and comparisons should be done with great care.

Table 4.2.9 Number of books at home by immigration status								
	first generation immigrant			native students		second generation immigrant		
Country	Mean	SE		Mean	SE	Mean	SE	
Korea, Republic of	191	24,8	↑	123	2,1	58	19,9	↓
Morocco	68	12,1		46	2,6	60	9,0	
Iran, Islamic Republic of	58	18,6		40	1,9	30	5,3	
Botswana	53	5,3	↑	37	1,3	46	4,0	↑
United Arab Emirates (Dubai)	81	3,1	↑	65	3,3	66	3,6	
Thailand	52	14,9		36	1,8	31	6,2	
Tunisia	49	5,2	↑	37	1,4	41	4,3	
Turkey	57	8,1		48	1,9	56	7,3	
Ghana	44	2,4	↑	37	1,6	39	6,3	
Jordan	66	5,7		59	2,0	70	2,9	↑
El Salvador	37	5,4		32	1,6	49	7,4	↑
Palestinian National Authority	53	2,7		49	2,1	45	3,5	
Kuwait	63	3,6		59	1,5	60	3,5	
Singapore	83	4,1		80	1,8	87	3,4	
Bosnia and Herzegovina	39	2,5		36	1,1	45	4,0	↑
Qatar	85	2,1		82	1,7	84	2,2	
Syria, Arab Republic of	47	2,5		45	1,4	46	4,0	
Canada (Quebec)	74	5,5		72	2,3	84	6,4	
Saudi Arabia	56	4,5		55	2,0	61	3,6	
Lithuania	72	5,6		71	1,8	71	5,2	
Ukraine	80	5,2		79	2,2	99	4,2	↑
Georgia	96	13,8		96	3,9	87	10,1	
Egypt	41	2,0		42	1,4	41	5,4	
Scotland	77	9,0		78	2,6	97	6,6	↑
Lebanon	63	4,8		64	2,4	77	7,7	
Indonesia	26	1,4		29	1,0	37	8,1	
Mongolia	27	2,7		31	1,5	25	2,1	↓
Bahrain	71	3,5		75	1,3	61	3,5	↓
Colombia	31	3,9		36	1,6	39	8,0	
Malta	98	4,7		102	1,3	99	3,6	
Canada (British Columbia)	112	4,4		120	2,8	106	5,1	↓
Oman	56	3,0	↓	64	2,2	70	4,4	
Malaysia	45	3,9	↓	54	2,2	48	5,2	
Russian Federation	88	5,9		98	2,0	100	5,3	
Romania	51	6,8		64	2,3	55	11,3	
Serbia	45	4,3	↓	59	1,9	60	2,9	
Slovenia	69	5,4	↓	84	1,7	67	3,5	↓
Canada (Ontario)	98	5,8	↓	116	4,3	112	4,3	
Cyprus	68	4,7	↓	87	1,6	84	3,7	
England	76	6,3	↓	96	2,7	93	5,0	
Italy	77	6,2	↓	103	2,7	112	6,0	
Australia	90	5,7	↓	116	2,8	111	4,6	
Chinese Taipei	64	7,2	↓	91	3,2	81	9,3	
Israel	82	4,9	↓	109	2,6	108	4,4	
Japan	61	11,1	↓	90	1,9	83	12,5	
Bulgaria	73	6,8	↓	102	2,8	109	14,4	
Norway	90	6,5	↓	119	2,3	103	5,6	↓
Armenia	64	6,0	↓	94	2,4	89	5,9	
Hong Kong, SAR	46	2,4	↓	78	2,5	53	2,0	↓
Czech Republic	61	8,6	↓	93	1,6	83	4,5	↓
United States (Massachusetts)	88	10,5	↓	125	3,8	90	6,7	↓
Hungary	83	11,2	↓	120	2,5	121	8,4	
United States	60	3,2	↓	103	2,5	68	3,0	↓
Sweden	81	5,1	↓	126	2,5	103	4,0	↓
Spain (Basque Country)	79	9,0	↓	125	2,7	119	8,6	
United States (Minnesota)	69	9,7	↓	120	3,8	73	4,9	↓

But since we know that socioeconomic status predicts student achievement quite well, it is even more interesting to investigate if and how socioeconomic status – measured by the number of books at home relates to achievement for the different groups of students.

To investigate this, a regression analysis was conducted and for native students and the first and second generation immigrant students the mathematics achievement regressed on the number of books at home. For the number of books at home, the recoded variable was used.

Table 4.2.10 shows the beta-coefficients of the regression analysis. The regression coefficients are highlighted if they are statistically significantly greater than zero. It is also marked if the regression coefficients for one of the immigrant student groups are statistically significantly different from the regression coefficients for the native students. Since the recoded variable is used, one can interpret the regression coefficients in the following way: a value of one indicates that students with one more book at home achieved one score more point on the TIMSS 2007 mathematics scale.

As for the results we see that for the native students in all countries the regression coefficients are statistically significantly positive. This is not surprising and in line with what is already reported in the TIMSS 2007 internationally mathematics report (see exhibit 4.4 in (Mullis et al., 2008)).

The results for the immigrant students are mostly similar. In most of the countries the regression coefficients are statistically significantly positive. In most other cases the regression coefficients are also positive but not statistically significant. This is not too surprising since the standard errors are larger for the immigrant populations due to the smaller sample sizes in these countries. There are also three countries where the regression coefficients are negative for the first generation immigrant students but not statistically different from zero. These countries are Armenia, Ghana and Kuwait.

When comparing the regression coefficients for the immigrant students to the ones for the native students, I find six countries where the regression coefficients for the first generation immigrant students are statistically significant lower than for the native students and three countries where they are statistically significant higher. The countries where they are higher are Chinese Taipei, Malta and Norway. In these countries, the SES background of the students measured by the number of books at home is stronger related to the mathematics achievement among first generation immigrant students than among the native students.

For the second generation immigrant students we find three countries where the regression coefficients for the second generation immigrant students are statistically significantly lower than for the native students and two countries where they are statistically significant higher. The countries with the lower regression coefficients for the immigrant students are Tunisia, the Canadian state of British Columbia and the US state Minnesota. The case of British Columbia will be discussed further in chapter five- the results match with other research on the influence of SES background on parents motivating their students and resulting higher achievement in British Columbia. The result for Minnesota is surprising in that sense that it contradicts the results for Massachusetts where exactly the opposite can be observed since Massachusetts is one of the two countries where the regression coefficients for the second generation immigrant students are statistically significantly higher than for the native students. The other one is Romania, where as discussed already earlier, the results are more an artifact created by a very small sample size.

Table 4.2.10 Regression coefficients of number of books at home on mathematics achievement for native students and first and second generation immigrant students

	first generation immigrant			native		second generation immigrant		
Country	Beta	SE	sign	Beta	SE	Beta	SE	sign
Thailand	0,38	0,29		0,58	0,07	0,19	0,29	
Turkey	0,59	0,29		0,52	0,04	0,58	0,20	
Romania	0,52	0,13		0,47	0,03	1,21	0,32	↑
Colombia	0,32	0,19		0,41	0,04	0,66	0,22	
England	0,31	0,08		0,40	0,03	0,35	0,05	
Korea, Republic of	0,25	0,31		0,40	0,02	0,22	0,36	
Malaysia	0,30	0,08		0,38	0,03	0,47	0,13	
Chinese Taipei	0,63	0,10	↑	0,38	0,02	0,26	0,13	
Scotland	0,48	0,07		0,37	0,03	0,35	0,06	
Hungary	0,58	0,12		0,37	0,02	0,51	0,09	
Tunisia	0,22	0,08		0,37	0,03	0,14	0,11	↓
Singapore	0,31	0,06		0,36	0,03	0,35	0,05	
Lithuania	0,26	0,09		0,34	0,02	0,34	0,06	
Iran, Islamic Republic of	0,30	0,17		0,34	0,04	0,16	0,24	
Serbia	0,26	0,14		0,33	0,03	0,43	0,05	
Indonesia	0,14	0,14		0,32	0,07	0,95	0,66	
Bulgaria	0,17	0,07	↓	0,32	0,04	0,42	0,17	
Czech Republic	0,43	0,11		0,31	0,02	0,43	0,07	
Australia	0,40	0,05		0,30	0,02	0,31	0,04	
Ukraine	0,38	0,08		0,29	0,03	0,29	0,05	
Malta	0,47	0,07	↑	0,29	0,02	0,23	0,05	
United States (Massachusetts)	0,36	0,07		0,29	0,03	0,42	0,05	↑
Bosnia and Herzegovina	0,30	0,05		0,29	0,04	0,37	0,12	
United States	0,32	0,06		0,28	0,01	0,33	0,03	
Mongolia	0,27	0,11		0,27	0,03	0,25	0,07	
Canada (Quebec)	0,29	0,08		0,27	0,03	0,19	0,06	
Hong Kong, SAR	0,27	0,05		0,27	0,04	0,23	0,05	
United Arab Emirates (Dubai)	0,34	0,03		0,27	0,05	0,22	0,04	
Slovenia	0,30	0,05		0,26	0,02	0,27	0,06	
Japan	0,67	0,26		0,26	0,02	0,34	0,14	
Georgia	0,35	0,11		0,25	0,03	0,34	0,12	
Russian Federation	0,10	0,06	↓	0,25	0,03	0,36	0,05	
Jordan	0,30	0,09		0,25	0,03	0,23	0,05	
Israel	0,19	0,06		0,25	0,03	0,22	0,05	
Cyprus	0,35	0,06		0,25	0,02	0,28	0,06	
Canada (Ontario)	0,24	0,05		0,24	0,04	0,21	0,03	
Canada (British Columbia)	0,18	0,05		0,24	0,02	0,16	0,03	↓
Spain (Basque Country)	0,32	0,08		0,23	0,02	0,32	0,06	
Sweden	0,32	0,05		0,23	0,02	0,19	0,03	
United States (Minnesota)	0,38	0,10		0,22	0,03	0,09	0,05	↓
El Salvador	0,21	0,15		0,22	0,05	0,14	0,13	
Italy	0,13	0,07		0,22	0,02	0,20	0,06	
Oman	0,15	0,06		0,21	0,03	0,26	0,05	
Norway	0,30	0,04	↑	0,20	0,02	0,22	0,03	
Morocco	0,10	0,10		0,20	0,03	0,20	0,10	
Palestinian National Authority	0,08	0,06		0,17	0,04	0,32	0,13	
Saudi Arabia	0,10	0,06		0,17	0,02	0,13	0,06	
Bahrain	0,21	0,06		0,16	0,03	0,18	0,05	
Qatar	0,11	0,03		0,16	0,02	0,13	0,03	
Lebanon	0,12	0,07		0,16	0,04	0,11	0,10	
Egypt	0,02	0,05		0,15	0,04	0,04	0,13	
Armenia	-0,10	0,09	↓	0,12	0,02	0,21	0,10	
Syria, Arab Republic of	0,05	0,05		0,12	0,04	0,06	0,10	
Botswana	0,23	0,14		0,11	0,03	0,06	0,07	
Ghana	-0,03	0,05	↓	0,10	0,04	0,19	0,14	
Kuwait	-0,02	0,05	↓	0,09	0,03	0,06	0,07	

Overall I conclude that the number of books at home as a predictor of the SES background of the students works quite similar for native students as well as for first and second generation immigrant students. Students with more books at home achieve better in TIMSS mathematics than students with fewer books at the home. The achievement difference for students with a different number of books at home varies between immigrant students and native students in some countries but the general tendency is the same. This is somewhat surprising as we know that the population of immigrant students is culturally quite diverse and using the number of books at home as an SES predictor does not necessarily work across cultures. A more in-depth analysis of the number of books at home and the varying achievement results for the three groups of students was not possible because the small number of observations for the immigrant populations and the number of response categories for the books at home resulted in quite unstable estimates.

Summarizing the results of the analysis of the socio-economic background of the students with respect to research question three I conclude that there are no differences between immigrant students and native students with respect to the parental education. Contradictory, I even found a couple of countries where the parental education was statistically significant better for first generation immigrant students than for native students. The results for the number of books at home are clearly different. I find that in a couple of countries, the first generation immigrant students have a significantly smaller number of books at home than the native students. And I also find that the number of books at home is a good predictor of mathematics achievement for native students as well as for first and second generation immigrant students.

Students' attitudes

After having looked at the students' background through various perspectives as age, sex and SES background, the next thing to look at are some of the students' attitudes. As described in the corresponding part of chapter two that dealt with the students' attitudes, students' attitudes are considered as influencing students' achievement as well as being influenced by the students' achievement. But as elaborated in chapter two positive attitudes are also considered as a positive outcome of the students in itself. The next analysis will investigate the attitudes towards the school, the subject mathematics and the students' self-efficacy in mathematics. I want to see if there are differences in these attitudinal scales between native students and first and second generation immigrant students.

Students' attitudes to school

The first focus is on the students' attitude towards the school in general. In TIMSS 2007, grade eight students are asked the following question:

How much do you agree with these statements about your school?

*Fill in **one** circle for each line*

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
a) I like being in school	①	②	③	④

(Source: page 223 in Foy and Olson, 2009)

Table 4.2.11 shows the percentages of students who answered that they agree a lot or agree a little to this question for each of the immigrant groups together with an indicator whether the percentage id statistically significant different for the immigrant groups than for the native students.

As can be seen from the table, there is higher percentage for the first generation immigrants than for the native students that like being in school in the Canadian provinces, Qatar, Bask, Sweden and Dubai. For Armenia, Botswana, Georgia, Ghana, Hong Kong, Jordan, Lebanon, Malaysia, Oman, Syria, and Tunisia this percentage is smaller for the first generation immigrants than for the native students. So overall, there are more countries where the attitudes towards the school among first generation immigrant students are less positive than for the naïve students.

For the second generation immigrant students this is quite different. Countries where the percentage of students with positive attitudes towards the school is statistically significant higher for the second generation immigrant students than for native students are Australia, British Colombia, Quebec, England, Korea, Mongolia, Qatar, Scotland, Sweden, Dubai and the United States compared to Armenia, Botswana, Iran, Jordan and Ukraine with the opposite effect. Interestingly the attitudes towards school are more positive among second generation immigrants than natives and first generation immigrants.

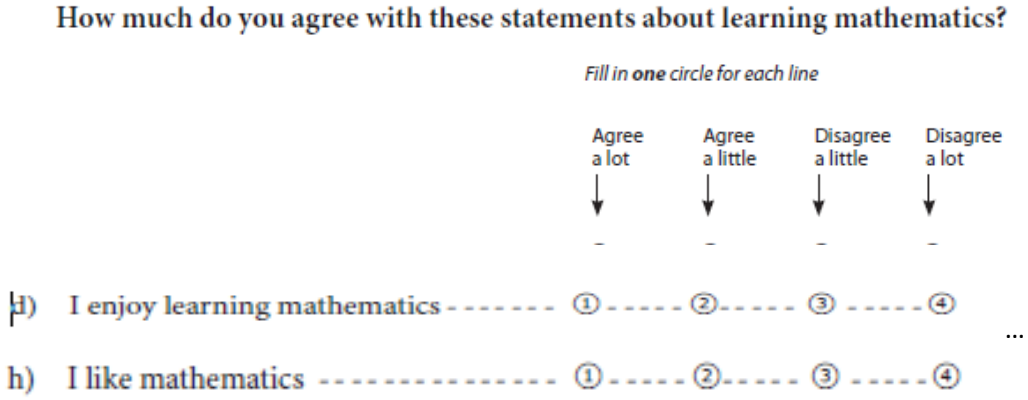
Especially interesting cases are British Columbia, Quebec and Dubai where for both immigrant groups the percentage of students with positive attitudes towards school are more than ten percent above the percentage for native students. Another very interesting case is the Basque region of Spain where 40 percent of the second generation immigrant students have positive attitudes towards school, 50 percent of the native students and 72 percent of the first generation immigrant students.

For the interpretation of these results we need to be careful and must consider that the students come from different cultural backgrounds which might influence their response pattern. But overall we can say that for the big majority of educational systems there is no difference in terms of attitudes towards school between the immigrant students and the native students. However, I can observe some countries where there are significant differences – in some cases in favor of native students in others for immigrant students. The results for some of the countries should be evaluated further to understand why these differences emerged.

Table 4.2.11: Percentage of students liking to go to school by immigration background								
Country	first generation immigrant			native		second generation immigrant		
	perc.	SE	sign	perc.	SE	perc.	SE	sign
Spain (Basque Country)	72	4,4	↑	50	1,9	40	5,3	
United Arab Emirates (Dubai)	87	1,1	↑	73	2,0	83	1,6	↑
Canada (British Columbia)	83	1,6	↑	71	1,4	82	1,3	↑
United States (Minnesota)	88	4,0	↑	76	1,7	80	2,6	
Canada (Quebec)	73	2,5	↑	63	1,5	76	2,4	↑
Canada (Ontario)	81	2,5	↑	72	1,8	75	1,6	
Czech Republic	63	4,9		56	1,2	58	3,7	
Qatar	78	1,0	↑	72	0,8	79	1,0	↑
Sweden	72	2,7	↑	66	1,1	71	1,9	↑
Korea, Republic of	76	8,9		71	0,9	100	0,0	↑
Ukraine	91	2,0		87	0,9	81	1,4	↓
England	76	2,8		73	1,3	79	1,8	↑
Cyprus	65	2,3		62	1,0	62	2,5	
Australia	75	2,2		73	1,2	77	1,7	↑
United States	74	1,8		72	0,9	75	1,4	↑
Bahrain	78	2,1		76	0,9	80	1,9	
Italy	66	3,9		65	1,2	62	3,2	
Lithuania	70	3,7		68	1,1	67	3,4	
Bulgaria	75	3,6		74	1,1	64	6,1	
Russian Federation	81	2,6		80	1,3	78	2,4	
Iran, Islamic Republic of	92	4,6		92	0,6	80	5,7	↓
Singapore	86	1,5		86	0,8	85	1,4	
Egypt	95	0,6		95	0,4	93	1,5	
Romania	87	3,2		87	0,7	76	10,3	
El Salvador	96	1,4		96	0,4	96	1,7	
Saudi Arabia	82	2,4		82	1,3	86	1,9	
Mongolia	92	1,0		93	0,6	96	0,9	↑
Indonesia	97	0,7		98	0,3	95	3,1	
Norway	74	2,6		75	1,1	77	1,9	
Colombia	94	3,2		96	0,4	95	2,2	
Bosnia and Herzegovina	76	1,8		78	1,2	78	3,5	
Israel	71	2,3		74	1,4	70	2,2	
Serbia	63	3,7		65	1,8	62	2,3	
Morocco	95	1,7		98	0,5	98	1,0	
Kuwait	73	2,2		75	1,0	77	1,9	
United States (Massachusetts)	67	4,2		70	1,9	72	2,7	
Malta	57	2,7		60	0,8	59	2,1	
Syria, Arab Republic of	94	0,8	↓	97	0,3	95	1,4	
Scotland	65	3,6		69	0,8	75	3,1	↑
Palestinian National Authority	86	1,7		90	1,1	90	2,1	
Oman	90	1,4	↓	94	0,5	95	1,2	
Japan	71	7,7		76	0,9	71	7,6	
Slovenia	46	4,6		50	1,2	54	2,5	
Thailand	86	7,0		91	0,5	86	3,4	
Lebanon	82	1,6	↓	87	1,1	82	3,0	
Ghana	93	1,1	↓	99	0,3	96	1,7	
Jordan	86	1,8	↓	92	0,9	88	1,3	↓
Georgia	89	2,5	↓	95	0,5	92	3,4	
Chinese Taipei	60	3,2		66	1,1	64	6,3	
Armenia	81	3,0	↓	88	0,8	79	3,1	↓
Malaysia	82	2,5	↓	89	0,7	92	1,8	
Turkey	89	5,3		96	0,3	93	2,6	
Tunisia	84	3,5	↓	91	0,6	86	2,9	
Hong Kong, SAR	67	2,0	↓	75	1,5	73	1,6	
Hungary	58	6,9		66	1,3	71	6,2	
Botswana	83	2,6	↓	96	0,3	88	1,5	↓

Students' attitude towards mathematics

Next I want to examine the attitudes towards mathematics. The TIMSS student questionnaire includes a question on agreement with several statements about learning mathematics. One of them is if they enjoy learning mathematics, another one is about liking mathematics.



(Source: page 207 in Foy and Olson, 2009)

Table 4.2.12 shows the percentages of students who agree or strongly agree to "I enjoy learning mathematics" by immigrant status. As for the statement "I like being in school" examined earlier, also here I cannot find a clear pattern. The average for all three groups across all participating countries is 65 percent. But again I can find countries where the results for immigrant students and native students clearly differ. Interestingly the pattern is very similar to the one about liking to go to school. Again, in the Canadian provinces the students from both immigrant groups have more positive attitudes than the native students. And again, it is the same for, Qatar, Bask, Sweden and Dubai. Also there are more countries with statistically significant lower percentages in the first generation immigrant group than positive compared to the native students. For the second generation immigrants the number with statistically significant higher percentages of students who like mathematics is the same as the opposite compared to the native students. Also here, it is a very similar set of countries.

An interesting case here is Cyprus where both immigrant groups have nine respectively eleven percent less students in the groups of students who like mathematics which did not show up in the attitude towards the school in general.

Overall I can conclude that the students' attitude towards mathematics is the same for native students and for immigrant students. I find countries where the attitudes of the immigrant students towards mathematics are more positive and I find countries where the attitudes of the native students in more positive. Again, I find the Canadian provinces and Singapore among the countries with more positive outcome – this time with respect to the students' attitudes – for the first generation immigrant students.

Table 4.2.12: Percentages of students who strongly agree or agree to enjoy learnig mathematics								
	first generation immigrant			native		second generation immigrant		
Country	Perc.	SE		Perc.	SE	Perc.	SE	
United Arab Emirates (Dubai)	76	1,4	↑	61	2,0	75	1,8	↑
Canada (Ontario)	75	2,7	↑	62	2,1	68	2,0	↑
Canada (British Columbia)	63	2,6	↑	52	1,6	57	1,6	↑
Spain (Basque Country)	59	4,5	↑	48	1,7	43	5,3	
England	68	3,4	↑	58	1,6	67	2,8	↑
Australia	63	2,8	↑	53	1,3	56	2,2	
Czech Republic	45	5,5		37	1,1	37	3,4	
Sweden	69	2,8	↑	61	1,2	68	2,0	↑
United States (Minnesota)	68	4,7		61	2,6	69	3,4	
Singapore	82	2,0	↑	75	0,9	72	1,8	
United States	65	1,6	↑	59	1,0	60	1,5	
Qatar	76	1,1	↑	70	0,8	77	0,9	↑
Norway	65	3,6		60	1,0	65	2,0	↑
Saudi Arabia	78	1,7	↑	73	1,5	75	2,2	
Canada (Quebec)	62	3,4		57	1,9	65	2,8	↑
Ukraine	64	3,7		60	1,6	57	2,3	
Kuwait	76	1,9		73	1,1	79	1,7	↑
Bahrain	80	2,0		78	0,9	76	2,1	
Scotland	59	3,0		56	1,2	60	3,6	
Russian Federation	59	4,2		57	1,2	54	2,7	
Slovenia	30	3,3		29	1,2	32	2,0	
Morocco	94	1,4		94	0,5	96	1,9	
Italy	57	3,5		58	1,2	53	3,5	
Hong Kong, SAR	61	2,3		62	1,6	60	1,5	
Colombia	89	3,1		90	0,7	82	3,7	↓
Japan	39	9,1		40	1,2	39	5,9	
Indonesia	86	1,5		87	0,8	85	5,5	
Serbia	31	4,4		33	1,4	30	1,8	
Korea, Republic of	37	10,5		39	0,9	9	10,0	↓
Turkey	85	4,6		87	0,9	89	3,4	
Jordan	84	2,0		86	1,1	84	1,7	
Hungary	40	5,5		42	1,5	45	5,4	
Oman	88	1,4		90	0,6	89	1,8	
Bosnia and Herzegovina	36	2,1		39	1,2	43	4,2	
El Salvador	82	2,9		85	0,9	86	3,3	
Ghana	84	1,6	↓	87	0,9	79	2,9	↓
Egypt	88	1,2	↓	92	0,6	88	3,2	
Romania	53	4,2		58	1,5	55	11,1	
United States (Massachusetts)	54	4,1		59	2,2	67	3,4	↑
Palestinian National Authority	70	1,9	↓	75	1,4	73	2,7	
Lebanon	72	2,5	↓	78	1,1	78	3,7	
Lithuania	47	4,9		53	1,3	55	3,8	
Mongolia	80	1,8	↓	86	1,0	79	2,5	↓
Bulgaria	53	5,4		60	1,4	42	5,8	↓
Malaysia	72	2,2	↓	79	1,0	80	3,3	
Syria, Arab Republic of	80	1,4	↓	87	0,8	79	3,1	↓
Israel	56	3,6	↓	64	1,3	60	2,5	
Malta	49	2,9	↓	58	0,9	52	2,1	↓
Georgia	61	5,9		69	1,5	70	4,3	
Tunisia	80	3,1	↓	89	0,6	88	2,5	
Cyprus	45	2,7	↓	54	1,1	47	2,5	↓
Chinese Taipei	35	3,1	↓	45	1,3	50	6,3	
Armenia	54	2,6	↓	66	1,4	64	3,8	
Thailand	67	8,2		81	0,9	76	4,1	
Botswana	70	3,7	↓	86	0,8	75	2,3	↓
Iran, Islamic Republic of	52	11,0	↓	82	0,9	65	5,2	↓

If I now look at the percentages of students who indicated that like mathematics by immigration status and also by sex some interesting results emerge. Table 4.2.13 shows the percentages of boys and girls by immigration status who agreed or strongly agreed that they like mathematics. Also an indicator for each of the three student groups is included that displays if the differences between the boys and the girls are significant within the group. Although the average of students who like mathematics across all countries is about the same for boys and girls and for all immigration status of about 64 percent with a small advantage towards the boys, some countries show very diverse results for the different immigration groups.

For example in Bulgaria the percentage of boys and girls among the native students is almost the same with 60 and 61 percent respectively. But 47 percent of the first immigrant girls like mathematics but 59 percent of the boys answered that they like mathematics. For the second generation immigrants in Bulgaria the pattern is clearly opposite and whereas 57 percent of the second generation immigrant girls reported to like math only 33 percent of the boys answered this way.

On the other hand I find exactly the opposite pattern in Georgia where the girls' attitudes are more positive among the first generation immigrants and the boys' attitudes towards mathematics more positive among the second generation immigrants. The same is true for Iran and the Russian Federation. More positive attitudes among girls in both immigration groups can be found in Japan and Romania. In Japan, one of the highest scoring countries in TIMSS, the positive attitudes towards mathematics are less prevalent as it is in general the case in high achieving countries.[7] The general negative association between achievement and students attitudes on country level is discussed for example in (Shen & Tam, 2008).

I conclude that the students' attitudes towards enjoy learning and liking mathematics are in general similar between native students and immigrant students. Also between boys and girls overall the percentage of boys and girls who like mathematics is similar for native students and for first and second generation immigrant students. On individual country level I do find countries where the attitudes towards mathematics are more positive for native students or immigrant students or for immigrant boys or native girls. But considering students' attitudes towards mathematics as an outcome, I do not find any disadvantage of immigrant students – also not with respect to sex. Thus I cannot confirm the negative findings for girls' attitudes in previous research (see (Mata et al., 2012; Meece et al., 2006) for any of the students' groups.

[7] But as a caveat, I have to admit that the statistics for Japan are not very reliable for the immigrant students because of the low number of immigrants in the sample.

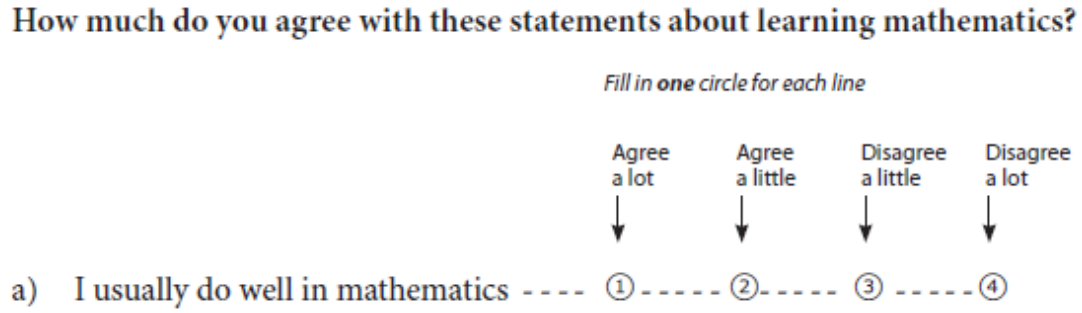
Table 4.2.13: Percentage of boys and girls who like mathematics by immigrantion status

Country	first generation immigrant					native					second generation immigrant				
	BOY			GIRL		BOY			GIRL		BOY			GIRL	
	Perc.	SE		Perc.	SE	Perc.	SE		Perc.	SE	Perc.	SE		Perc.	SE
Qatar	73	1,6		70	1,7	72	1,0	↑	54	1,2	77	1,6	↑	68	1,4
Chinese Taipei	37	4,4		29	5,0	52	1,6	↑	36	1,5	51	7,8		37	8,0
England	67	5,1		63	5,7	62	1,7	↑	50	2,0	67	3,7		58	3,7
Hong Kong, SAR	62	3,4	↑	49	2,2	63	2,0	↑	52	2,3	62	2,1	↑	52	2,4
Japan	18	8,4	↓	52	13,5	42	1,2	↑	32	1,4	28	8,8		41	11,0
Kuwait	71	2,6		72	3,2	75	1,3	↑	66	1,7	77	3,5		74	2,9
Korea, Republic of	62	10,0		30	14,2	46	1,2	↑	38	1,4	-	-		-	-
Saudi Arabia	70	3,0		67	3,5	70	2,2	↑	62	2,2	80	2,8	↑	62	3,3
Italy	44	4,5	↑	30	4,0	42	1,5	↑	35	1,6	35	4,1		38	5,4
Palestinian National Authority	69	2,6		66	2,8	74	2,2	↑	68	1,9	69	5,2		68	4,7
United Arab Emirates (Dubai)	74	2,1		70	3,1	58	4,1		52	3,0	76	3,9		67	2,5
Australia	57	3,5		55	4,2	53	2,0		47	2,5	57	2,8	↑	48	3,0
El Salvador	82	4,0		75	5,3	86	1,0	↑	81	1,2	78	5,7		80	6,2
Canada (Ontario)	79	3,0		73	3,8	66	2,2		61	2,6	69	3,0		63	2,6
Lebanon	77	2,8	↑	68	3,1	81	1,6	↑	77	1,4	80	4,5		73	6,1
Ghana	85	2,1		80	2,2	89	1,2	↑	85	1,3	91	3,0	↑	75	5,0
Egypt	87	1,2		87	1,6	92	0,8	↑	88	1,1	91	3,0		88	3,8
Georgia	71	7,2		83	4,8	75	1,7		71	2,6	92	2,8	↑	44	10,5
United States (Minnesota)	71	4,3		74	5,2	63	2,6		60	3,4	68	6,1		64	5,3
Tunisia	72	4,7		79	5,8	80	1,1		77	1,4	77	4,8		73	6,2
Morocco	88	3,9		88	3,6	89	0,9	↑	86	1,1	86	4,3		84	4,1
Colombia	75	4,5		64	12,2	80	1,2		77	1,5	83	4,0	↑	67	6,5
Indonesia	83	1,9		84	1,8	86	1,1		83	1,3	82	7,6		69	9,6
United States	62	2,6		61	2,7	61	1,0		58	1,3	59	2,5		54	2,0
Scotland	55	4,8		57	4,5	54	1,3		51	1,6	58	4,9		50	4,3
Syria, Arab Republic of	77	2,1		76	2,7	83	1,1		81	1,3	76	4,4		68	4,4
Canada (British Columbia)	63	2,9		57	3,5	51	2,0		48	1,8	60	2,4		56	2,3
Malta	51	4,2		53	4,3	54	1,1		52	1,1	54	3,0		50	2,6
Hungary	39	10,9		40	6,9	44	1,6		42	1,8	40	6,6		45	8,6
Spain (Basque Country)	60	5,6		55	6,1	55	1,9		54	2,2	48	7,8		50	7,1
Mongolia	82	2,5		83	2,2	86	1,1		85	1,2	76	3,5		79	3,0
Canada (Quebec)	63	4,9		64	4,5	54	2,0		53	1,9	67	3,7		61	2,9
Sweden	61	4,5		49	4,3	44	1,7		43	1,5	52	3,1		46	2,9
United States (Massachusetts)	49	7,6	↓	69	4,0	62	2,4		61	2,1	69	4,0		65	3,4
Cyprus	52	3,7		52	3,5	63	1,1		63	1,3	54	3,6		55	3,9
Iran, Islamic Republic of	54	16,5		86	11,2	77	1,6		77	1,6	81	6,1		66	10,2
Bahrain	71	2,4		76	3,2	70	1,2		70	1,6	73	4,0		70	2,0
Slovenia	34	4,7		39	5,5	37	1,8		37	1,7	40	3,7		40	3,3
Norway	57	5,4		54	4,7	49	1,4		49	1,6	53	3,3		49	3,7
Botswana	82	4,5		80	4,5	86	1,2		87	0,9	78	2,7		82	3,2
Thailand	63	16,1		54	12,2	75	1,5		76	1,2	69	5,4		70	6,7
Bulgaria	59	4,9		47	6,6	60	1,5		61	1,8	33	8,2	↓	57	8,0
Jordan	77	3,5		77	3,7	82	2,2		83	1,6	84	1,8		84	2,5
Turkey	84	5,9		76	8,9	80	1,0		81	1,3	78	6,0		80	6,8
Singapore	81	2,2		80	2,7	71	1,3		73	1,4	71	2,5		69	2,8
Oman	85	1,4		89	2,0	88	1,2		90	0,8	85	2,8		91	2,1
Armenia	52	3,5		55	4,2	66	1,8		68	1,8	61	5,9		63	7,0
Bosnia and Herzegovina	46	2,6		51	2,5	51	1,8		54	1,9	43	6,1		52	6,3
Malaysia	77	3,9		74	4,1	77	1,0		80	1,1	75	4,9		79	4,3
Romania	44	7,2	↓	69	7,3	58	1,7		61	1,7	47	14,5		58	10,8
Israel	53	3,6		59	3,3	61	1,8		64	2,2	62	2,7		59	3,0
Czech Republic	39	6,7		57	7,7	41	1,7	↓	46	1,5	42	4,8		46	4,6
Lithuania	47	6,1		40	9,3	54	1,7	↓	59	1,7	58	5,7		58	3,5
Serbia	40	5,7		41	5,5	42	2,1		47	2,4	40	3,2		45	3,4
Ukraine	73	4,6		73	5,1	65	1,6	↓	71	1,9	64	2,6		66	3,2
Russian Federation	66	3,9		76	4,3	62	1,5	↓	70	1,5	65	3,8		59	4,0

Students' attitudes – self-efficacy

Previous research has shown that the students' self-rating regarding their abilities is in most cases quite accurate and matches the results from standardized test. Also in chapter two I discussed the importance of students' self-efficacy and its bi-directional connection to students' achievement.

Also the TIMSS student questionnaire has a question about the students' self-rating of their mathematics abilities. The following question addresses this topic:



(Source: page 207 in Foy and Olson, 2009)

As also for the other students' attitudes scales the percentages of students agreeing or strongly agreeing are tabulated.

Table 4.2.14 shows the percentage of the students agreeing or strongly agreeing to usually doing well in mathematics. Statistical significant differences of the percentages for the first and second generation immigrant students compared to the native students are indicated. The countries are ordered by the differences between native students and first generation immigrant students with the more positive results for the first generation immigrant students listed first.

I find three countries with statistically significant a higher percentage of first generation immigrant students agreeing or strongly agreeing to doing well in mathematics compared to the native students in their country. These three countries are Korea, Singapore and the Canadian province of British Columbia. As stated above, Korea has very few immigrant students and the statistics are not reliable. For Singapore and British Columbia the results will be discussed below in chapter five more in-depth. Especially for British Columbia the results are remarkable – as we will see in chapter five – because of the high percentage of Asian immigrants which are known for a lower self-rating (see for example (Shen & Tam, 2008)). On the other hand, I find 11 countries with a statistical significant lower percentage of students who agree or strongly agree to doing well in mathematics among the first generation immigrant students compared to the native students. If I calculate the percentage of students who agree or strongly agree to doing well in mathematics I find 76 percent for the native students but only 74 percent for the first generation immigrant students.

Table 4.2.14: Percentages of students agreeing or strongly agreeing to doing well in mathematics by immigration status								
Country	first generation immigrant			native		second generation immigrant		
	Perc.	SE		Perc.	SE	Perc.	SE	
Korea, Republic of	65	9,5	↑	44	1,0	12	10,5	↓
Singapore	81	2,1	↑	65	1,1	66	1,5	
Armenia	63	3,5		56	1,2	57	3,8	
Canada (British Columbia)	83	2,2	↑	77	1,2	82	1,4	↑
Malaysia	49	3,1		45	1,6	43	5,4	
Colombia	84	2,6		80	1,1	77	4,2	
Indonesia	86	1,7		83	1,0	77	6,5	
Czech Republic	67	4,2		63	1,0	63	3,1	
Turkey	81	4,6		78	1,0	81	4,2	
Canada (Ontario)	87	1,4		85	1,4	83	1,5	
Australia	84	2,0		81	1,2	81	1,5	
England	89	2,4		88	0,8	91	1,5	
Qatar	90	0,8		90	0,5	91	0,7	
Jordan	91	1,4		91	0,9	91	1,2	
Mongolia	77	2,1		77	1,3	71	2,7	↓
United Arab Emirates (Dubai)	83	1,2		84	1,6	82	1,9	
Botswana	75	3,4		75	1,1	70	2,6	
Oman	90	1,3		91	0,6	92	1,3	
Morocco	87	2,8		88	0,7	88	3,5	
Lebanon	86	2,4		86	1,0	83	3,1	
Syria, Arab Republic of	87	1,2		89	0,7	91	1,8	
Sweden	83	2,4		84	0,8	81	1,7	
Bahrain	87	1,9		88	0,7	82	1,9	↓
Bosnia and Herzegovina	62	1,8		63	1,3	61	4,3	
Ukraine	65	3,9		67	1,6	67	2,7	
Canada (Quebec)	71	2,6		74	1,2	71	2,3	
El Salvador	82	3,2		84	1,0	85	3,4	
Ghana	88	1,2		90	0,9	87	2,5	
Saudi Arabia	89	1,4		91	0,7	91	1,4	
Norway	79	2,6		82	0,7	77	2,1	↓
Scotland	86	2,4		89	0,7	86	3,4	
Hong Kong, SAR	56	2,0		59	1,7	56	1,6	
Kuwait	86	2,0		89	0,7	89	1,4	
Egypt	90	0,7	↓	94	0,6	93	1,7	
Russian Federation	57	4,5		61	1,3	62	2,3	
Bulgaria	68	3,8		72	1,3	53	6,0	↓
Thailand	78	8,0		82	0,8	84	3,9	
Tunisia	83	3,2		87	0,8	89	2,6	
Malta	65	2,7		69	0,7	62	2,3	↓
Israel	81	2,5		86	1,0	86	1,3	
Palestinian National Authority	85	1,5	↓	90	0,7	88	1,9	
United States (Massachusetts)	81	3,1		87	1,2	82	2,6	
United States	79	1,9	↓	85	0,7	80	1,2	↓
Hungary	65	5,0		71	1,1	72	4,4	
Japan	17	7,0		25	1,0	25	6,0	
United States (Minnesota)	77	4,8		85	1,1	81	4,9	
Serbia	54	4,8		63	1,5	65	2,1	
Italy	62	3,7	↓	70	1,0	66	3,1	
Georgia	68	5,4		78	1,2	71	4,6	
Lithuania	54	4,1	↓	65	1,0	66	3,0	
Spain (Basque Country)	63	4,6	↓	73	1,4	66	5,9	
Chinese Taipei	43	3,1	↓	54	1,2	59	5,6	
Cyprus	67	2,3	↓	80	0,9	74	2,0	↓
Slovenia	62	3,5	↓	75	1,0	69	2,2	↓
Romania	53	6,7	↓	70	1,3	62	13,1	
Iran, Islamic Republic of	49	7,3	↓	77	1,2	71	5,5	

For the second generation immigrant students I find nine countries with a statistical significant lower percentage of students who agree or strongly agree to doing well in mathematics among the second generation immigrant students compared to the native students but none with a statistical significant higher percentage. As for the first generation immigrant students, the average percentage of students agreeing or strongly agreeing to doing well in mathematics is 74 percent – compared to 76 percent for the native students.

An interesting aspect is to investigate how the differences in self-rating of the mathematics abilities match the actual differences in mathematics achievement in TIMSS 2007. Table 4.2.15 shows the mathematics achievement results for the native students in TIMSS 2007 and the differences for the first and second generation immigrant students compared to the achievement of the native students. Statistically significant differences are indicated. Moreover, I find the percentage of students agreeing or strongly agreeing to doing well in mathematics for the native students and the differences for the first and second generation immigrant students compared to the percentage of the native students. Again, statistical significant differences are indicated.

What we can conclude from table 4.2.15 is for example that in Dubai where the second generation immigrants are scoring 65 points higher in mathematics than the native students and the first generation immigrants even 91 score points higher in mathematics than the native students, 84 percent of the native students answered that they are doing well in mathematics and a slightly – not statistical significant – percentage of the first and second generation immigrant students answered that they are doing well in mathematics. Also in Ontario the higher mathematics achievement of the first generation immigrant students is not reflected in a higher self-esteem of the students compared to the native students. And in Qatar and in Saudi Arabia the higher mathematics achievement of the second generation immigrant students is not reflected in a higher self-esteem of the students compared to the native students. Based on these results, one might hypothesize that there is a cultural effect in some of the Gulf States that the self-esteem of immigrant students is –compared to their- achievement – lower than for native students in these countries.

In Singapore and British Columbia on the other hand the higher achievement of the immigrant populations are reflected in a higher self-esteem.

In general I observe in some countries a lower self-esteem and also a lower mathematics achievement for immigrant students. I see that in some of the countries with more positive outcome of immigrant students also the self-esteem of the immigrant students is higher – but interestingly not in all. Especially in the Gulf stated the native students seem to have a higher self-esteem compared to immigrant students which does not match the achievement results.

Table 4.2.15: Mathematics achievement and students reporting doing well in mathematics for native students and the differences for immigrant students

	native		difference of immigrants				natives doing well in math		differences for immigrants			
Country	**Math Ach**	**SE**	**1st gen**		**2nd gen**		**Perc.**	**SE**	**1st gen**		**2nd gen**	
United Arab Emirates (Dubai)	397	5,7	91	↑	65	↑	84	1,6	-0,4		-1,5	
Korea, Republic of	598	2,7	36		-66		44	1,0	21,8	↑	-31,3	↓
Canada (British Columbia)	499	2,7	35	↑	18	↑	77	1,2	6,3	↑	5,4	↑
Singapore	588	3,9	34	↑	9		65	1,1	15,2	↑	0,6	
Canada (Ontario)	512	4,5	22	↑	9		85	1,4	2,4		-1,5	
Armenia	498	2,9	9		5		56	1,2	7,2		0,7	
Australia	496	3,8	1		4		81	1,2	2,3		-0,7	
Bosnia and Herzegovina	457	2,9	-4		5		63	1,3	-1,5		-2,4	
Qatar	305	2,1	-9	↓	26	↑	90	0,5	0,2		1,0	
Russian Federation	515	3,9	-15		-12		61	1,3	-3,7		1,0	
Tunisia	423	2,5	-17	↓	-29	↓	87	0,8	-4,1		1,4	
Canada (Quebec)	531	3,2	-17		-1		74	1,2	-2,3		-2,4	
Czech Republic	505	2,5	-19	↓	-14	↓	63	1,0	3,4		-0,2	
England	515	5,1	-20		13		88	0,8	1,3		3,1	
Botswana	369	2,3	-22	↓	-28	↓	75	1,1	-0,4		-5,1	
Hong Kong, SAR	579	5,9	-26	↓	4		59	1,7	-3,4		-3,0	
Bahrain	403	1,9	-26	↓	3		88	0,7	-1,3		-6,0	↓
Israel	469	4,1	-27	↓	11		86	1,0	-4,9		-0,6	
Iran, Islamic Republic of	405	4,1	-29		-38	↓	77	1,2	-28,5	↓	-6,9	
Norway	474	2,2	-29	↓	-12	↓	82	0,7	-2,9		-5,1	↓
Turkey	434	4,8	-29		-30		78	1,0	2,8		3,0	
Italy	481	3,2	-30	↓	-1		70	1,0	-8,6	↓	-4,2	
Serbia	488	3,5	-31	↓	8		63	1,5	-8,2		2,5	
Kuwait	362	2,7	-33	↓	2		89	0,7	-3,6		-0,2	
Japan	571	2,4	-34		-10		25	1,0	-7,8		-0,2	
Lebanon	459	4,0	-36	↓	-6		86	1,0	-0,7		-3,2	
Saudi Arabia	335	3,0	-37	↓	16	↑	91	0,7	-2,5		-0,8	
Scotland	491	3,6	-41	↓	8		89	0,7	-3,4		-3,6	
Sweden	499	2,2	-41	↓	-16	↓	84	0,8	-1,1		-2,9	
Cyprus	472	1,7	-44	↓	-6		80	0,9	-13,4	↓	-6,6	↓
Syria, Arab Republic of	409	3,4	-45	↓	-23	↓	89	0,7	-1,1		2,4	
Jordan	430	4,7	-45	↓	21	↑	91	0,9	0,1		0,3	
Georgia	418	6,0	-47	↓	-55	↓	78	1,2	-10,1		-6,9	
El Salvador	344	2,9	-47	↓	-3		84	1,0	-2,3		1,1	
United States	517	2,8	-49	↓	-19	↓	85	0,7	-6,1	↓	-5,0	↓
Malaysia	479	5,0	-50	↓	-27	↓	45	1,6	4,6		-1,3	
Palestinian National Authority	380	3,5	-51	↓	-12		90	0,7	-5,5	↓	-1,9	
United States (Minnesota)	539	4,1	-53	↓	-24	↓	85	1,1	-7,8		-4,0	
Spain (Basque Country)	505	2,8	-57	↓	-13		73	1,4	-10,7	↓	-7,1	
Indonesia	409	3,7	-58	↓	-61	↓	83	1,0	3,7		-5,7	
Hungary	519	3,3	-58	↓	4		71	1,1	-6,7		1,0	
Mongolia	448	3,8	-58	↓	-52	↓	77	1,3	-0,1		-6,3	↓
Ghana	324	4,3	-60	↓	-24	↓	90	0,9	-2,5		-3,6	
United States (Massachusetts)	558	4,0	-61	↓	-25	↓	87	1,2	-6,0		-4,6	
Slovenia	509	2,3	-61	↓	-21	↓	75	1,0	-13,6	↓	-6,3	↓
Thailand	443	4,9	-62	↓	-28		82	0,8	-4,0		1,6	
Malta	494	1,5	-62	↓	-2		69	0,7	-4,4		-6,8	↓
Lithuania	510	2,3	-64	↓	-1		65	1,0	-10,7	↓	1,2	
Bulgaria	473	4,8	-65	↓	-10		72	1,3	-4,0		-19,5	↓
Morocco	388	2,9	-65	↓	-28	↓	88	0,7	-0,6		0,4	
Colombia	385	3,5	-67	↓	-41	↓	80	1,1	3,8		-3,6	
Ukraine	466	3,6	-69	↓	12	↑	67	1,6	-2,0		0,1	
Oman	387	3,4	-70	↓	-20	↓	91	0,6	-0,6		1,5	
Egypt	427	3,3	-76	↓	-67	↓	94	0,6	-3,6	↓	-0,8	
Romania	466	4,1	-85	↓	-94	↓	70	1,3	-16,8	↓	-7,4	
Chinese Taipei	606	4,3	-111	↓	-15		54	1,2	-11,0	↓	5,7	

Summary

In this chapter I focused on the TIMSS 2007 data and the student level data. I aimed to find answers to the aspects of research question 3 that asked about differences between immigrant and native students with respect to their demographical background.

In this chapter I found that in more than half of the countries the first generation immigrant students are statistically significant older than their native peers. The same holds true for the second generation immigrant students in more than 20 percent of the countries. I could not come to a clear conclusion regarding the age when students migrated and the relation to their mathematics achievement although I found that in 19 countries the mathematics achievement of the immigrants declined with age when migrating to the country

I also looked at the sex of the students and relations to enrollment and achievement. With respect to the enrollment I found in the majority of countries fewer girls than boys enrolled in schools. With respect to the achievement I found that the first generation immigrant boys are lagging behind in mathematics more often and to a greater extent than the first generation immigrant girls. For the second generation immigrant boys and girls I found the same tendency although less dominant.

When I looked at the language spoken at home I found many countries with more students who do not speak the language of instruction at home among the immigrant students than among the native students. Bu the effect of not speaking the language of instruction at home on the mathematics achievement is larger for native students than for first and second generation immigrant students.

I looked also at two indicators of the socio-economic status of the students. I did not find major differences in the parents' education between first and second generation immigrant students and native students. I even found that first generation immigrant students have better educated parents than native students in a couple of countries. The second indicator that I examined was the number of books at home. I found in several countries the first generation immigrant students having fewer books at home than native students. I also found the number of books at home being clearly related to the students' mathematics achievement for all groups of students.

Finally in this chapter I looked at students' attitudes towards school in general, the attitudes towards mathematics in particular and the students' self-esteem in mathematics. I found for most countries no differences in attitudes towards school between the immigrant students and native students. For some countries there were differences – sometimes more positive for immigrant students and sometimes more positive for native students.

Regarding the attitude towards mathematics I found the same result as for the attitudes towards school: For most countries there are no differences between native students and immigrant students but there are some countries where there are more positive attitudes towards mathematics among the native students and others with more positive attitudes towards mathematics among the immigrant students. When comparing boys' and girls' attitudes towards mathematics I couldn't find general patterns among any of the student groups (natives, first and second generation immigrants) showing a higher percentage of boys than girls who like mathematics. Although I found some differences between countries there was no general pattern.

For the self-esteem in mathematics I found - especially for the first generation immigrants - a number of countries with lower self-esteem in mathematics than for the native students. The difference in self-esteem follows in several countries the difference in mathematics achievement.

In summary, I conclude that immigrant students tend to be older than their native peers, having less affluent - although similar educated – parents, speaking the language of instruction less at home and having a lower self-esteem. First generation immigrant girls seem to be excluded from education in several countries but on the other hand achievement differences for immigrant students in schools can be seen more pronounced for boys.

Despite these general results I found some countries that have shown more positive results of immigrant students than others. Quite consistently I find Singapore and the Canadian provinces among the countries with positive outcomes for immigrant students.

Chapter 4C School Factors

After exploring some selected aspects of the students' background, I want to look if I find differences between schools attended by native students and by immigrant students. I want to look at differences between attending rural or urban schools, school attendance, and school resources, climate and safety.

Distribution of immigrants within countries

The countries' immigrant student populations are also not distributed equally within the countries. And for policy makers it makes a difference if students in more rural areas need special support or if students in urban areas need more support. The support in rural areas might be more difficulty than in the urban areas due to a less developed infrastructure in rural areas. Centers for special language courses might be less accessible. As discussed in the next paragraph, also achievement differences can be observed for the different community types.

In TIMSS the school principals were asked about the type of community that the school is located in. In TIMSS 2007 the response options were: "3,000 people or fewer", "3,001 to 15,000 people", "15,001 to 50,000 people", "50,001 to 100,000 people", "100,001 to 500,000 people", and "more than 500,000 people". To make the results easier to interpret the response options "3,001 to 15,000 people", "15,001 to 50,000 people", "50,001 to 100,000 people", and "100,001 to 500,000 people" were combined. This leaves the response options "3,000 people or fewer". "3,001 to 500,000 people", and "more than 500,000 people". The principal data was matched to the student data and the percentage of immigrant students in the different community types was calculated.

When calculating average over all countries for these three groups of communities, I see that the achievement is the lowest in the most rural areas, higher in the middle sized communities and the highest in the largest communities. Table 4.3.0 shows the mean achievement across all countries participating in TIMSS 2007.

Table 4.3.0: Mathematics Achievement in different types of communities

	500.000 and more		3001-500.000		less than 3000	
Country	math ach	SE	math ach	SE	math ach	SE
native students	480	2,4	461	0,6	439	1,6
1st gen immigrants	447	4,1	421	1,9	396	3,7
2nd gen immigrants	468	3,1	449	1,6	419	3,8

The following two tables 4.3.1 and 4.3.2 explain the distribution of first and second generation immigrant students within the countries in TIMSS 2007. In the tables it is also indicated if the percentage in the extreme categories differs from the percentage in the middle category.

Table 4.3.1: Percentage of first generation immigrant students in different community types

Country	500.000 and more			3001-500.000			less than 3000	
	percent	SE	sign	percent	SE	sign	percent	SE
Canada (Ontario)	29	2,8	↑	9	1,2	↑	5	0,9
Canada (British Columbia)	28	3,4	↑	14	1,6		9	3,3
Bosnia and Herzegovina	38	24,6		23	1,5		28	5,7
United Arab Emirates (Dubai)	58	1,4	↑	45	4,0	↑	15	6,9
United States (Minnesota)	18	7,8		7	2,0		4	1,3
Singapore	11	0,6						
Canada (Quebec)	14	1,9	↑	6	0,8	↑	2	0,9
United States (Massachusetts)	17	8,0		9	1,1		15	15,1
Australia	15	1,7	↑	9	1,0		5	2,1
Bahrain	20	2,0	↑	14	0,8	↑	11	1,4
Norway	10	1,2	↑	6	0,4		3	2,6
Czech Republic	7	2,8		2	0,4		2	0,5
United States	13	2,1		9	0,6	↑	4	1,0
Jordan	16	4,7		12	1,1		12	2,7
Ghana	21	3,0		17	1,7		18	2,7
Spain (Basque Country)	9	8,0		6	0,6			
England	11	2,6		7	0,7		6	1,1
Sweden	10	3,7		8	0,6		5	1,4
Cyprus	13	2,3		10	0,6		9	1,6
Ukraine	9	1,4		7	0,6		8	1,5
Malaysia	10	2,2		8	0,7		6	2,8
Scotland	8	2,8		6	0,7		6	2,6
Indonesia	17	2,3		15	1,4		25	13,3
Lithuania	6	0,9		4	0,4		6	1,2
Morocco	8	1,5		7	0,8		7	9,0
Saudi Arabia	18	2,0		17	1,8		13	2,5
Japan	2	0,4	↑	1	0,2			
Romania	4	1,4		3	0,5		5	1,2
Italy	6	1,4		5	0,4		4	1,7
El Salvador	6	1,4		5	0,6		7	1,2
Russian Federation	8	1,7		7	0,8		9	2,4
Korea, Republic of	1	0,2		0	0,1			
Serbia	7	1,3		7	0,6		7	2,0
Thailand	1	0,2		1	0,1		0	0,2
Turkey	2	0,4		1	0,3		1	0,9
Iran, Islamic Republic of	1	0,2		1	0,3		0	0,4
Chinese Taipei	6	0,8		6	0,5			
Hungary	2	1,0		3	0,4		4	1,6
Botswana	4	1,8		5	0,5		5	0,8
Israel	12	6,0		13	1,4		19	4,3
Kuwait	15	5,1		17	1,0		13	3,0
Slovenia	3	3,6		5	0,4		5	1,0
Georgia	4	0,7		6	1,0		5	1,2
Egypt	40	4,1		42	2,2		42	6,0
Colombia	3	0,6		6	0,8		6	1,1
Oman	12	4,3		15	1,6		16	1,9
Tunisia	2	1,3		5	0,4	↑	3	0,8
Syria, Arab Republic of	22	2,6		25	1,3		24	2,7
Lebanon	17	3,5		21	1,8		22	5,8
Bulgaria	6	1,5		10	1,0		15	2,1
Palestinian National Authority	17	3,1		21	1,3		23	5,1
Mongolia	9	2,3		13	1,0		22	3,1
Hong Kong, SAR	22	1,7		27	1,7			
Armenia	7	1,2		13	1,5		11	1,5
Malta				7	0,4		8	1,3
Qatar	18	2,0		26	0,7		29	1,6

Table 4.3.2: Percentage of SECOND generation immigrant students in different community types

Country	500.000 and more			3001-500.000			less than 3000	
	percent	SE	sign	percent	SE	sign	percent	SE
United States (Massachusetts)	40	18,3		17	1,6		10	9,9
Canada (British Columbia)	47	3,8	↑	25	1,3		19	3,8
Canada (Quebec)	30	4,2	↑	10	1,2		9	5,5
Singapore	19	0,5	↑					
Norway	25	3,6	↑	9	0,6			
England	26	4,1	↑	12	1,1		11	2,9
Sweden	29	3,0	↑	16	1,2	↑	7	2,4
Slovenia	28	11,4		16	1,1	↑	11	1,7
Bosnia and Herzegovina	16	13,8		5	0,5	↑	2	0,6
Canada (Ontario)	39	2,9	↑	28	2,3	↑	18	2,7
Serbia	27	3,8	↑	16	1,0		11	2,5
Ukraine	26	2,4	↑	17	1,0	↑	12	1,7
Australia	36	1,8	↑	28	1,4	↑	10	2,5
United States	25	3,8	↑	17	1,4	↑	7	1,6
Jordan	27	2,9		22	1,1	↑	12	3,4
Saudi Arabia	14	1,7	↑	10	1,2		8	1,1
Malaysia	8	1,8		4	0,5		11	5,8
Lithuania	9	1,9		6	0,5		6	1,1
Mongolia	13	3,0		11	0,9		8	1,7
United States (Minnesota)	12	4,1		9	1,1	↑	3	1,1
Lebanon	8	1,4		6	0,6		4	1,2
Georgia	6	1,5		4	0,8		4	0,9
Scotland	9	2,3		7	0,7		9	1,3
Czech Republic	9	2,0		7	0,5	↑	4	0,9
Turkey	3	0,7	↑	1	0,2		2	0,8
Indonesia	2	0,6	↑	1	0,2		5	0,4
Bulgaria	3	1,0		2	0,2		2	0,6
Japan	2	0,5	↑	1	0,2			
Colombia	3	0,6		2	0,4		2	0,6
Palestinian National Authority	8	1,5		8	0,6	↑	4	1,1
Thailand	2	0,7		2	0,4		1	0,6
Romania	1	0,6		0	0,1		1	0,5
Chinese Taipei	3	0,5		2	0,3			
Syria, Arab Republic of	6	0,8		6	0,5		6	1,1
Russian Federation	10	1,0		10	0,8		10	1,7
Iran, Islamic Republic of	2	0,6		2	0,4		2	0,7
Ghana	5	0,7		5	0,7		5	0,6
Hungary	3	1,1		3	0,5		4	0,8
Korea, Republic of	0	0,1		0	0,2			
El Salvador	3	1,1		3	0,4		3	0,8
Bahrain	13	1,5		13	0,7		11	1,2
Tunisia	3	0,8		4	0,3		4	1,1
Armenia	6	1,2		7	0,7	↑	4	0,9
Kuwait	13	3,5		14	0,9	↑	11	1,1
Morocco	5	1,0		6	0,7		9	8,1
Egypt	2	0,5		4	0,4		3	0,9
Botswana	9	2,7		10	0,7		11	1,2
Italy	6	1,3		7	0,6		6	1,9
Oman	8	3,2		10	0,8		8	1,4
Spain (Basque Country)	3	2,6		5	0,5		6	3,9
Israel	25	6,1		27	1,1	↑	5	2,6
Cyprus	7	3,2		10	0,5		9	2,8
Hong Kong, SAR	33	1,7		36	1,2			
Qatar	19	2,4		25	0,6		24	1,3
United Arab Emirates (Dubai)	28	1,1		37	4,6		38	3,7
Malta				12	0,6		12	1,4

I see that whereas in some countries there are more immigrant students in more rural areas but there are more countries where there are significantly more immigrant students in the more urban areas. In Australia, Bahrain, the three Canadian provinces British Columbia, Ontario and Quebec, Japan, Norway and Dubai there are statistically significant more first generation immigrant students in cities with more than 500,000 inhabitants than in mid-size areas of 3,001 to 500,000 inhabitants. In Bahrain, the Canadian provinces Ontario and Quebec, Korea, Tunisia, Dubai and the United States there are also statistically significant more first generation immigrant students in the mid-size communities of 3,001 to 500,000 inhabitants than in the rural communities with less than 3,000 inhabitants.

On the other hand there are Armenia, Bulgaria, Columbia, Hong Kong, Qatar, and Tunisia where are statistically significant more first generation immigrant students in the mid-size communities than in the large cities and Bulgaria and Mongolia with statistically significant more first generation immigrant students in the rural communities than in the mid-size communities. The most extreme case is Ontario where I find 29 percent of first generation immigrant students in cities with more than 500,000 inhabitants or more but only nine percent in areas with less than 500,000 inhabitants but more than 3,000 inhabitants and only five percent in areas with less than 3,000 inhabitants.

This might have an impact on policies addressing immigrant issues in the different countries. Whereas in more countries the first generation immigrant students are concentrated in the most urban areas – like Ontario - where for example language course can easier be organized in a country like Bulgaria this might be more difficulty and more resource intensive. But there are also effects when immigrant students cluster together in classes as discussed later in chapter 4.4.

For the second generation immigrant students the picture is somewhat more uniform. In fourteen countries there are statistically significant more students in the most urban areas compared to the mid-size communities and also fourteen countries where there is a statistically significant lower percentage of second generation immigrant students in the most rural areas than in the mid-size communities.

There are only two countries – Qatar and Dubai – where there is a statistically significant lower percentage of second generation immigrant students in the cities with more than 500,000 inhabitants than in the mid-size communities and only in Indonesia there is a statistically significant higher percentage of second generation immigrant students in the communities with less than 3,000 inhabitants than in the mid-size communities. The highest difference in the percentages can be seen for British Columbia where I find 47 percent of second generation immigrant students in cities with 500,000 inhabitants or more but only 25 percent in areas with less than 500,000 inhabitants but more than 3,000 inhabitants and only 19 percent in areas with less than 3,000 inhabitants.

But does the community size have an impact on the differences between native students and immigrant students? Next I calculated the difference of mathematics achievement between first and second generation immigrant students and their native peers in the three types of communities for each participating country.

Table 4.3.3: Mathematics Achievement differences between first generation immigrant students and native students in different types of communities

Country	500.000 and more			3001-500.000			less than 3000	
	Difference immi-native	SE	sign	Difference immi-native	SE	sign	Difference immi-native	SE
Korea, Republic of	59	23,0		-40	45,4			
Hungary	45	30,2	↑	-51	19,3		-83	45,0
Malta				-68	6,6		-34	17,3
Jordan	-4	18,5	↑	-62	11,1		-59	25,9
Chinese Taipei	-66	26,3		-121	10,6			
Bulgaria	-20	26,5		-64	11,9		-56	24,5
Israel	13	31,5		-32	10,0		-35	27,3
Slovenia	-20	15,1	↑	-60	9,0		-73	14,0
Thailand	-32	43,7		-71	36,6		-105	57,8
United States (Minnesota)	-28	11,0		-64	15,2		-22	24,2
Singapore	34	7,2						
England	8	28,2		-23	13,6		-28	73,1
Georgia	-21	22,8		-51	19,7		-46	29,7
Canada (Ontario)	27	9,9	↑	-2	10,7		2	19,6
Mongolia	-31	26,3		-60	7,9		-54	12,7
Serbia	-6	24,3		-35	10,7		-31	29,8
Italy	-8	18,1		-30	7,0		-66	37,4
Palestinian National Authority	-28	21,6		-49	8,3		-70	31,4
Ukraine	-48	18,5		-69	12,2		-86	14,5
Hong Kong, SAR	-7	13,3		-27	12,0			
Tunisia	2	16,6		-17	6,9		-4	18,5
Lithuania	-57	23,7		-72	9,3		-50	21,4
Norway	-18	14,9		-29	5,4		-34	43,8
United Arab Emirates (Dubai)	94	12,2		83	11,1	↑	-8	37,2
Sweden	-33	20,7		-43	7,4		-24	32,9
Lebanon	-24	32,0		-34	7,8		-53	15,8
Australia	0	15,5		-9	12,6		-23	16,5
United States (Massachusetts)	-56	91,1		-65	10,3		-10	9,1
Iran, Islamic Republic of	-29	36,7		-36	26,1		7	23,4
Indonesia	-51	23,1		-58	7,4		-39	22,3
Malaysia	-46	24,8		-52	10,4		-60	34,9
El Salvador	-36	35,1		-40	14,6		-53	16,1
United States	-51	17,2		-53	7,6		-62	36,7
Scotland	-39	34,6		-36	14,4		-67	13,0
Colombia	-69	15,4		-66	11,8		-39	27,9
Oman	-71	30,5		-67	9,3		-73	14,9
Bahrain	-30	10,6		-25	5,9		1	11,9
Morocco	-69	14,4		-64	10,1		-7	20,2
Canada (Quebec)	-27	16,9		-21	12,4		-43	41,6
Egypt	-81	14,5		-74	7,8		-65	16,3
Syria, Arab Republic of	-48	9,6		-42	9,7		-50	15,7
Romania	-92	26,7		-85	13,7		-73	26,5
Cyprus	-54	30,1		-42	6,3		-58	16,8
Ghana	-70	17,0		-55	11,1		-60	12,7
Japan	-41	21,0		-25	34,0			
Saudi Arabia	-45	11,9		-27	11,0	↑	-64	14,3
Czech Republic	-43	26,5		-23	10,1		9	17,6
Russian Federation	-35	15,1		-14	11,3		4	18,1
Bosnia and Herzegovina	-29	89,8		-4	6,0		-5	11,7
Canada (British Columbia)	15	20,4		41	9,8		-6	41,9
Spain (Basque Country)	-93	113,4		-55	9,8			
Armenia	-25	14,7		18	19,5		6	19,6
Turkey	-68	28,6		-20	25,5		10	65,7
Kuwait	-81	61,8		-30	6,9		-25	23,9
Qatar	-65	15,2		-10	4,1		7	7,6
Botswana	-76	35,3		-9	13,5		-33	12,7

Table 4.3.4: Mathematics Achievement differences between second generation immigrant students and native students in different types of communities

Country	500.000 and more			3001-500.000			less than 3000	
	Difference immi-native	SE		Difference immi-native	SE		Difference immi-native	SE
Cyprus	86	25,1	↑	-2	5,7		5	24,7
Korea, Republic of	-12	75,2		-84	32,3	-	-	-
Tunisia	16	20,9	↑	-30	7,2		-23	26,4
Italy	35	19,6		-3	7,2		-10	27,6
Scotland	36	28,4		4	10,5		-23	19,4
Jordan	41	13,1		16	8,6		-5	25,7
Colombia	-30	26,7		-55	14,8		-49	53,2
Israel	34	29,1		12	8,0		31	39,1
Czech Republic	4	22,1		-16	6,3		-42	20,3
Slovenia	-7	17,2		-28	4,6		-8	11,5
Canada (Ontario)	13	10,6		-3	6,1		20	15,2
El Salvador	11	25,9		-3	9,3		-1	14,0
Mongolia	-45	19,0		-58	6,6		-38	13,0
Hungary	33	33,1		20	11,3		-40	28,7
Morocco	-19	16,0		-31	13,4		-54	56,2
Bahrain	14	13,2		3	5,1		-5	8,5
Syria, Arab Republic of	-16	11,8		-26	9,4		-7	23,2
Singapore	10	7,0		-	-		-	-
Ghana	-18	18,7		-27	17,0		-19	16,7
Georgia	-63	19,9		-69	25,4		-26	25,9
Malaysia	-24	29,2		-29	13,7		22	25,7
Serbia	10	15,0		6	6,1		-15	19,0
Japan	-9	19,4		-13	18,5		-	-
Bulgaria	-5	26,5		-7	25,8		-21	42,1
Malta	0	0,0		-2	4,3		-	-
Russian Federation	-9	12,2		-8	8,8		-28	14,4
United Arab Emirates (Dubai)	74	12,3		76	10,2	↑	9	18,3
Thailand	-34	38,5		-32	23,2		-33	23,3
Kuwait	-1	22,3		3	6,6		9	11,8
Egypt	-63	25,3		-59	10,6		-48	31,6
Lebanon	-10	32,7		-6	10,0		16	19,4
Canada (British Columbia)	10	11,9		15	5,7		-4	20,1
England	13	20,3		19	9,0		-40	51,7
Saudi Arabia	14	9,2		20	9,6	↑	-19	16,8
United States (Minnesota)	-31	12,3		-24	11,5		2	46,1
Palestinian National Authority	-18	15,7		-9	10,5		-36	25,8
Sweden	-25	13,1		-16	4,9		7	39,5
Spain (Basque Country)	-16	45,7		-6	9,6		-59	33,4
United States (Massachusetts)	-40	96,6		-29	9,9		-21	11,4
Armenia	0	11,7		11	16,3		2	28,6
Ukraine	2	11,3		12	7,4		-5	15,7
Hong Kong, SAR	1	14,0		12	10,6		-	-
Turkey	-40	37,3		-29	23,2		-39	74,3
United States	-31	13,4		-19	6,8		9	20,5
Lithuania	-17	18,4		-4	6,3		8	16,1
Norway	-26	14,0		-10	4,6		-	-
Australia	-11	15,4		7	9,5		21	18,6
Botswana	-44	27,2		-21	7,0		-38	8,4
Iran, Islamic Republic of	-52	23,2		-28	18,3		-50	24,9
Chinese Taipei	-36	22,0		-5	15,5		0	0,0
Canada (Quebec)	-27	14,7		9	11,8		19	23,2
Oman	-60	31,8		-22	8,1		-6	13,6
Qatar	-13	15,8		27	3,6		41	7,9
Indonesia	-86	30,9		-34	18,3		-75	29,3
Bosnia and Herzegovina	-55	50,7		2	9,2		28	19,6
Romania	-115	65,3		-37	21,3		-127	50,8

Table 4.3.3 show the mathematics achievement difference between first generation immigrant students and native students in cities with 500,000 inhabitants or more, in communities with 3,000 to 500,000 inhabitants and in rural areas with less than 3,000 inhabitants. Again, the picture is quite diverse but I find some very interesting results. In Hungary, for example, the first generation immigrant students in the big cities with 500,000 or more inhabitants outperform their native peers in the cities by 45 score points whereas in the mid-size communities with less than 500,000 inhabitants but more than 3,000 inhabitants, the native students outperform their first generation immigrant peers by 51 score points. In the rural communities with less than 3,000 inhabitants this difference in favor of the native students even increases to 83 score points. Also in Ontario, Jordan, and Slovenia I see similar effects between the cities with 500,000 inhabitants and more and the mid-size communities.

Tables 4.3.4 shows the mathematics achievement difference between second generation immigrant students and native students in the cities with 500,000 inhabitants or more, in communities with 3,000 to 500,000 inhabitants and in rural areas with less than 3,000 inhabitants. The table suggests that the second generation immigrant students are very well off in big cities in Cyprus compared to the native students. But this statistic is based on three second generation immigrant students. Consequently, this result is not reliable and I will ignore this. Also in Tunisia the statistic is based on five second generation immigrant students in cities with 500,000 inhabitants and more. Also for several other countries, the big standard errors indicate very small sample sizes and consequently not very reliable statistics. Actually, I do not find reliable statistical differences for second generation immigrants and native students between the different community types.

In terms of research question five what I conclude from this analysis is that immigrant students are concentrated in some countries in more urban areas – especially the second generation immigrant students – but in some countries also in more rural areas, which poses different challenges to the education systems of the different countries. There is no unique picture but some interesting differences across countries. In terms of achievement I see for the first generation immigrant students some differences in some countries. Some countries seem to be able to offer good opportunities for immigrant students mostly in large cities but facing challenges in more rural areas.

School attendance

After investigating the distribution of immigrant students in the countries, I want to take a look at school attendance as the first school factor and consequently as the first part of research question six. As found in the literature review in chapter 2, school attendance can be a problematic issue in schools and achievement results usually relate positively to school attendance.

Table 4.3.5 shows the data for all countries. It is indicated where the percentages for the immigrant groups differ from statistically significant from the one for the native students. In Cyprus for example, the percentage of first generation immigrant students attending schools with low school attendance is 22.8% whereas it is only 15.1% among the native students.

Also in Japan, Malta, Dubai and the United States the percentage is statistically significantly higher among first generation immigrant students than for native students. For Japan, it must be noted that the statistics are based on less than 50 first generation immigrant students and still less than 100 second generation immigrant students. Consequently, there is a high probability that the result found is an artifact.

For Bahrain and Qatar the situation is statistically significantly more positive among second generation immigrant students than for the native students. For Qatar, the percentage of first generation immigrant students is even smaller. For several countries the differences of the percentages although they are quite high are not statistically significantly different due to the large sampling error for this variable in some countries. For example in Serbia there are 13% more first generation immigrant students in the group than the native students but this difference is not statistically significant. It should also be noted here that consequently the percentage of immigrant students in schools with a high school attendance is in most countries lower than for the native students.

There is only one country where there is a statistically significant higher percentage of first generation immigrant students in schools with high attendance than for the native students which is Singapore. In Singapore 35.7 percent of the first generation immigrant students attend schools with a high level of school attendance compared with 29,0 percent among the native students.

But what can also be see in the table 4.3.5 is that overall there is not much difference between the immigrant students and the native students in terms of percentage in the schools with high, medium, or low school attendance. Across all countries the average percentage of native students in schools with low school attendance is 19,4 percent, for first generation immigrant students it is 21,2 percent and for second generation immigrant students it is20,1percent. This means that in most countries low school attendance is not a problematic issue specifically for immigrant students but a slight tendency of a higher percentage of first generation immigrant students in schools with low school attendance.

Next I want to take a look at the mathematics achievement differences for students attending schools with high, medium, or low participation of the students.

Table 4.3.5 Percentage of students in schools with low school attendance

Country	first generation immigrant			native		second generation immigrant		
	percent	SE		percent	SE	percent	SE	
Japan	60,7	10,2	↑	38,8	3,9	43,0	9,0	
Lithuania	53,5	6,4		49,4	4,5	54,5	5,6	
Colombia	49,5	6,8		46,1	4,2	51,2	7,0	
Bulgaria	48,7	5,3		36,7	4,2	37,7	7,3	
Indonesia	44,9	6,1		33,1	4,4	39,0	9,8	
Mongolia	43,1	4,9		47,8	4,8	51,8	5,2	
Sweden	42,4	5,3		37,9	4,1	34,5	5,2	
Serbia	39,7	6,2		26,7	3,5	33,3	4,6	
Kuwait	38,8	5,4		35,1	4,4	37,7	5,4	
Morocco	38,3	10,8		43,8	6,3	37,5	7,6	
Romania	36,6	7,6		29,7	4,1	24,9	9,9	
United States	27,5	5,2	↑	16,2	2,5	26,0	5,9	
Georgia	25,5	6,4		21,4	4,3	15,5	4,5	
Canada (Quebec)	25,2	5,5		24,8	4,0	23,1	6,0	
Ghana	24,5	5,0		24,4	4,1	28,0	5,8	
Hungary	23,3	6,7		19,1	3,7	20,9	6,1	
Cyprus	22,8	2,4	↑	15,1	0,4	15,0	1,4	
Israel	22,6	5,1		23,4	4,3	24,9	4,7	
Russian Federation	21,9	6,3		20,3	2,8	16,8	3,2	
Slovenia	21,8	5,0		17,2	3,0	24,6	5,3	
Botswana	21,7	4,0		27,9	3,7	20,0	3,4	
Malaysia	21,6	5,9		14,8	2,8	16,9	4,9	
Jordan	19,6	4,8		17,2	3,3	16,3	3,7	
Saudi Arabia	19,3	3,9		20,6	3,3	26,9	4,9	
Malta	18,5	2,3	↑	8,7	0,4	9,8	1,3	
Australia	18,3	4,4		15,8	3,1	16,2	3,2	
Qatar	17,6	0,8	↓	27,0	0,5	21,4	0,9	↓
Spain (Basque Country)	17,6	4,8		7,9	2,6	11,0	3,7	
Tunisia	17,5	4,6		22,8	3,8	29,0	6,0	
Bahrain	17,3	1,8		20,2	0,5	16,0	1,7	↓
Norway	17,2	4,1		19,2	3,7	18,0	4,2	
Syria, Arab Republic of	17,0	3,1		19,6	3,6	22,5	4,5	
Palestinian National Author	16,9	3,9		13,4	2,4	10,7	2,2	
El Salvador	16,8	4,2		22,7	3,9	13,1	5,1	
Hong Kong, SAR	15,5	4,8		6,7	2,2	9,5	3,0	
United States (Massachus	14,5	8,8		7,6	4,3	11,1	6,5	
England	14,5	4,7		11,3	2,7	13,5	4,8	
Czech Republic	14,4	6,3		10,8	2,8	11,7	3,9	
Scotland	13,2	5,6		6,7	1,9	3,8	2,0	
Turkey	12,9	4,9		22,3	3,5	25,4	8,2	
Ukraine	12,6	4,9		12,5	3,1	12,3	3,9	
Armenia	12,6	3,2		13,0	2,5	12,0	4,5	
United Arab Emirates (Dub	12,0	1,0	↑	4,7	0,5	5,3	0,7	
Canada (British Columbia)	11,9	3,6		22,0	4,1	16,0	3,8	
Oman	11,2	4,4		8,0	2,5	11,0	4,2	
Egypt	11,1	2,8		13,6	2,9	16,9	5,1	
Thailand	10,6	7,2		17,5	3,5	20,4	7,3	
Italy	10,1	2,7		16,1	2,8	10,8	2,5	
Canada (Ontario)	9,4	4,4		10,5	3,1	7,3	3,0	
Bosnia and Herzegovina	8,9	2,0		11,9	3,0	14,4	4,3	
Lebanon	6,9	3,3		4,6	1,4	9,1	4,2	
Singapore	5,8	1,7		4,0	0,2	3,4	0,7	
Korea, Republic of	4,9	5,1		9,2	1,8	9,5	10,0	
United States (Minnesota)	4,0	3,5		1,5	0,9	2,1	2,1	
Chinese Taipei	3,0	1,5		5,4	1,9	10,8	4,5	
Iran, Islamic Republic of	0,0			3,4	1,3	3,7	2,5	

Table 4.3.6 Mathematics Achievement of first generation immigrant students in schools with different levels of school attendance

Country	HIGH			MEDIUM		LOW			Difference between high and low groups		Difference between high and low for native students		
	Math Ach	SE		Math Ach	SE	Math Ach	SE		Math Ach	SE	Math Ach	SE	
Morocco	429	44,1	⇧	319	9,3	313	10,1		116	45,3	44	24,9	
Malta	511	9,6	⇧	403	8,0	422	14,6		89	17,5	84	4,7	
Lithuania	555	99,7		453	11,5	430	10,8		125	100,3	-20	10,1	
Scotland	523	22,8	⇧	439	12,5	444	35,5		79	42,2	48	23,6	
Mongolia	453	28,0	⇧	385	8,3	390	8,3		63	29,2	10	27,6	
Sweden	528	23,3	⇧	462	8,3	444	10,4		83	25,5	31	17,7	
Canada (Quebec)	564	22,7	⇧	508	10,2	500	13,4		64	26,3	54	12,0	
Australia	554	16,9	⇧	500	8,6	425	11,8	⇩	129	20,6	92	12,7	
Singapore	658	10,8	⇧	604	7,2	560	24,8		97	27,0	94	33,5	
England	538	26,2		490	12,8	460	17,0		77	31,2	74	17,6	
Hong Kong, SAR	596	11,0	⇧	549	7,1	472	21,6	⇩	124	24,2	99	31,0	
Japan	612	21,2		573	29,9	518	26,2		94	33,7	14	9,1	⇧
Botswana	392	32,0		354	10,6	304	17,7	⇩	89	36,6	34	9,1	
United Arab Emirates (Dubai)	508	5,2	⇧	471	5,5	566	6,8	⇧	-58	8,5	-17	23,3	
Russian Federation	532	23,9		496	8,7	492	14,0		40	27,6	37	10,9	
Bahrain	412	6,7	⇧	376	5,6	355	8,3	⇩	57	10,6	21	5,9	⇧
Qatar	321	7,9	⇧	286	3,3	297	6,5		24	10,2	-3	5,8	⇧
Ukraine	427	20,5		393	11,0	385	11,8		42	23,7	31	11,6	
Turkey	446	45,1		412	22,8	332	30,9	⇩	114	54,7	37	16,0	
El Salvador	326	16,0		298	13,1	286	17,3		40	23,5	26	11,9	
Iran, Islamic Republic of	391	69,0		371	22,4	NA			NA		9	10,9	
Bulgaria	438	17,0		419	10,5	392	16,2		45	23,5	41	13,8	
Oman	333	9,2		316	11,4	277	20,4		55	22,4	15	18,0	
Cyprus	443	19,2		429	6,4	416	13,3		27	23,3	-11	7,2	
Malaysia	443	26,2		429	11,0	420	12,0		23	28,8	47	17,8	
Indonesia	377	19,0		363	9,1	334	9,3	⇩	43	21,2	48	19,1	
Egypt	361	9,0		348	7,9	331	8,9		30	12,6	32	12,2	
Kuwait	336	15,5		324	10,8	333	9,9		4	18,4	12	9,7	
United States	485	15,9		473	7,8	443	9,5	⇩	42	18,6	36	8,6	
United States (Minnesota)	501	10,5		490	13,5	369	21,1	⇩	131	23,6	109	13,3	
Canada (Ontario)	546	22,8		536	6,5	500	13,7	⇩	46	26,6	18	17,1	
Romania	391	40,7		382	15,9	375	14,9		16	43,3	39	13,7	
Chinese Taipei	499	14,2		491	13,4	469	33,4		30	36,3	30	12,3	
Hungary	470	78,2		462	24,1	452	22,7		18	81,4	34	11,4	
Tunisia	416	14,9		409	8,6	400	13,6		16	20,1	6	8,0	
United States (Massachusetts)	509	41,2		506	12,0	436	15,1	⇩	73	43,9	48	21,3	
Thailand	386	60,1		384	34,8	354	50,2		32	78,4	16	19,8	
Bosnia and Herzegovina	453	7,5		451	6,1	457	7,7		-4	10,8	9	13,1	
Lebanon	424	8,9		423	10,9	403	19,2		21	21,2	18	16,7	
Canada (British Columbia)	544	13,6		544	10,5	502	13,4	⇩	43	19,1	44	14,5	
Norway	443	16,6		445	5,6	454	11,6		-10	20,2	17	8,5	
Ghana	270	71,5		272	7,3	238	10,4	⇩	33	72,3	96	26,3	
Saudi Arabia	296	16,3		298	7,7	317	15,8		-21	22,7	-14	10,4	
Spain (Basque Country)	447	20,7		449	11,5	456	21,4		-9	29,7	19	12,0	
Serbia	446	19,5		449	14,4	463	13,2		-17	23,6	15	10,2	
Italy	448	13,4		452	7,0	459	21,2		-10	25,1	12	9,9	
Colombia	315	16,8		322	21,3	314	10,3		1	19,7	30	11,6	
Israel	436	27,1		443	8,9	449	18,4		-13	32,8	11	13,4	
Jordan	382	13,8		390	13,2	365	20,3		17	24,5	27	14,4	
Palestinian National Authority	330	15,3		340	8,6	288	18,8	⇩	41	24,2	43	11,0	
Syria, Arab Republic of	358	12,6		368	7,9	350	13,3		8	18,3	-17	10,7	
Czech Republic	482	18,5		493	8,6	479	11,3		3	21,7	35	7,9	
Korea, Republic of	625	44,9		637	39,0	696	19,9		-71	49,1	1	9,2	
Slovenia	426	15,4	⇩	463	9,4	433	15,8		-8	22,1	-2	6,8	
Georgia	335	32,3		378	13,6	366	31,6		-31	45,2	-28	29,0	
Armenia	468	11,1	⇩	526	18,7	481	16,9		-12	20,2	0	7,8	

Students' school attendance has also consequences for the achievement of the students. As can be seen in Exhibit 8.3 in (Mullis et al., 2008) students attending schools with a better school attendance performed better in most of the countries. Table 4.3.6 shows the achievement of the first generation immigrant students attending any of the three groups of schools.

The results confirm that also first generation immigrant students attending schools with a better school attendance performed better than first generation immigrant students attending schools with medium or low school attendance in most of the countries. The average mathematics achievement for first generation immigrant students in schools with high school attendance is 449 points, for first generation immigrant students in schools with middle school attendance it is 429 and for first generation immigrant students in schools with low school attendance it is 412 points.

Interesting counter examples here are Armenia or Slovenia where students in the highest group performed statistically significant lower than the students in the medium group. In Slovenia this might be caused by the small number of observations. We find less than 50 students in the two extreme groups of student participation among the first generation immigrant students which might lead to unstable estimates. But in Armenia a similar problem could not be found and we are left with the puzzling result. Interestingly, we find also in Dubai that the students in the lowest category performed above the medium group.

Very interesting are the last two columns in Table 4.3.6 that compare the differences between the students in the highest group of school attendance with the lowest for first generation immigrant students and for native students. In most countries the difference is higher for the immigrant students than for the native students – for some countries even tremendously high. Also on average I find that the difference for first generation immigrant students attending schools with high school attendance compared first generation immigrant students attending schools with low school attendance amounts to 38 points compared to only 29 score points difference for the native students. Following the argument of Büchel et al that an important role of the school is also the social aspect (Büchel, F. et al., 2001), one might conclude that a higher school attendance could be especially important for immigrant students to integrate into the host society which then would also lead to better achievement.

The case of Lithuania shows a difficulty with these statistics. In Lithuania the native students in schools with high school attendance score 20 points below the native students in schools with low school attendance whereas for the first generation immigrant students the ones in schools with high school attendance score 125 above the first generation immigrant students who attend schools with low school attendance. The large standard errors for the achievement of students in schools with high school attendance - especially for the first generation immigrants – are mainly caused by the low percentage of students in this group – 6.0 percent for native students and 3.9 percent for the first generation immigrant students plus the huge variance between the students in this group. Finally it can be concluded that there are at least some first generation immigrant students in Lithuania in schools with low school attendance that under-achieved in mathematics considerably. Although further research of this case is necessary, it might be a starting point for finding reasons and measures for improving the achievement of first generation immigrant students in Lithuania.

We find similar results in Sweden, Botswana, or Morocco with huge differences of the achievement gaps but due to very small percentages in the group of students attending schools with high

attendance rates also huge standard errors for these differences. But also for these countries it is the case that further research is necessary but the data might give a hint for a starting point in analyzing the difficulties of immigrant students in these countries.

The only countries where the differences in mathematics achievement are statistically significant are Bahrain, Qatar and Japan. For these countries we can say that attending a school with high respectively low school attendance has a statistically significant higher effect for first generation immigrant students than for native students. Approaching the problem of low school attendance in schools with a high proportion of immigrant students might help improving the achievement of these students.

In terms of the research question six, I conclude that in terms of school attendance there is a slightly higher percentage of first generation immigrant students in schools with low school attendance. I also found that lower school attendance is associated with lower mathematics achievement in TIMSS 2007 also for first generation immigrant students. The differences between students at schools with high school attendance and students at schools with low school attendance for the first generation immigrant students are on average higher than for the native students.

School resources

After investigating the effect of school attendance, I will take a look at the school resources.

That adequate school resources play an important role and a shortage can affect the teaching negatively was already discussed in chapter 2. Hansson and Gustafsson stated:" Neighborhood and school SES, not family SES, may exert a more powerful effect on academic outcomes in minority communities. "(Hansson & Gustafsson, 2010, p. 12). In TIMSS the school resources for mathematics teaching were captured in the school principal questionnaire. Principals were asked to which degree general instruction was affected by a shortage or inadequacy of instructional materials, budget for supplies, school buildings and grounds, heating/cooling and lightning systems and instructional space.

Regarding the mathematics teaching there were similar questions about a shortage of computers, software, calculators, library materials, or audio-visual resources affecting the mathematics teaching negatively. The response options were none (coded to 1), a little (coded to 2), some (coded to 3), and a lot (coded to 4). Schools were marked as highly resourced if for both areas – effects for general instruction and mathematics instruction – had an average below 2 (a little). Details can be found at (Mullis et al., 2008, p. 342). When looking at the achievement the results was not surprisingly that "Students at the high level of the index had the highest average mathematic achievement (464 points), followed by the students at the medium level (449 points) and then by the students at the low level (420 points)" (Mullis et al., 2008, p. 343).

Table 4.3.7 Percentage of students in highly resourced schools

Country	first generation			native		second generation		
	percent	SE		percent	SE	percent	SE	
United Arab Emirates (Duba	77,6	1,5	↑	58,8	2,7	75,2	2,1	↑
Korea, Republic of	38,9	14,3		29,8	3,9	32,0	17,3	
Australia	61,0	5,4		52,4	3,8	58,0	4,7	
Thailand	20,5	10,1		13,0	2,5	13,5	5,3	
England	40,6	6,3		33,2	3,9	32,8	5,4	
Turkey	13,6	5,5		7,5	2,3	15,5	9,0	
Jordan	26,1	8,2		20,4	3,6	19,3	3,5	
Spain (Basque Country)	75,0	5,8		69,5	4,6	65,4	6,8	
Canada (British Columbia)	59,8	6,4		54,7	5,3	57,5	5,4	
Sweden	52,6	6,0		47,8	4,4	52,6	5,6	
Botswana	8,9	3,8		4,1	1,7	5,8	2,3	
Norway	25,4	4,8		20,9	3,7	30,8	6,0	
Ghana	13,8	4,1		9,4	2,6	9,5	3,5	
United States (Minnesota)	52,0	12,9		47,6	9,2	43,9	10,7	
Scotland	51,5	6,0		47,2	4,7	48,7	5,5	
Saudi Arabia	10,2	3,2		7,3	2,1	5,4	1,8	
Italy	27,7	5,1		24,9	3,4	17,7	3,7	
Colombia	18,9	5,9		16,2	3,5	21,5	7,4	
Tunisia	8,2	2,0		5,7	1,7	3,8	1,7	
El Salvador	15,2	3,8		13,1	2,6	11,7	3,4	
Oman	16,9	3,8		15,2	3,1	21,6	4,6	
Ukraine	14,7	5,1		13,2	3,1	11,2	3,0	
Lebanon	37,5	5,9		36,7	4,2	37,3	5,9	
Romania	19,4	6,9		18,7	3,4	19,1	8,3	
Malaysia	43,2	5,1		42,5	4,4	40,9	6,3	
Morocco	2,1	1,5		1,5	0,9	0,3	0,3	
Japan	51,1	10,2		50,8	4,1	57,1	9,5	
Singapore	91,4	1,6		91,2	0,4	91,4	0,8	
Palestinian National Author	18,9	4,0		19,1	3,2	23,7	4,7	
Chinese Taipei	35,3	4,7		35,8	3,8	34,6	5,7	
Bahrain	23,3	1,9		23,8	0,5	29,2	2,2	↑
Indonesia	5,6	2,7		6,3	2,1	3,6	2,6	
Bosnia and Herzegovina	5,5	2,0		6,3	1,9	10,1	3,4	
Mongolia	4,8	1,9		6,1	2,3	4,4	2,7	
Lithuania	21,1	5,6		22,5	3,9	22,6	5,6	
Serbia	13,2	4,1		14,9	3,1	16,5	4,1	
Syria, Arab Republic of	11,2	2,7		13,0	2,8	12,9	4,6	
Israel	34,5	7,1		36,4	4,4	38,6	5,3	
Georgia	4,6	2,2		6,5	2,3	3,9	1,5	
Egypt	25,4	4,3		27,3	3,9	23,9	4,9	
Canada (Ontario)	35,0	8,7		37,5	5,0	32,0	5,0	
Hungary	47,4	7,8		50,0	4,8	38,0	7,0	
Kuwait	11,1	3,0		13,9	3,1	14,5	3,7	
Cyprus	8,6	1,0	↓	11,7	0,4	15,3	1,5	↑
Canada (Quebec)	50,5	6,5		53,8	5,4	54,2	6,5	
Slovenia	59,9	5,6		63,3	4,4	60,5	5,9	
United States	47,9	4,6		52,1	3,8	50,9	5,5	
Armenia	14,5	3,2		19,3	3,4	15,8	4,3	
Bulgaria	24,7	5,2		29,9	3,6	31,1	7,7	
Malta	49,5	2,4	↓	55,1	0,4	50,1	2,0	↓
Hong Kong, SAR	68,6	4,7		74,5	3,7	67,2	4,5	
Russian Federation	19,9	3,7		28,3	2,9	33,3	5,0	
Iran, Islamic Republic of	1,9	1,4	↓	10,8	2,2	6,5	2,8	
Qatar	20,9	0,8	↓	33,6	0,5	21,5	0,9	↓
United States (Massachuse	37,2	8,8		52,8	7,5	37,2	7,4	
Czech Republic	44,1	7,4	↓	62,9	3,9	60,9	5,0	

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Table 4.3.7 shows the percentage of native students and first and second generation immigrant students that attend highly resourced schools. It is also indicated if the percentages for first or second generation immigrant students are statistically significant different from the percentages of the native students for this group.

Although on average the percentage is the same for the three groups of students, there are some countries where there is a statistically significant difference for some countries – mostly to the disadvantage of the immigrant students. Czech Republic, Qatar, Cyprus, Iran, and Malta are the countries that show a statistically significant lower percentage of first generation immigrant students in well-resourced schools than native students. Only in Dubai there is a statistically significant higher percentage of first generation immigrant students in well-resourced school than native students.

Malta and Qatar also show a statistically significant lower percentage of second generation immigrant students in well-resourced schools than native students. But on the other hand Dubai, as well as Bahrain and Cyprus show a statistically significant higher percentage of second generation immigrant students in well-resourced schools than native students.

When examining the achievement differences one finds that not surprisingly students in well-resourced schools achieved on average better than students attending medium or low resourced schools. Tables 4.3.8 and 4.3.9 show the results for first and second generation immigrant students respectively. Also statistically significant differences for the well-resourced and low resourced schools from medium resourced schools are indicated. Since some countries had no schools where the principal indicated a low resourced school for these countries the achievement is indicated as "NA". As can be seen the general picture is the same showing that also for the immigrants students, students attending better resourced schools achieved higher – and in a fair amount of countries statistically significant higher - than their peers in less resourced schools.

For the first generation immigrant students the highest effect of high resourced schools can be seen in Thailand where the students in highly resourced schools achieved 175 score points above the medium resourced schools. But when looking at the number of observations that this statistic is based on there are only 28 first generation immigrant students in the data base of which 6 are in high resourced schools, 17 in medium resourced schools and 5 in low resourced schools.

Consequently, although the differences are statistically significant, this is likely to be an artifact of the data. Also for Morocco we see a difference of 127 score points between students in well-resourced schools and medium resourced schools. But although there are 169 first generation immigrant students in the Moroccan data, only five of them are in high resourced schools. We can also regard this difference as an artifact.

For Australia, Bahrain and El Salvador we also see statistical significant differences of around 60 score points. For these three countries there is a good amount of observations that this statistic is based on. In Australia there are 258 first generation immigrant students in high resourced schools and 152 in medium resourced schools. In Bahrain there are 136 first generation immigrant students in high resourced schools and 430 in medium resourced schools. In El Salvador there are 30 first generation immigrant students in high resourced schools and 108 in medium resourced schools – which is probably on the thin side for regarding this as authoritative data.

Table 4.3.8 Achievement of first generation immigrant students attending well-resourced schools

Country	HIGH			MEDIUM		LOW		
	Math ach	SE		Math ach	SE	Math ach	SE	
Thailand	513,0	49,5	↑	337,6	30,6	380,5	48,5	
Morocco	447,3	41,5	↑	320,0	12,2	315,7	8,3	
Botswana	424,1	35,8		356,3	14,8	296,4	13,6	↓
Bahrain	424,6	8,2	↑	360,2	5,0	385,5	16,3	
El Salvador	352,8	26,2	↑	291,6	13,0	284,2	16,4	
Hungary	493,3	20,2		435,4	34,1	419,3	28,9	
Mongolia	444,7	34,4		387,0	7,6	380,5	8,5	
Australia	520,0	9,8	↑	463,0	11,6	465,2	19,7	
Israel	469,6	11,7	↑	424,0	10,4	458,2	21,2	
Turkey	453,9	32,1		410,1	21,7	353,8	46,8	
Oman	348,1	18,9	↑	305,4	7,6	322,1	10,7	
Canada (Quebec)	535,4	15,0	↑	495,3	8,4	571,5	15,9	↑
Jordan	415,6	22,2		376,5	10,1	347,5	21,2	
Malaysia	447,2	7,9	↑	409,3	13,4	466,3	24,8	↑
Lebanon	444,5	10,5	↑	408,7	5,3	350,1	39,2	
Malta	447,7	8,7	↑	412,6	10,2	426,2	17,0	
Palestinian National Authority	361,3	14,5	↑	327,3	8,1	299,3	17,5	
Tunisia	433,1	25,8		402,4	7,7	408,1	11,8	
Ukraine	422,6	51,1		393,1	9,0	392,2	14,6	
Canada (Ontario)	548,2	10,3	↑	520,2	7,6	584,0	5,2	↑
Russian Federation	521,0	14,4		495,7	10,5	443,5	82,3	
United States	479,7	8,8	↑	455,5	7,1	434,7	14,0	
Indonesia	383,9	21,3		359,9	7,6	334,5	11,7	
United States (Massachusetts)	511,0	16,6		488,8	13,1	446,5	19,5	
Bulgaria	421,4	13,9		403,1	12,6	416,6	16,5	
Japan	548,2	24,5		532,1	30,8	NA		
Saudi Arabia	315,2	14,9		302,8	7,3	265,6	10,9	↓
Bosnia and Herzegovina	462,9	23,0		451,3	4,7	454,4	14,2	
Norway	453,9	9,8		442,6	5,9	470,7	13,6	
Korea, Republic of	645,5	44,8		634,3	38,8	498,0	24,5	↓
Italy	456,7	9,7		449,0	7,4	453,2	15,3	
Canada (British Columbia)	537,4	10,4		530,4	13,8	577,7	108,7	
Hong Kong, SAR	552,8	10,1		546,0	15,0	NA		
Egypt	355,3	12,0		349,5	6,3	345,8	26,6	
Kuwait	332,8	18,4		327,3	7,3	329,3	12,2	
England	497,1	19,7		493,3	13,9	496,1	17,2	
Chinese Taipei	498,3	17,2		495,6	13,2	481,8	31,6	
United Arab Emirates (Dubai)	493,1	4,6		490,6	7,0	431,0	16,1	↓
Qatar	297,7	6,2		295,9	3,4	291,5	11,7	
Cyprus	421,8	24,8		421,4	5,9	456,7	14,8	↑
Lithuania	443,2	12,4		445,6	10,6	453,7	18,7	
Syria, Arab Republic of	359,9	15,4		363,8	6,8	348,6	28,5	
Scotland	455,1	12,6		459,1	19,1	345,4	17,4	↓
Sweden	455,5	9,0		461,0	7,7	485,3	12,2	
Slovenia	444,9	9,7		451,5	10,4	NA		
Iran, Islamic Republic of	367,6	49,0		374,4	23,2	381,5	71,4	
Romania	380,2	22,9		387,1	13,7	306,9	87,3	
Czech Republic	483,1	13,2		490,4	9,2	NA		
Singapore	619,5	6,2		635,9	15,6	NA		
Colombia	319,5	22,2		339,3	9,8	295,8	13,2	↓
Georgia	354,1	29,0		374,7	12,1	361,2	43,0	
Spain (Basque Country)	443,8	9,1		469,2	15,5	350,1	83,5	
Serbia	437,2	34,7		462,6	9,1	441,5	26,4	
United States (Minnesota)	471,3	15,2		502,9	10,5	499,6	18,9	
Ghana	230,4	19,5		269,9	5,7	262,8	14,6	
Armenia	453,9	11,1	↓	519,3	15,6	484,3	20,6	

The differences in the Canadian provinces cannot be attributed to a small number of observations. In Ontario there are 154 observations in the high category and 204 in the medium category; in Quebec there are 162 and 157 respectively. Also Israel, Lebanon, Malta, Oman, Palestine, and the United States have a good number of observations to make it unlikely that the calculated differences are only an artifact of the data. Anyhow, this does not mean that there is a causal effect between the school resources and the mathematics achievement of the students but this is something that should be investigated further.

An interesting case is Armenia where the students in the high resourced schools score statistical significant lower than the students in the medium resourced schools with a difference of 65 score points. This statistic is based on 80 observations in the high resourced category and 367 observations in the medium resourced category. Also this requires some further investigations. Is it a special group of first generation immigrant students in Armenia that attend high resourced school and perform relatively poor or might that there already be some policies in place that give better school resources for schools with relatively poorly achieving immigrant students?

When I look at the differences between the medium resourced schools and the low resourced schools for the first generation immigrant students there are also some interesting differences. In Korea the first generation immigrant students in the low resourced schools achieved 136 score points below their peers in medium resourced schools in mathematics or better: The students in the low resourced school achieved below the peers in the medium resourced school since there is a total of 20 first generation immigrant students and only one of them in the low resourced schools.

Consequently this result is anything but representative for the country. In Scotland the difference is 114 score points but there are only five students in the low resourced schools. The difference of 119 points in Spain is statistically not significant due to the huge standard error for the achievement in the low resourced schools also because of only 10 students in this category. Also in Botswana and Dubai there are statistically significant differences of around 60 score points but in Botswana there are 56 first generation immigrant students in the low resourced school category and in Dubai only 23. In Colombia the 44 points difference is based on 79 observations in the medium resourced category and 91 in the low resourced category. The difference of 37 score points in Saudi Arabia is based on 526 observations in the medium resourced category and 106 in the low resourced.

Interestingly there are also a couple of countries where the first generation immigrant students in the lower resourced schools scored statistically significantly better than their peers in the medium resourced schools. This is the case for the Canadian provinces Ontario and Quebec, as well as Malaysia and Cyprus. But again in Ontario there are only 12 first generation immigrant students in the low resourced school category and Quebec 2. In Malaysia there are 20 and in Cyprus 34. Consequently, none of these results can be regarded as representative for the country.

This leaves us with the following countries where there is a higher mathematics achievement for first generation immigrant students attending better resourced schools: Australia, Bahrain, El Salvador, Ontario, Quebec, Israel, Lebanon, Malta, Oman, Palestine, Saudi Arabia and the United States. And there is the special case of Armenia where a negative relationship between school resources and mathematics achievement could be observed. All these cases should be examined further.

Table 4.3.9 Achievement of second generation immigrant students attending well-resourced schools

Country	HIGH			MEDIUM		LOW		
	Math ach	SE		Math ach	SE	Math ach	SE	
Indonesia	544,9	28,2	↑	377,2	25,3	298,2	20,6	↓
Turkey	541,6	53,8	↑	405,2	17,4	315,4	29,2	↓
Morocco	475,7	22,3	↑	363,6	15,1	352,5	13,3	
Korea, Republic of	586,4	16,3	↑	478,5	20,7	672,9	48,0	↑
Thailand	510,7	35,7	↑	404,8	20,4	381,1	32,1	
Botswana	413,6	29,5	↑	337,0	6,3	333,3	8,6	
El Salvador	403,0	20,9	↑	329,0	9,5	343,0	11,9	
Lebanon	482,5	10,8	↑	437,5	9,6	428,2	34,0	
Saudi Arabia	392,5	24,2		348,1	6,3	334,0	12,3	
Australia	518,5	10,0	↑	476,3	8,5	484,7	36,9	
Japan	577,7	18,3		537,3	20,2	NA		
Canada (Quebec)	548,5	12,2	↑	509,4	8,4	557,5	15,9	↑
Hungary	545,2	21,4		510,9	13,1	548,2	8,6	↑
Palestinian National Authority	395,1	16,3		362,7	9,8	354,7	13,3	
Tunisia	422,7	35,8		390,7	7,4	401,7	14,3	
United States (Massachusetts)	547,8	14,8		517,0	12,7	605,1	9,9	↑
Egypt	385,2	20,1		357,0	10,6	333,6	23,3	
Malaysia	467,3	14,1		440,0	15,9	449,9	22,5	
Syria, Arab Republic of	408,5	20,7		381,3	8,4	410,9	16,4	
United Arab Emirates (Dubai)	474,1	5,5	↑	447,4	7,5	412,4	36,2	
Oman	389,7	13,0		363,0	6,6	355,7	13,7	
Jordan	469,1	13,9		444,1	6,0	469,6	21,9	
Ukraine	499,9	16,5		475,3	5,9	480,8	13,2	
Cyprus	488,4	8,8	↑	464,6	5,8	480,9	20,4	
Bosnia and Herzegovina	484,3	17,6		461,4	9,2	446,3	19,2	
Colombia	372,9	58,5		351,8	12,5	309,2	17,3	↓
Serbia	513,5	15,9		493,6	5,7	480,3	12,9	
Malta	499,9	5,5	↑	481,3	5,5	502,8	22,0	
Qatar	344,8	5,6	↑	326,7	3,3	320,8	9,5	
Scotland	506,6	9,4		489,3	10,5	413,5	28,2	↓
Canada (Ontario)	531,4	6,7		514,8	5,3	576,7	7,9	↑
Iran, Islamic Republic of	387,3	32,9		374,9	15,2	334,4	23,4	
Bahrain	416,1	9,0		403,8	4,2	389,1	12,5	
Singapore	598,0	6,1		585,7	14,2	NA		
Russian Federation	511,2	10,3		501,1	8,8	491,9	24,7	
Georgia	374,2	32,1		365,3	17,5	340,9	31,9	
Norway	467,7	7,0		460,1	4,9	503,5	19,9	↑
Italy	485,5	12,1		479,1	7,1	481,6	16,3	
Kuwait	366,3	12,1		362,5	5,5	372,4	19,7	
United States	500,0	7,4		497,9	6,7	465,5	15,2	
Czech Republic	492,2	7,8		490,5	7,4	NA		
Israel	484,3	9,6		484,2	8,9	493,8	22,6	
Spain (Basque Country)	495,7	10,4		497,4	14,0	386,7	15,5	↓
Canada (British Columbia)	517,0	4,8		519,0	5,0	561,1	42,0	
United States (Minnesota)	510,6	14,3		513,9	7,0	522,3	7,1	
Mongolia	394,3	15,2		400,0	5,8	386,4	7,1	
Slovenia	485,7	4,8		491,8	6,2	NA		
England	524,3	8,9		534,5	8,5	474,5	28,0	↓
Hong Kong, SAR	577,8	8,0		588,2	10,0	NA		
Bulgaria	454,4	29,6		466,0	24,5	528,7	28,4	
Sweden	475,1	5,5	↓	491,5	4,4	392,0	20,4	↓
Lithuania	494,2	11,7		511,4	8,3	553,5	18,0	↑
Chinese Taipei	580,6	20,7		605,3	16,0	530,0	60,0	
Ghana	272,6	29,7		309,6	10,9	278,0	20,2	
Armenia	465,9	22,4		513,8	13,3	508,3	15,6	
Romania	341,5	50,3		400,3	31,4	309,7	101,8	

For the second generation immigrant students the results are as follows. For 14 countries there is a statistically significant achievement difference in mathematics between the high resourced and the medium resourced schools. Countries with more than 100 score point statistically significant differences between these two groups are Indonesia (168 points difference), Turkey (137), Morocco (112), Korea (108), and Thailand (106).

There is only one country (Sweden with a difference of 16 score points) where the mathematics achievement is statistically significant higher for the second generation immigrant students in the medium resourced schools than in the high resourced schools. But again, when looking at the number of observations that these statistics are based on we see that there are couple of countries where the number is very low – even down to one observation in Morocco in the high resourced category or 2 in Indonesia or Korea. This leaves us with the following 8 countries where there is a statistically significant difference based on a fair number of observations: Australia, Canada Quebec, Cyprus (with only 61 observations in the high category), Lebanon, Malta, Qatar, Sweden and Dubai.

For the second generation immigrants students the results when comparing students in the medium and in the low resourced school is somewhat more ambiguous. There are 8 countries with students in medium resourced school scoring statistically significant better than students in the low resourced schools but also 7 countries where the students in the low resourced schools score statistical significant higher.

The highest statistically significant differences in favor of the second generation immigrant students in medium resourced schools can be found in the Basque region of Spain (111 points difference), Sweden (100), Turkey (90), and Indonesia (80). On the opposite the countries with the highest statistical significant difference favoring the students in the low resourced schools are Korea (194 points difference), the state of Massachusetts (88), and the Canadian province Ontario 62). But again, when checking the number of observations, none of the countries with statistically significant differences in either direction has a number of observations in the low category that makes the data trustworthy to be representative for the country.

The highest numbers of these countries in the low category can be found in Colombia with 36 observations and England with 27. For other countries, there are down to one or two observations in this category, for example in Hungary, Korea, the Basque region of Spain, Sweden, or Turkey. Consequently, these differences I will not be investigate any further.

As already discussed in chapter 2 the students attending better resourced school might be also the same students that come from more affluence homes. The TIMSS student background questionnaire includes a question about the number of books at the home. The data for this variable was already analyzed in chapter 4.2 with respect to the different immigrant student groups. Table 4.3.10 shows the average number of books at home for first generation immigrant students in highly resourced, medium resourced and low resourced schools. The table contains only those countries that have shown statistical significant achievement differences that are based on a sufficient number of observations.

Table 4.3.10 Average number of books for first generation immigrant students by school resources for selected countries

Country	HIGH			MEDIUM			LOW	
	number of books	SE		number of books	SE		number of books	SE
El Salvador	69	18,4		35	5,3		25	10,6
Canada (Ontario)	115	11,4	↑	84	6,0		129	16,4
Armenia	82	13,4		56	6,8		100	15,0
Australia	99	8,0		76	10,0		74	24,6
United States	72	5,7	↑	54	4,9		42	11,0
Bahrain	83	7,0	↑	67	4,4		74	11,0
Canada (Quebec)	79	11,1		69	5,8		78	0,0
Lebanon	66	6,1		56	4,6		150	116,3
Palestinian National Authority	60	7,0		52	3,5		46	6,5
Israel	85	9,1		82	6,4		74	26,1
Oman	55	7,0		56	4,2		57	6,8
Saudi Arabia	57	12,3		60	5,5	↑	36	4,0
Malta	93	6,4		101	6,3		109	16,7

We can see that there are quite some differences of the number of books – as a predictor for the socioeconomic background of the students – and the attendance of highly, medium or low resourced schools. But only in few of the countries the differences are statistical significant.

In Bahrain, Saudi Arabia and the United States the socioeconomic background of the first generation immigrant students seems to be highly significantly positive related to the school resources of the schools they attend. In the Canadian province of Ontario the picture is indifferent. The students in medium resourced school have the lowest socio economic background – statistical significant lower than the students in high resourced schools.

But the highest socioeconomic background of the students is found in the low resourced schools – statistically significant higher than for the students in the medium resourced schools. Not surprisingly, in Armenia the socio economic background of the students in the low resourced schools is the highest which is in line with the results reported in chapter 4.2 regarding the socioeconomic background measured by the number of books at home and their mathematics achievement.

To get an idea of how much the effect of more affluence homes and better resourced schools two regression models were calculated. First, a regression model was calculated that regresses the mathematics achievement on the number of books at home and secondly the mathematics achievement was regressed on the number of books at home and the well-resourced schools together. Again, this analysis was only done for the countries where a statistical significant difference of the mathematics achievement for differently resourced schools was found and the results based on a sufficient number of observations. For a comparison the results of these regression analyses are presented for the first generation immigrant students but also for the native students. The results are presented in table 4.3.11

Table 4.3.11 Percent of variance of mathematics achievement explained by different regression models

Country	first generation immigrant			native		
	books only	difference	res + books	books only	difference	res + books
Lebanon	2,7%	7,7%	10,3%	4,3%	3,6%	7,9%
Australia	17,6%	6,0%	23,6%	13,3%	2,3%	15,6%
Canada (Quebec)	10,5%	5,2%	15,7%	10,6%	4,5%	15,2%
El Salvador	3,6%	4,0%	7,6%	5,2%	2,5%	7,7%
Bahrain	3,0%	3,7%	6,7%	3,9%	1,2%	5,1%
Palestinian National Authority	0,5%	2,6%	3,1%	2,6%	1,1%	3,7%
Saudi Arabia	2,8%	2,0%	4,8%	4,5%	0,1%	4,7%
Malta	16,9%	1,9%	18,8%	11,1%	0,3%	11,4%
Israel	3,6%	1,7%	5,4%	6,2%	1,7%	7,9%
Armenia	1,6%	1,3%	2,8%	2,4%	0,1%	2,5%
United States	11,2%	1,0%	12,2%	13,4%	-0,6%	12,8%
Oman	2,1%	0,3%	2,4%	4,8%	0,1%	4,9%
Canada (Ontario)	8,6%	0,0%	8,6%	11,3%	-2,8%	8,5%

When comparing the variance explained by the models, we can see that in few countries the inclusion of the well-resourced schools increase the explained variance substantially. Most prominent are the results for Lebanon where the number of books at home explained only 2.7% of the variance of the mathematics achievement but an additional 7.7% of the variance of achievement could be explained by the indicator of well-resourced schools. Interestingly for Lebanon the results for the native students are quite different and the bigger part of the achievement variance is explained by the books at home compared to the school resources. This might indicate that the school resources are especially relevant for the immigrant students in Lebanon. Also in Australia and the Canadian province of Quebec the school resources explain more than five percent of the variance of the mathematics achievement of the first generation immigrant students.

In terms of the research question six I conclude that overall immigrant students attend to the same degree well-resourced schools than native students do. But there are some countries where first generation immigrant students can be found less in well-resourced schools. These countries are Czech Republic, Qatar, Cyprus, Iran, and Malta. In Malta and Qatar this holds also true for second generation immigrant students in comparison to native students. I also found that the resourcing is positively related to the students' achievement in some countries. From the literature we know that students from more affluence homes attend better resourced schools. This was also found for the first generation immigrant data in this study when measuring affluence by the number of books at home. But I could show that beyond this effect there is an additional effect of first generation immigrant students attending better resourced schools achieving better in TIMSS mathematics.

School climate

The next thing to look at is the school climate, how it might differ for immigrant and native students and how it relates to achievement. As discussed in chapter 2, the school climate can have a big impact on student achievement and especially for students at risk a positive school climate can influence the achievement positively. The school climate was assessed in TIMSS on teacher and on school level. For teachers as well as for principals the TIMSS data includes an index on school climate indicating high, medium and low school climate.

Table 4.3.12 shows the percentages of students in schools where the principal rated the school climate in the highest positive category. Only those countries are included where the percentage for at least one of the immigrant student groups is statistically significant different from the percentage for the native students. Also the percentages of students in the medium and low categories are not shown since the information is mostly redundant to the one that is shown here.

For Malta and the Basque region of Spain the percentage of students in the highest category of school climate is statistically significant lower than for the native students. For Qatar and Dubai the opposite is the case and there is a statistical significant higher percentage of students among the first generation immigrant students attending schools where the principal indicated the school climate as very positive. For the second generation immigrant students there is a higher percentage of them attending schools where the principal indicated a highly positive school climate in Bahrain, Cyprus, England, and Dubai.

Table 4.3.12 Percent of students in schools with a school climate rated highly positiv by the principal by immigrantion status for selected countries

Country	first generation immigrant			native		second generation immigrant		
	percent	SE		percent	SE	percent	SE	
United Arab Emirates (Dubai)	59	1,9	↑	37	2,6	59	3,4	↑
England	37	6,5		28	3,8	45	6,5	↑
Qatar	26	0,8	↑	22	0,5	22	0,7	
Bahrain	18	1,7		17	0,4	20	1,6	↑
Cyprus	9	1,1		10	0,3	14	1,4	↑
Malta	12	1,5	↓	22	0,4	22	1,9	
Spain (Basque Country)	11	4,2	↓	24	5,1	22	7,4	

The next consecutive question is then: Does the difference of the school climate it make a difference for the students' achievement. In general this question has already been answered in chapter two – also for the results in TIMSS – but not in perspective to the immigrant students. When calculating the mathematics achievement of the native students and the two immigrants student groups separately for the grouping in high, medium and low school climate one mainly gets the same result as reported in the TIMSS international report (Mullis et al., 2008, p. 356).

The students in the schools with the school climate rated highest by the principal achieved better than the ones in the medium category who achieved better than the students attending schools where the principal rated the school climate lowest. Among the 56 analyzed countries (and benchmark participants) there are 34 where the native students in school with a high rating achieved statistically significant better in mathematics than the native students in the middle category and there are 27 where the native students achieved statistically significant better than the native students in the low category.

There is one country (Qatar) where the native students in the middle category achieved statistically significantly better than the native students in the high category. For the first generation immigrant students there are 19 countries where the first generation immigrant students in school with a high rating achieved statistically significant better in mathematics than the first generation immigrant students in the middle category and there are 14 where the first generation immigrant students achieved statistically significant better than the first generation immigrant students in the low category.

Similar for the second generation immigrant students there are also 19 countries where the second generation immigrant students in school with a high rating achieved statistically significant better in mathematics than the second generation immigrant students in the middle category and there are 15 where the second generation immigrant students achieved statistically significant better than the second generation immigrant students in the low category.

The higher number of statistically significant differences for the native students is by no means an indicator that there are more or higher differences for the native students than for the immigrant students but an effect of the smaller sample size that impacted the standard errors of the means. Indeed, the average difference for all countries between the achievement of the students in the high category and the medium category is 25.0 score points for the native students, 33.8 for the first generation immigrant students and 35.0 for the second generation immigrant students. The achievement difference between the students in the middle and the low category is 22.3 score points for the native students, 26.3 for the first generation immigrant students and 23.2 for the second generation immigrant students. Thus we can conclude that the school climate tends to make a difference in terms of mathematics achievement for all groups of students.

Since I have observed differences in percentages of students in the three categories of school climate between the native students and the two immigrant groups in seven countries, the results for these seven countries are presented in table 4.3.13. As can be seen in this table the attendance of a school where the principal rated the school climate more positively mattered – to different degrees – also for these countries.

Table 4.3.13 Mathematics Achievement of students in schools with different levels of school climate as indicated by the principal separated for different immigrant groups

Country	native							
	HIGH			MEDIUM		LOW		
	math ach	SE		math ach	SE	math ach	SE	
Bahrain	423,8	5,1	↑	400,6	2,0	376,2	7,3	↓
Cyprus	464,5	5,1		472,9	2,0	462,7	4,4	↓
England	535,6	9,1	↑	510,1	6,5	454,6	25,3	↓
Malta	531,6	2,4	↑	506,2	1,7	396,8	3,2	↓
Qatar	296,0	3,8	↓	309,6	2,0	277,9	4,8	↓
Spain (Basque Country)	526,7	4,6	↑	502,0	3,1	468,7	8,2	↓
United Arab Emirates (Dubai)	423,9	11,8	↑	382,5	8,5	394,2	20,7	

	first generation immigrant							
	HIGH			MEDIUM		LOW		
	math ach	SE		math ach	SE	math ach	SE	
Bahrain	411,4	7,5	↑	372,1	4,5	341,7	13,5	↓
Cyprus	412,8	25,1		424,3	6,3	443,4	13,2	
England	520,4	20,2		491,3	11,1	370,8	22,7	↓
Malta	476,0	11,1		462,6	7,2	346,0	9,0	↓
Qatar	298,9	4,4		293,3	3,5	277,3	9,3	
Spain (Basque Country)	480,4	40,4		444,0	11,2	445,3	12,4	
United Arab Emirates (Dubai)	501,5	5,5	↑	478,6	5,3	394,7	12,0	↓

	second generation immigrant							
	HIGH			MEDIUM		LOW		
	math ach	SE		math ach	SE	math ach	SE	
Bahrain	444,0	7,7	↑	399,8	4,0	352,4	12,8	↓
Cyprus	474,0	16,4		470,4	5,6	460,6	13,2	
England	547,4	8,6	↑	514,5	9,2	420,1	73,9	
Malta	514,2	7,4		503,5	4,1	404,5	10,2	↓
Qatar	329,7	5,3		332,8	2,9	307,9	7,2	↓
Spain (Basque Country)	507,3	17,0		502,7	10,9	470,5	14,9	
United Arab Emirates (Dubai)	481,8	4,5	↑	444,3	6,0	432,5	33,6	

As stated above, the same set of questions was also administered to the mathematics teachers of the students and the same indicator was calculated. Of course their perspective is a little bit different and for a slightly different set of countries shows statistical significant differences between the immigrant and the students. Table 4.3.14 shows the percentage of students where the teachers' responses lead to the school climate indicator coded to low for native students, first generation immigrant students and second generation immigrant students. Only countries are displayed where the percentages of the native student differ statistically significant from at least one of the immigrant student groups.

Table 4.3.14 Percent of students in schools with a school climate rated negatively by the mathematics teacher by immigrantion status for selected countries

Country	first generation immigrant			native		second generation immigrant		
	percent	SE		percent	SE	percent	SE	
Spain (Basque Country)	53,5	8,7	↑	18,4	3,4	27,0	5,9	
Bulgaria	64,7	4,5	↑	39,8	3,5	44,3	8,2	
Bahrain	34,7	3,6	↑	23,6	1,7	23,3	2,5	
United States	30,4	3,4	↑	19,7	2,0	30,4	3,7	↑
Lebanon	20,4	4,0	↑	9,9	2,1	7,9	2,4	
Qatar	20,0	0,9	↓	22,2	0,5	21,2	0,8	

As can be seen from table 4.3.14, in Bahrain, Bulgaria, Lebanon, the Basque region of Spain and in the United States the percentage of first generation immigrant students in the lowest category of school climate is significantly higher than for the native students. In Qatar the opposite is the case and the percentage of first generation immigrant students in the lowest category of school climate is significantly lower than for the native students.

The highest difference can be observed for Bulgaria where 39.8 percent of the native students attend schools where the mathematics teacher rated the school climate as low whereas 4.7 percent of the first generation immigrant students attend such a school. For the second generation immigrant students only the United States shows a statistically significant difference of the percentages with statistically significant more second generation immigrant students in schools where the mathematics teacher rated the school climate as low.

Again, when looking at the students' mathematics achievement a clear pattern can be observed that highest achievement is in most countries with the students in schools where the mathematics teacher rated the school climate as high and lowest among the students attending schools where the mathematics teacher rated the school climate low.

When looking exemplary at the results from the United States native students in school rated high on the school climate index by the mathematics teacher have an average mathematics achievement in TIMSS of 537 score points. The native in the middle category have a score of 509 points and the ones in the low category of 493. The first generation immigrant students in the schools rated high on school climate by the mathematics teachers have an average mathematics score of 505 points, the ones in the middle category of 457 and the ones in the low category of 426. The same pattern occurs for the second generation immigrant students and we can observe an average mathematics score in TIMSS of 524 for the students in the schools ranking high on the school climate scale, 495 for the ones in the middle category and 458 for the ones in the low category.

For all three groups of students the achievement differences between the high and the middle and between the middle and the low category are statistically significant except the score for the native students in the low category (493) which is not statistically significant different from the one for the students in the middle category (509). Interestingly here is that the achievement gap between the students in the different school climate categories is larger for the immigrant students than for the native students. This suggests that the school climate might be more important for the immigrant students than for native students. Since the group of immigrant students in the United Stated can be regarded as students at risk (Baca, Bryan, & McKinney, 1993; Shields & Behrman, 2004)this would

follow the argument of Freiberg that a more positive school climate can be a measure for improving the achievement of students at risk (Freiberg, 1998).

With respect to research question six I conclude that in general there is not much difference between the percentages of immigrant and native students in terms of attending schools where the principal rated the school climate positive. But I found seven countries where there is a statistical significant difference of the percentage of either first or second generation immigrant students compared to the native students attending schools with a positive school climate. These countries are Bahrain, Cyprus, Dubai, England, Malta, Qatar, and the Basque region of Spain. For Malta and Spain I observed a higher percentage of native students than first generation immigrant students attending schools rated positively in terms of the school climate. For the other five countries the difference is in advantage to one of the immigrant groups compared to the native students. A more positive school climate – as rated by the principal – is related to a higher mathematics achievement for native students as well as for immigrant students.

When examining the teacher's perspective about the school climate, I find six countries where there is a statistical significant difference of the percentage of either first or second generation immigrant students compared to the native students attending schools with a negative school climate. These countries are Bahrain, Bulgaria, Lebanon, the Basque region of Spain, Qatar, and in the United States. In all countries but Qatar there is a higher percentage of fist generation immigrant students attending school where the teacher rated the climate negatively. In the United States also the percentage of second generation immigrant students attending schools with a school climate rated negatively by the teacher is higher than for the native students. In Qatar there are is a lower percentage of fist generation immigrant students attending school where the teacher rated the climate negatively. As for the principal rating I observed a positive relation between positive school climate and higher student mathematics achievement.

School safety

One particular aspect of school climate is that students feel safe in the school. As discussed in chapter 2 there are two indices calculated for school safety in TIMSS. One I based on teacher level information and one on student level. Here I want to take a deeper look at the student level index on student safety. This index was calculated by questions that ask the students if anything of the following has happened to him/her:

In school, did any of these things happen during the last month?

*Fill in **one** circle for each line*

		Yes	No
a)	Something of mine was stolen	①	②
b)	I was hit or hurt by other student(s) (e.g., shoving, hitting, kicking)	①	②
c)	I was made to do things I didn't want to do by other students	①	②
d)	I was made fun of or called names	①	②
e)	I was left out of activities by other students	①	②

Source: Page 223 in (Foy & Olson, 2007)

The index has three values high, medium, and low. Students were assigned the high value if all five statements were answered negatively.

Table 4.3.15 shows the percentages of students in the highest category for native students, and first and second generation immigrant students together with an indicator for the immigrant student groups if the percentage is statistically significant different from the one for the native students. As can be seen in the table, in 38 out of 53 countries, the percentage of the first generation immigrant students that are in the high level of feeling safe at school is statistically significant lower than for the native students. Only in British Columbia, Australia and Singapore the percentage of the first generation immigrant students in this group is higher – but in none of the countries this difference is statistically significant.

For the second generation immigrant students there are 17 countries with a statistically significant lower percentage of students in the high category than native students. Again, I have to admit that the statistics are based on very few cases in some countries and the results for example for Korea (with a 33 percent difference for the first generation immigrant students) are not authoritative. But for example the statistics for Armenia that show a difference of 32 percent fewer first generation immigrant students in the group of students classified as high on the student perception of school safety index is based on 415 cases and can consequently be considered as reliable.

There is only one country with a higher percentage of students being in the high school safety index among the second generation immigrant students compared to the native students which is England. The analysis of the percentage of native students and immigrant students in the category of low school safety reveals the same result with a significant higher percentage of immigrant students in this category than for the native students.

This rather negative result - especially for the first generation immigrant student population - should be seriously considered by policymakers and other stake holders as teachers and principals and measures for raising the perception of safety in schools for immigrant students should be searched for.

Table 4.3.15 Percent of students that ranked feeling safe at the school high for native and immigrant students

Country	first generation			native students		second generation		
	percent	SE		percent	SE	percent	SE	
Canada (British Columbia)	53	3,3		48	1,3	48	1,6	
Australia	49	3,1		47	1,5	46	1,7	
Singapore	52	2,7		52	1,0	52	1,9	
Canada (Ontario)	45	3,2		46	1,8	50	2,6	
Hong Kong, SAR	51	1,8		52	1,5	51	1,5	
United Arab Emirates (Dubai)	47	2,4		50	2,6	44	3,0	
Botswana	8	1,9		10	0,6	6	1,1	↓
Japan	62	8,2		65	1,1	51	6,7	↓
Bosnia and Herzegovina	64	2,1		68	1,1	69	4,4	
Thailand	26	10,8		31	1,2	15	4,6	↓
Canada (Quebec)	55	3,1		61	1,2	58	2,6	
Chinese Taipei	44	3,1		49	1,2	44	6,1	
Indonesia	31	2,2	↓	37	1,4	30	7,7	
Ghana	9	1,4	↓	15	1,0	15	2,6	
Russian Federation	66	3,2		72	1,1	67	2,3	↓
Ukraine	63	3,0	↓	70	1,0	72	1,9	
England	51	3,3	↓	58	1,2	63	2,2	↑
Turkey	43	7,2		50	1,5	50	6,1	
Colombia	33	6,1		41	1,5	28	5,2	↓
Mongolia	39	2,4	↓	47	1,4	41	2,6	↓
Bahrain	29	2,1	↓	38	1,1	37	2,1	
Cyprus	42	2,7	↓	52	1,0	46	2,6	
Tunisia	34	3,4	↓	44	1,2	30	3,8	↓
Norway	56	3,1	↓	67	1,2	63	2,5	
Qatar	40	1,0	↓	51	0,8	47	1,3	↓
Serbia	59	4,1	↓	70	1,2	67	2,4	
Israel	53	3,1	↓	64	1,4	58	2,1	↓
Slovenia	43	4,5	↓	54	1,3	57	2,2	
Czech Republic	48	4,2	↓	59	1,2	61	3,2	
Sweden	64	2,7	↓	75	0,9	77	1,9	
Malta	40	2,5	↓	52	0,8	53	2,0	
El Salvador	41	4,4	↓	55	1,1	47	5,1	
Morocco	24	3,2	↓	38	1,5	32	5,0	
Malaysia	38	3,1	↓	52	1,5	46	6,7	
Kuwait	47	2,4	↓	62	1,2	54	2,4	↓
Spain (Basque Country)	50	4,4	↓	65	1,7	58	5,0	
Iran, Islamic Republic of	34	7,4	↓	49	1,6	32	5,5	↓
Jordan	40	2,5	↓	56	1,6	51	2,2	
Italy	48	4,0	↓	64	1,2	59	3,3	
Palestinian National Authority	33	2,6	↓	49	1,5	43	3,5	
Scotland	45	3,5	↓	61	1,1	56	3,1	
Hungary	45	5,1	↓	62	0,9	55	4,6	
Oman	34	2,1	↓	51	1,4	40	2,6	↓
Bulgaria	38	4,2	↓	55	1,1	54	5,7	
Saudi Arabia	32	2,4	↓	50	1,4	46	2,6	
Romania	30	4,1	↓	49	1,1	23	7,7	↓
Syria, Arab Republic of	35	1,7	↓	55	1,3	46	3,2	↓
Egypt	30	2,0	↓	52	1,4	37	3,9	↓
Lebanon	23	2,0	↓	44	2,1	30	4,1	↓
Lithuania	37	4,2	↓	61	1,1	58	3,8	
Georgia	47	6,0	↓	75	1,5	62	8,6	
Armenia	38	4,0	↓	69	1,0	57	4,4	↓
Korea, Republic of	19	7,7	↓	52	1,3	33	13,1	

Table 4.3.16 Achievement differences for first generation immigrant students with different levels of feeling safe in school

Country	HIGH			MEDIUM		LOW		
	Math Ach	SE		Math Ach	SE	Math Ach	SE	
Japan	581,59	19,80	↑	466,06	36,47	458,15	60,46	
Thailand	450,50	64,07		363,91	38,93	350,30	28,63	
Botswana	439,77	28,71	↑	359,64	11,53	317,89	14,27	↓
Serbia	473,62	8,92	↑	430,32	17,15	434,19	29,93	
Georgia	394,26	16,95		354,48	13,98	373,33	28,54	
Lebanon	466,57	8,13	↑	427,36	7,79	397,97	5,80	↓
Jordan	411,19	9,14	↑	373,05	8,97	376,92	24,90	
Oman	346,16	7,52	↑	315,52	8,08	287,45	11,71	↓
Qatar	323,45	5,26	↑	294,46	4,61	259,86	5,07	↓
Chinese Taipei	507,56	11,91		479,39	18,16	493,42	15,63	
Ghana	301,89	12,33		275,65	7,07	247,93	6,13	↓
Egypt	375,60	5,86	↑	349,41	6,42	336,68	8,03	
Sweden	472,02	6,31	↑	447,49	10,27	417,99	10,61	↓
United Arab Emirates (Dubai)	503,40	5,03	↑	479,03	4,20	462,43	9,20	
Ukraine	412,81	10,80		389,15	12,81	357,44	23,95	
Turkey	433,93	32,79		410,86	23,58	317,71	18,71	↓
Scotland	469,04	14,34		446,60	11,86	416,73	16,64	
Palestinian National Authority	359,00	11,36		336,76	8,76	296,59	12,15	↓
Malaysia	444,93	7,00		423,18	9,56	412,96	15,80	
Mongolia	405,99	8,58		384,46	7,77	371,21	8,06	
Singapore	637,20	7,78		615,66	8,64	577,61	13,14	↓
Kuwait	348,47	6,99		327,54	8,26	295,02	11,71	↓
Canada (Quebec)	528,14	10,19		507,27	7,07	478,93	26,05	
Bahrain	399,72	8,60	↑	379,24	5,84	349,48	9,75	↓
Iran, Islamic Republic of	392,84	27,76		372,47	27,02	341,77	33,59	
Israel	461,24	8,72		441,69	9,85	400,34	18,32	↓
Russian Federation	506,50	10,25		487,11	9,09	500,28	21,77	
England	509,74	13,02		491,00	12,96	459,57	19,09	
Bulgaria	421,61	11,41		405,48	15,06	394,35	18,27	
Syria, Arab Republic of	375,95	7,20		361,00	6,08	356,45	7,90	
Spain (Basque Country)	459,74	12,00		445,69	10,21	422,00	21,41	
Hong Kong, SAR	562,82	8,26		550,48	10,53	517,54	15,86	
Canada (Ontario)	542,80	5,96		531,72	7,90	503,98	14,76	
Romania	396,80	16,93		387,50	17,76	363,34	16,45	
Canada (British Columbia)	542,34	7,91		533,06	9,90	507,97	10,68	
Italy	459,30	7,60		450,72	8,36	399,76	27,30	
Colombia	327,31	13,73		318,92	10,98	308,60	11,44	
Bosnia and Herzegovina	460,81	5,55		452,56	6,17	409,40	11,95	↓
Tunisia	409,07	8,77		402,63	8,73	410,43	12,56	
Malta	449,72	10,60		443,31	9,31	383,11	13,71	↓
Slovenia	456,16	10,87		450,42	9,78	433,82	15,60	
Lithuania	456,58	17,55		452,03	11,93	424,44	13,58	
Norway	447,46	6,07		444,12	7,41	427,03	16,64	
Indonesia	358,32	9,01		355,65	7,10	336,68	10,22	
Australia	502,15	9,94		500,86	9,34	471,46	18,75	
Cyprus	438,86	8,57		437,85	8,03	402,33	12,83	↓
Hungary	473,19	25,05		474,12	19,89	422,79	27,17	
Czech Republic	486,24	9,90		489,04	10,26	482,19	28,70	
Saudi Arabia	297,90	8,13		304,01	9,19	294,26	10,96	
El Salvador	299,01	18,09		305,26	12,29	303,60	13,75	
Morocco	317,15	18,13		324,59	12,10	327,22	13,36	
Algeria	368,66	48,01		383,21	23,98	NA		
Armenia	483,76	8,36		505,83	17,96	548,50	19,41	
Korea, Republic of	619,49	48,96		643,35	33,79	584,79	57,30	

The TIMSS international report found: "There was a positive association between average mathematics achievement and students' perception of being safe at both fourth and eighth grades, with highest achievement among students at the high level of the index and lowest achievement among those at the low index level." (Mullis et al., 2008, p. 368)

When analyzing the mathematics achievement results for the native students and the immigrant students separately for the three levels of the school safety index the results that are also reported in the TIMSS international report are found for all three groups. The achievement differences are more often statistically significant for the native students than for the immigrant student populations although they are on average higher due to larger standard errors for the smaller sized samples of immigrant students.

The results of the analysis are displayed for the first generation immigrant students exemplary. Table 4.3.16 shows the mathematics achievement of immigrant students for the three levels of students feeling safe at school. It is also indicated if the achievement for the high or low level of feeling safe is statistically significant different from the mathematics achievement of the students in the middle category of feeling safe at school.

The difference of more than 100 score points between the students in the high and medium category found for Japan – although statistically significant – is based on less than 50 students in total. Consequently, we should not rely on this result. But the results for the other countries that are marked as statistically significant different are based on a couple of hundred students each and consequently can be trusted to be actual.

For example in Botswana, the achievement difference between first generation immigrant students in the high category of feeling safe at school and the more first generation immigrant students in the medium category of feeling safe at school is more than 80 score points – a difference in learning of more than two school years. The first generation immigrant students in the high category of feeling safe at school achieved even more than 120 score points in mathematics above the first generation immigrant students in the low category– a difference in learning of more than three school years.

For the first generation immigrant students the difference between students in the high level of school safety and students in the medium level of school safety across all countries is 18 score points and between the students in the medium level of school safety and the low level it is 21 score points.

For the native students the results are not displayed in detail but the average mathematics achievement difference between students in the high level of school safety and students in the medium level of school safety across all countries is 9 score points and between the students in the medium level of school safety and the low level it is 18 score points.

Also the results for the second generation immigrant students are not shown here for each country. But for the second generation immigrant students the difference between students in the high level of school safety and students in the medium level of school safety across all countries is 18 score points and between the students in the medium level of school safety and the low level it is 19 score points. Due to the standard error terms I cannot say that the differences for the immigrant students are higher than for the native students but we can conclude that there is a clear relationship between the students feeling safe at school and their mathematics achievement which also matches the previous research as laid down in chapter 2.

In terms of the sixth research questions, I conclude that there is a difference of percentage of students feeling safe at school between immigrant and native students. In the majority of countries there is a statistically significant lower percentage of first generation immigrant students with a high level of feeling safe at school compared to the native students. Also for the second generation immigrant students there is in nearly one third of the participating countries a statistically significant lower percentage of students in the high category of feeling less safe in school. This is a matter of concern since for all three groups of students – native students, and first and second generation immigrant students – there is a clear positive relation between the students feeling safe at school and the mathematics achievement of the students.

Summary

In this chapter I found some differences in terms of where immigrant students are located within the countries. I concluded with respect to research question five that in some countries immigrant students are located more in more urban areas. This is in particular true for second generation immigrant students. But in other countries immigrant students are found more in rural areas, which creates different challenges for the education systems of the different countries. I saw also some achievement differences for the countries between immigrants located in urban or rural areas. Some countries seem to be able to offer good opportunities for immigrant students mostly in large cities but facing challenges in more rural areas.

I also found in this chapter the answers to research question six. I found that a slightly higher percentage of first generation immigrant students in schools with low school attendance. I also found school attendance to be associated with mathematics achievement and that the association is stronger for the first generation immigrant students in some countries.

Also with respect to research question six I found immigrant students attending in general similar resourced schools than native students. But I found that in Czech Republic, Qatar, Cyprus, Iran, and Malta first generation immigrant students attending less well-resourced schools. In Malta and Qatar this is also true for second generation immigrant students. I also found that the resourcing is positively related to the students' achievement in some countries – also when considering that students from more affluence homes attend better resourced schools

Furthermore with respect to research question six I found that in general immigrant students and native students are similarly attending schools where the principal but rated the school climate positive. I found also the school climate – as rated by the principal – is related to a mathematics achievement for native students as well as for immigrant students. I found similar results when analyzing the teacher rating of the school climate. This is that in general native students and immigrant students are attending schools with similar ratings of the school climate by the teacher. But there are some countries where I find significant differences. And again also attending schools that are rated positively relates also positive to the students mathematics achievement.

Lastly in this chapter I found with respect to research questions six major differences between immigrant and native students in terms of feeling safe in school. This is probably the most amazing result. I found that in the majority of countries there is a statistically significant lower percentage of first generation immigrant students with a high level of feeling safe at school compared to the native students. And also for the second generation immigrant students I found in nearly one third of the participating countries a statistically significant lower percentage of students in the high category of

feeling less safe in school. And I found for native students as well as for first and second generation immigrant students a clear positive relation between the students feeling safe at school and the mathematics achievement of the students.

Especially for this last result it is important to find the mechanisms behind this and to find ways to improve the situation for immigrant students feeling safer in schools. But this is clearly beyond the scope of this research and would probably require more qualitative approaches.

Chapter 4D Class level and teacher level factors

So far, I have looked at general trends for immigrants and investigated the immigrant students' background. I also looked at the distribution of immigrant in the different countries and looked at school level differences. Now, in this chapter, the class level factors that can influence student achievement are evaluated. This includes factors as class size but also teacher related factors. Teacher related factors became increasingly important in educational research and policy recommendations. The OECD stated: "The research indicates that raising teacher quality is perhaps the policy direction most likely to lead to substantial gains in school performance." (OECD, 2005, p. 23). On the other hand Hattie has a much more differentiated perspective on teacher effects and stated: "…teachers make a difference is misleading. Not all teachers are effective, not all teachers are experts, and not all teachers have powerful effects on students…" (Hattie, 2008, p. 108).

Class size

I want to start looking at the class sizes of the classes attended by immigrant students compared to native students. As discussed in chapter 2 class size is found to be related to students' achievement in some studies while other researchers contradict that small classes impact student achievement positively. As TIMSS grouped the grade eight students in three groups; students in small classes with 1 t o24 students, medium sized classes with 25 to 32 students and big classes with 33 students and more, table 4.4.1 shows the percentage of students in small classes for native students as well as for first and second generation immigrant students.

If the percentage of one of the immigrant student groups differ statistically significant from the percentage for the native students this is indicated in the table. Although for most countries we cannot identify statistically significant differences, for some countries there are differences in the percentages. In Bahrain, Bulgaria, Malta, Qatar, Romania and Scotland there is a statistically significant higher proportion of first generation immigrant students in smaller classes than native students.

In the United States the opposite is the case and there are statistically significant more native students in small classes than first – and also second – generation immigrant students. Also in Jordan and Norway there are statistically significant more native students in small classes than second generation immigrant students.

Although it is intuitively evident that there are better opportunities in smaller classes for supporting students that are facing language difficulties or other problems, the question remains if I can find higher achievement of immigrant students in small classes. Table 4.4.2 shows the mathematics achievement of first generation immigrant students in small, medium size, and big classes. But contra-intuitively also for the first generation immigrant students the same comparison as for all TIMSS students is trues, namely that the first generation immigrant students in small classes achieve on average less well than their immigrant peers in medium size classes. There are three countries with the opposite result. In Bahrain, Botswana and Malaysia first generation immigrant students in small classes outperform their peers in medium size classes significantly.

Table 4.4.1 Percent of students in classes with 1 to 24 students by immigrant status								
	first generation			native		second generation		
IDCNTRY	percent	SE		percent	SE	percent	SE	
United States (Minnesota)	47,3	11,4		29,8	5,7	35,4	6,6	
Bulgaria	73,0	5,4	↑	57,7	3,5	49,2	7,5	
Romania	90,5	2,5	↑	75,3	3,0	83,6	6,6	
Scotland	56,7	5,5	↑	41,5	3,2	45,2	4,6	
United States (Massachusetts)	76,5	8,0		62,3	5,8	70,1	8,7	
Lithuania	44,5	6,1		33,5	3,2	39,9	6,2	
England	38,9	6,2		29,0	3,8	28,9	5,2	
Qatar	26,6	1,2	↑	17,8	0,5	17,8	0,8	
Bosnia and Herzegovina	54,5	5,0		45,8	3,8	49,8	6,4	
Ukraine	44,6	6,5		36,9	3,2	27,9	4,1	
Malta	77,3	2,7	↑	70,6	0,4	70,2	2,0	
Israel	9,2	4,5		2,8	0,6	6,3	2,1	
Spain (Basque Country)	73,1	6,2		67,5	2,8	66,5	5,9	
Colombia	16,6	5,6		12,3	2,4	24,1	8,0	
Italy	77,8	4,1		73,5	2,9	69,4	4,7	
El Salvador	38,7	6,0		34,6	3,7	37,0	5,7	
Indonesia	9,2	3,4		5,7	1,6	7,3	4,2	
Lebanon	42,0	5,3		38,6	4,8	35,7	5,2	
Hungary	74,3	5,9		71,2	3,4	80,1	4,6	
Bahrain	8,5	1,2	↑	5,6	0,7	7,0	1,3	
Russian Federation	65,4	6,3		62,6	2,6	59,0	4,1	
Botswana	3,6	2,8		0,9	0,6	0,8	0,5	
Ghana	15,5	3,4		12,7	2,5	11,8	3,6	
Sweden	65,9	4,9		63,2	3,8	59,7	5,0	
Canada (Ontario)	39,1	8,8		36,4	3,8	34,9	5,1	
Hong Kong, SAR	12,2	2,3		9,8	2,6	8,5	1,6	
Armenia	42,1	5,7		39,9	4,0	38,3	6,6	
Canada (British Columbia)	32,6	5,3		31,0	4,7	28,0	3,9	
Thailand	12,5	9,6		11,0	2,4	21,5	12,2	
Palestinian National Authority	8,8	2,5		7,8	1,7	4,6	1,9	
Slovenia	95,3	1,3		94,4	1,0	94,7	1,5	
Tunisia	3,6	1,7		2,8	1,2	4,8	2,7	
Turkey	19,4	7,6		18,6	3,5	15,2	6,2	
Georgia	53,1	7,3		52,4	5,4	50,3	9,4	
Singapore	2,1	0,8		1,5	0,6	1,8	0,8	
Chinese Taipei	4,2	2,1		4,2	1,8	6,1	3,6	
Oman	9,6	2,9		9,7	2,2	15,1	3,4	
Kuwait	12,1	3,6		12,5	3,4	9,7	2,9	
Mongolia	8,4	2,7		9,1	2,2	8,2	3,0	
Malaysia	0,4	0,4		1,4	0,8	0,9	0,7	
Morocco	5,7	3,3		6,8	2,7	5,0	2,2	
Egypt	3,3	1,4		4,5	1,6	5,6	2,6	
Cyprus	53,0	3,7		54,2	2,8	54,0	3,3	
Serbia	51,1	5,7		53,0	3,9	54,3	5,1	
Japan	7,5	5,5		9,7	2,2	15,7	7,0	
Syria, Arab Republic of	21,8	3,7		24,3	3,9	24,1	5,3	
United Arab Emirates (Dubai)	29,7	4,2		33,3	5,4	23,8	3,7	
Australia	27,8	4,1		31,4	3,4	26,9	2,9	
Saudi Arabia	25,7	4,0		29,4	4,0	23,2	3,8	
Korea, Republic of	NA	-		4,1	1,4	21,2	15,4	
Jordan	9,9	2,8		15,5	3,4	7,7	1,3	↓
Iran, Islamic Republic of	28,8	12,3		35,5	3,2	28,3	4,9	
Czech Republic	41,9	7,7		49,7	4,3	43,2	5,6	
Canada (Quebec)	12,6	2,8		21,1	3,8	16,8	5,1	
Norway	37,7	4,5		49,0	3,9	36,4	4,3	↓
United States	48,5	3,9	↓	61,7	2,5	44,2	3,6	↓

Table 4.4.2 Mathematics achievement of first generation immigrant students attending different class sizes

Country	1 TO 24			25 TO 40		41 OR MORE		
	Math ach	SE		Math ach	SE	Math ach	SE	
Botswana	475	42,3	↑	355	13,6	331	19,0	
Bahrain	453	12,0	↑	365	5,5	447	17,2	↑
Malaysia	502	19,5	↑	421	8,8	463	13,8	↑
Iran, Islamic Republic of	400	34,7		366	21,3			
Armenia	527	20,5		494	10,7	437	22,3	↓
Ghana	275	13,9		249	9,6	271	8,9	
Palestinian National Authority	348	15,8		324	10,2	330	13,0	
United Arab Emirates (Dubai)	500	10,6		478	5,7	352	20,7	↓
Thailand	364	91,7		342	38,3	448	57,1	
Morocco	338	13,5		319	10,0	324	16,5	
Georgia	379	16,8		362	17,2	400	16,1	
Serbia	463	16,0		448	11,0			
Egypt	365	17,4		354	7,2	350	6,8	
Czech Republic	492	12,7		484	9,4			
United States	469	6,5		462	8,7	533	14,6	↑
Syria, Arab Republic of	366	11,0		361	6,8	373	22,3	
Turkey	418	67,9		412	19,9	358	24,2	
Cyprus	431	7,3		427	8,2	341	28,5	↓
Mongolia	389	20,8		386	6,4	430	17,7	↑
Oman	317	25,7		316	6,7			
Saudi Arabia	294	12,2		298	9,3	288	22,2	
Israel	441	53,6		448	8,4	557	70,6	
Norway	441	7,5		450	5,9	418	13,7	↓
Jordan	377	32,4		385	12,2	388	13,3	
Colombia	311	21,5		321	11,2	318	12,7	
Canada (Ontario)	527	12,5		536	9,1	543	7,6	
Italy	448	7,0		461	9,9			
Qatar	285	6,6		298	3,1	278	20,5	
Kuwait	326	18,1		340	7,1	438	17,1	↑
Canada (Quebec)	498	9,3		513	9,4	506	14,2	
Bosnia and Herzegovina	443	6,4	↓	463	5,3			
Hungary	454	25,6		476	18,9			
Canada (British Columbia)	516	9,9		542	10,6	487	42,9	
Indonesia	323	13,1	↓	352	5,7	356	12,2	
Lebanon	404	7,9	↓	434	9,5	399	31,3	
Sweden	450	7,2	↓	481	9,5	490	17,7	
Ukraine	379	13,0		411	12,5	405	7,8	
Russian Federation	488	11,1	↓	521	11,3			
El Salvador	275	14,6		308	14,8	311	19,7	
United States (Minnesota)	466	17,6		503	10,3			
Chinese Taipei	441	49,0		485	10,7	568	51,8	
Slovenia	445	7,7	↓	490	17,5			
Japan	482	171,6		530	18,3	701	29,4	↑
Bulgaria	402	10,3	↓	451	16,8			
Malta	416	7,3	↓	468	11,7			
Spain (Basque Country)	442	9,7	↓	496	15,2			
Lithuania	413	15,3	↓	468	9,6			
Hong Kong, SAR	483	19,3	↓	542	13,5	587	11,7	↑
United States (Massachusetts)	482	11,8	↓	543	16,8	570	8,6	
Australia	455	12,9	↓	519	9,5	452	17,8	↓
Tunisia	331	34,9	↓	405	6,5			
Singapore	549	44,9		628	7,2	609	11,7	
Scotland	413	13,7	↓	500	11,0			
Romania	370	12,6	↓	467	24,8			
England	429	19,2	↓	535	10,5	446	100,8	
Korea, Republic of			↓	646	34,3	625	25,8	

But the curvilinear relationship that was found for all TIMSS students ("The complexity of this issue is evidenced in the TIMSS 2007 results showing a curvilinear relationship, on average, between class size and mathematics achievement at both the eighth and fourth grades." (Mullis et al., 2008, p. 273)) cannot be confirmed. In some countries first generation immigrant students in big classes perform less well than their peers in medium size classes but in some countries the opposite is the case.

Whereas for native students the average achievement for students in medium size classes is eight score points above the achievement of students in big classes, which is statistically significant, there is a difference of less than one score point between first generation immigrant students in medium size classes and in big classes which is far beyond any statistical significance. This means that big classes have a lower association with achievement for first generation immigrant students than for native students. This needs some further research.

Although not for all countries the number of first generation immigrant students in the TIMSS sample and their distribution in different types of communities and class sizes allows for comparisons of these groups, one can look at the results in Hong Kong. Honk Kong is a country where immigrant students in larger classes outperform the immigrant students in smaller classes and the number of immigrant students is quite large. Due to the structure of Honk Kong there are no students from communities with less than 3,000 inhabitants and I can distinguish only between students in communities with less than 500,000 inhabitants and with more than 500.000 inhabitants.

Table 4.4.2a shows the percentages of first generation immigrant students in Hong Kong in classes with 1 to 24 students, 25 to 40 students and with more than 40 students and their mathematics achievement differentiated between the two types of communities. One can see that in the larger communities there is a higher percentage of the first generation immigrant students in larger classes with more than 40 students (35 percent compared to 60 percent). I also find that the mathematics achievement increases with class size in both types of communities between small and medium size classes but very differently. Whereas the achievement difference between small and medium size classes in communities with less than 500,000 inhabitants is only 34 score points, it is 129 in the communities with more than 500,000 inhabitants. Another difference is that there is no increase between medium and large classes in communities with more than 500,000 inhabitants.

Table 4.4.2a Percentages of first immigrant students in Hong Kong in different mathematics class sizes for larger and smaller community sizes and their

	between 3.001 and 500.000					
	1 TO 24	SE	25 TO 40	SE	41 OR MORE	SE
Percentage	16	3,3	49	6,8	35	6,0
Math score	483	19,8	517	14,3	568	18,4
	more than 500.000					
	1 TO 24	SE	25 TO 40	SE	41 OR MORE	SE
Percentage	4	2,7	35	9,1	60	9,2
Math score	484	55,4	613	15,7	608	9,3

In contrast to this, I see the same statistics for native students in table 4.4.2b. The distribution of students in different class sizes is for both community types very similar between the native students and the first generation immigrant students. But there are differences between native students and immigrant students in terms of achievement and not only in terms of overall achievement levels but also in terms of the differences between the groups. The most extreme difference can be observed for the students in small classes in communities with more than 500,000 inhabitants. This is relatively much higher for the native students – although the mean achievement is predicted with a big standards error for the immigrant students and even more for the native students. These results show that there is also an effect of urban and rural communities linked to the class size effect.

Table 4.4.2b Percentages of native students in Hong Kong in different mathematics class sizes for larger and smaller community sizes and their

	between 3.001 and 500.000					
	1 TO 24	SE	25 TO 40	SE	41 OR MORE	SE
Percentage	13	3,5	53	6,6	35	5,6
Math score	514	24,6	537	11,3	600	10,2
	more than 500.000					
	1 TO 24	SE	25 TO 40	SE	41 OR MORE	SE
Percentage	6	4,3	31	6,0	63	7,2
Math score	590	111,6	623	16,2	608	12,8

The achievement results for second generation immigrant students over all for the countries are very similar to the ones for the first generation immigrant students and consequently will not be displayed and be no further discussed here.

In terms of research question seven I conclude that there are differences in various countries between the class sizes of classes attended by immigrant students and native students. But the differences are in both ways. In some countries immigrant students are attending smaller classes and in some countries native students attend smaller classes. Also the relation between class sizes and mathematics achievement is rather complex. Although in some countries immigrant students attending smaller classes perform better in mathematics, mostly the opposite is the case. I can only speculate why this is the case. I could find some associations of class sizes with community sizes and as I have shown previously the community sizes are also a factor for learning environments and particular for learning outcome – in this case mathematics achievement. But beyond this the data available does not give us much more insight.

Homework

After looking at the class sizes, the next thing to investigate is the homework assigned by the mathematics teacher. As seen in the literature research in chapter two, homework can be a factor in education. The homework In TIMSS the mathematics teachers of the sampled students are administered a set of five questions about the mathematics homework that they assign to their students. Among them also questions about the frequency and expected time that it takes for an average student to finish them. In TIMSS an indicator was developed that reflects the teachers' emphasis on mathematics homework. "Students in the high category had teachers who reported giving relatively long homework assignments (more than 30 minutes) on a relative frequent basis (in about half of the lessons or more). Students in the low category had teachers who gave short assignments (less than 30 minutes) relatively infrequently (in about half the lessons or less). The medium level includes all other possible combinations of responses" (Mullis et al., 2008, p. 302)

Table 4.4.3 shows the percentage of students in the low level of mathematics teachers' emphasis on homework for the native students and the two groups of immigrant students. As can be seen in the table, there are only three countries where the percentage of first generation immigrant students in this category is statistically significant lower is smaller than the percentage for native students. These countries are the two Canadian provinces British Columbia and Quebec and thirdly Singapore. For the last Canadian province, Ontario, the difference is not statistically significant different but slightly below the threshold. As stated above, these countries are also the countries where first generation immigrant students perform relatively high compared to the native students. One might hypothesize that there is a positive relationship between the immigrant students higher achievement and the relatively higher emphasize of the teachers on homework. But further research in this area is necessary to proof the relationship and even more to prove its causal nature.

For the second generation immigrant students the percentages appear to be smaller than for the native students in Bulgaria, Qatar and Sweden. The statistics for Bulgaria are based on 76 second generation immigrant students of which one is in the low category. Consequently, the statistics cannot be regarded as trustworthy.

Table 4.4.3 Percentage of students in mathematics classes with a low emphasize on homework

Country	first generation immigrant			native		second generation immigrant		
	percent	SE		percent	SE	percent	SE	
Korea, Republic of	37,5	11,5		55,6	3,3	32,1	16,3	
Canada (British Columbia)	11,0	2,8	⇩	23,9	3,5	15,5	2,6	
Canada (Quebec)	14,8	4,6	⇩	27,4	4,2	16,2	4,4	
Canada (Ontario)	19,8	4,7		32,1	5,3	22,9	4,2	
United Arab Emirates (Dubai)	18,5	3,6		30,8	7,9	19,4	4,4	
Czech Republic	67,7	7,4		78,1	3,2	73,2	4,5	
Thailand	0,0	NA		9,2	2,2	8,1	4,3	
Sweden	56,8	4,8		65,6	3,0	53,4	4,8	⇩
Singapore	12,1	2,4	⇩	19,6	2,4	17,3	2,5	
Norway	11,4	3,0		18,7	3,3	12,0	3,1	
Iran, Islamic Republic of	6,9	7,0		13,2	2,8	14,7	4,8	
Bahrain	42,7	4,5		48,8	2,9	39,1	4,0	
Australia	46,9	5,6		51,8	4,4	43,7	4,2	
Syria, Arab Republic of	20,2	3,8		23,5	4,0	23,6	5,1	
England	57,4	6,6		60,3	4,2	47,7	6,3	
Ghana	19,6	4,0		21,9	3,6	17,9	4,3	
Colombia	14,2	4,8		16,0	3,2	20,6	5,6	
Italy	0,0	NA		1,5	0,8	0,5	0,5	
Armenia	9,3	3,4		10,3	2,5	10,2	3,2	
Jordan	29,4	5,5		29,8	4,2	20,7	4,2	
Cyprus	0,2	0,2		0,6	0,6	0,0	NA	
Romania	1,0	0,7		1,2	0,8	0,0	NA	
Serbia	27,2	6,0		27,4	3,9	28,3	4,8	
Ukraine	0,8	0,8		1,0	0,8	1,3	0,9	
Bosnia and Herzegovina	25,3	4,3		25,5	3,7	23,6	5,9	
Malaysia	12,4	3,9		11,6	2,3	7,8	2,8	
Israel	6,7	1,5		5,9	1,5	9,0	2,0	
Tunisia	7,0	3,7		6,1	2,0	5,7	3,3	
Morocco	14,0	4,4		13,2	2,7	17,0	3,8	
El Salvador	24,5	5,5		23,6	3,9	28,7	6,4	
Georgia	3,0	1,8		2,0	1,2	7,7	5,2	
Kuwait	83,3	4,1		81,7	3,8	84,6	4,3	
Lithuania	8,0	3,0		6,2	1,8	7,3	2,9	
Qatar	41,2	1,2		39,3	0,6	33,1	1,1	⇩
Malta	7,8	1,8		5,9	0,2	7,4	1,0	
Egypt	33,1	4,9		31,1	4,4	33,6	5,9	
United States	15,6	3,4		13,2	2,3	13,4	2,6	
Mongolia	8,1	3,6		4,6	1,6	4,7	2,3	
Lebanon	12,6	3,7		8,7	2,4	10,7	4,1	
Hong Kong, SAR	19,7	4,7		15,3	3,7	16,1	3,6	
Botswana	13,9	3,7		9,2	2,5	10,6	2,9	
Turkey	32,7	8,1		27,6	3,3	42,3	9,1	
Slovenia	10,8	3,8		5,4	1,3	7,2	2,2	
Bulgaria	12,0	4,8		5,4	1,6	1,1	1,1	⇩
Scotland	60,5	5,8		53,8	3,7	60,4	4,8	
United States (Massachusetts)	13,3	5,7		6,6	2,2	13,1	5,0	
Indonesia	17,8	5,1		10,8	2,5	6,8	4,1	
Japan	65,4	10,4		58,4	3,8	71,0	6,3	
United States (Minnesota)	15,4	8,2		8,3	3,1	19,9	12,2	
Hungary	13,3	5,5		5,1	1,4	4,6	2,1	
Palestinian National Authority	35,7	5,7		25,9	3,5	27,0	5,1	
Spain (Basque Country)	20,4	7,8		10,5	2,6	16,0	5,9	
Oman	35,1	4,9		25,1	3,2	31,0	6,0	
Chinese Taipei	34,8	4,9		24,1	3,5	26,5	6,5	
Saudi Arabia	58,6	5,3		46,2	4,0	40,5	5,3	

More interesting are the results when comparing the relations of mathematics homework assigned to achievement. In Table 4.4.4 the mathematics achievement of native students are tabulated for the three groups of classes with different teacher emphasis on mathematics homework. Interestingly, there are several countries where the achievement differs statistically significant between the different groups.

There are three countries where the mathematics achievement of students with mathematics teachers with a high emphasize on mathematics homework achieved statistically significant lower than students with mathematics teacher with a medium emphasis on mathematics homework. But there are 12 countries where the mathematics achievement of students with mathematics teachers with a high emphasize on mathematics homework achieved statistically significant better than students with mathematics teacher with a medium emphasis on mathematics homework.

On average across all countries the students in the high category achieved seven score points above the students in the medium category. When focusing only on the countries where there is a statistically significant difference, in these countries the average difference between the students in the high category and the medium category amount even to 32 score points. The achievement difference between the students in the medium category and the students in the low category is even more pronounced.

There is no country where the students in the low category achieved statistically significant better than the students in the medium category but there are 18 countries out of 55 that have students in the low category where the mathematics achievement of students with mathematics teachers with a low emphasize on mathematics homework achieved statistically significant below the students with mathematics teacher with a medium emphasis on mathematics homework.

On average across all countries the students in the low category achieved 27 score points below the students in the medium category. Again, when focusing only on the countries where there is a statistically significant difference, in these countries the average difference between the students in the low category and the medium category amount even to 38 score points.

Table 4.4.5 shows the same results for the first generation immigrant students. There are four countries where the mathematics achievement of students with mathematics teachers with a high emphasize on mathematics homework achieved statistically significant lower than students with mathematics teacher with a medium emphasis on mathematics homework. But there are also four countries where the mathematics achievement of students with mathematics teachers with a high emphasize on mathematics homework achieved statistically significant better than students in the medium category.

The average achievement difference across all countries between the students in the high category and the students in the medium category is six score points. For the countries where there is a statistically significant difference, the average difference between the students in the high category and the medium category is nine score points. Again, the achievement difference between the students in the medium category and the students in the low category is on average higher.

Table 4.4.4 Mathematics Achievement of native students by mathematics teachers' emphasis on homework

Country	HIGH			MEDIUM		LOW		
	Math ach	SE		Math ach	SE	Math ach	SE	
Czech Republic	575,7	28,3	↑	505,0	7,7	502,1	3,1	
United States (Minnesota)	575,3	10,8	↑	532,9	4,7	493,5	15,4	↓
Bulgaria	502,7	8,7	↑	461,5	6,3	460,3	9,8	
United States (Massachusetts)	585,5	9,6	↑	547,2	5,3	508,1	11,1	↓
England	556,1	11,5	↑	521,3	10,5	500,0	6,3	
Israel	490,3	5,7	↑	457,7	7,7	408,9	24,1	
Romania	476,6	4,8	↑	445,4	9,1	407,8	13,0	↓
United Arab Emirates (Dubai)	422,1	38,6		394,7	14,8	403,9	21,9	
United States	542,2	5,8	↑	515,5	3,9	483,2	6,1	↓
Malta	514,9	2,6	↑	492,9	1,5	421,5	6,7	↓
Scotland	535,6	14,5		513,7	6,1	468,5	5,3	↓
Canada (British Columbia)	521,2	6,5	↑	500,2	3,5	487,5	8,6	
Singapore	608,4	6,0	↑	587,4	6,8	539,1	12,5	↓
Korea, Republic of	608,6	7,6		591,6	5,8	597,5	4,0	
Ukraine	473,2	5,3		460,8	5,6	444,7	6,6	
Iran, Islamic Republic of	407,6	5,0		395,5	8,4	413,8	12,0	
Cyprus	479,0	3,9	↑	467,4	2,2	463,5	9,4	
Morocco	397,7	8,1		386,1	4,6	381,2	9,0	
Thailand	448,7	7,7		437,8	9,0	439,7	14,0	
Georgia	421,5	8,0		411,4	7,9	408,9	37,8	
Ghana	329,6	8,6		319,6	7,9	323,5	7,4	
Botswana	375,7	4,4		366,1	3,7	357,0	6,7	
Hungary	527,7	14,2		518,8	3,7	484,7	17,7	
Mongolia	452,5	5,1		444,4	6,1	404,3	13,5	↓
Syria, Arab Republic of	411,5	4,7		403,4	7,6	406,4	8,0	
Hong Kong, SAR	589,7	11,2		581,8	10,2	549,8	17,1	
Chinese Taipei	621,1	7,5		613,3	4,8	569,7	7,5	↓
Russian Federation	519,1	6,1		511,8	4,4			
Turkey	433,9	9,6		428,7	8,8	434,9	10,4	
Armenia	499,9	3,6		495,1	5,4	499,8	12,8	
Malaysia	483,8	7,9		479,8	6,6	463,5	15,9	
Canada (Quebec)	543,6	12,6		540,4	5,1	509,8	5,3	↓
Sweden	509,7	7,4		507,0	3,6	494,3	2,3	↓
Oman	391,8	12,2		389,4	4,2	375,0	5,9	↓
Slovenia	511,5	7,7		509,2	2,6	491,3	12,0	
Italy	482,9	3,4		481,6	5,3	392,6	25,5	↓
Canada (Ontario)	517,0	5,3		515,8	4,7	506,6	11,5	
Colombia	387,1	4,5		387,9	7,6	371,5	10,2	
Spain (Basque Country)	505,2	6,0		506,1	3,6	499,8	7,8	
Jordan	429,2	13,1		432,8	6,0	420,1	9,0	
Egypt	424,9	8,6		428,7	4,7	424,7	7,5	
Norway	471,9	3,8		476,9	3,3	471,4	5,5	
Serbia	485,0	7,4		490,4	4,9	485,7	7,3	
Tunisia	420,1	3,5		426,7	3,3	425,0	10,3	
El Salvador	340,6	6,9		347,8	4,0	334,6	6,9	
Lithuania	502,8	5,6		511,8	2,6	484,1	6,0	↓
Japan	563,3	7,7		576,0	4,6	569,7	3,9	
Indonesia	403,9	7,9		417,1	6,7	393,0	9,9	↓
Bosnia and Herzegovina	449,4	9,7		463,5	4,0	449,8	5,9	
Lebanon	451,5	5,1		467,6	7,1	445,8	14,7	
Bahrain	388,1	5,7	↓	405,3	2,8	397,9	3,2	
Palestinian National Authority	367,1	14,8		386,1	4,3	368,2	6,4	↓
Saudi Arabia	316,5	17,7		338,2	4,0	331,1	4,2	
Kuwait	339,9	10,3	↓	366,6	7,6	362,6	3,3	
Australia	495,2	30,3		522,2	5,2	475,8	5,5	↓
Qatar	276,6	8,6	↓	314,7	2,0	298,4	3,7	↓

Table 4.4.5 Mathematics Achievement of first generation immigrant students by mathematics teachers' emphasis on homework

Country	HIGH			MEDIUM		LOW		
	Math ach	SE		Math ach	SE	Math ach	SE	
Japan	702,5	22,3	↑	559,2	28,7	521,1	26,1	
Thailand	425,6	55,6		346,7	39,7	NA		
Iran, Islamic Republic of	380,2	21,7		310,7	49,6	444,9	13,1	↑
Canada (Quebec)	577,8	26,8	↑	509,1	9,6	493,1	11,6	
Bulgaria	458,9	19,7	↑	391,6	10,5	438,1	26,9	
Korea, Republic of	648,8	89,0		599,0	35,9	655,3	24,2	
Spain (Basque Country)	486,6	16,0		446,9	12,5	423,8	8,3	
Czech Republic	537,3	18,9		501,2	11,1	480,1	9,3	
Israel	472,2	8,3	↑	436,5	15,8	371,7	41,8	
Georgia	386,6	15,7		351,6	16,4	335,8	32,6	
Scotland	507,4	42,6		476,8	19,9	429,1	12,0	↓
United States (Massachusetts)	521,1	22,5		491,4	12,0	456,5	18,4	
Saudi Arabia	325,4	25,3		303,6	9,1	291,8	8,3	
United States	487,3	12,8		465,5	6,3	439,5	9,8	↓
England	530,0	22,3		508,5	21,2	478,5	15,4	
Lithuania	464,8	20,6		446,6	9,8	407,7	21,0	
Hungary	481,7	31,0		465,7	18,5	433,5	77,5	
Armenia	515,8	23,4		501,3	13,6	492,5	19,1	
Romania	384,4	11,7		374,0	27,1	382,4	214,3	
Singapore	635,4	9,1		626,3	7,8	571,1	21,3	↓
Morocco	322,6	20,4		315,4	10,4	332,5	21,3	
Slovenia	459,9	19,3		452,9	7,9	391,8	17,8	↓
Tunisia	411,6	11,1		408,2	8,1	373,6	33,2	
Botswana	351,7	19,6		348,3	13,5	336,5	22,8	
Indonesia	349,3	10,2		347,0	8,3	353,6	9,6	
Sweden	464,4	13,5		464,4	13,2	454,1	8,3	
Turkey	401,2	24,4		402,6	27,0	409,1	41,4	
Cyprus	427,7	11,3		429,3	6,9	483,7	23,4	↑
Mongolia	390,7	8,1		392,3	8,2	371,8	18,9	
Syria, Arab Republic of	361,5	8,0		365,2	11,3	366,2	11,3	
Malaysia	428,1	15,6		433,2	10,8	410,0	15,6	
Colombia	314,4	13,4		319,6	10,7	321,0	15,6	
Italy	449,2	6,7		455,0	11,1	NA		
Ghana	258,2	11,2		265,2	9,0	271,8	11,7	
Russian Federation	494,9	10,8		502,6	12,4	NA		
United States (Minnesota)	484,7	18,8		492,7	14,5	458,4	13,7	
Egypt	339,0	7,4		347,0	7,0	368,7	8,3	↑
United Arab Emirates (Dubai)	472,4	16,4		482,6	5,6	504,4	13,0	
Hong Kong, SAR	564,5	12,5		576,2	9,2	492,1	21,6	↓
Jordan	381,8	22,6		393,9	12,0	363,5	14,1	
Norway	441,0	8,3		453,1	6,5	426,3	11,8	↓
Bosnia and Herzegovina	450,0	9,2		463,2	6,7	428,4	7,8	↓
Canada (British Columbia)	526,3	19,2		540,7	8,8	524,4	17,0	
Ukraine	389,4	13,0		403,9	11,0	343,5	10,1	↓
Serbia	446,2	16,7		461,1	13,2	462,4	14,3	
Lebanon	412,8	8,5		429,3	7,6	420,5	14,4	
Australia	498,2	29,1		516,7	10,0	478,7	12,4	↓
Kuwait	310,0	9,4		332,8	19,4	333,9	7,5	
Malta	418,2	19,5		442,1	6,0	337,5	26,8	↓
Oman	292,6	32,4		321,0	8,1	311,0	11,0	
Canada (Ontario)	514,0	11,8	↓	546,2	8,4	512,2	11,9	↓
Qatar	278,1	8,6	↓	310,9	5,0	278,4	3,8	↓
Chinese Taipei	491,1	18,6		524,2	16,5	474,1	12,6	↓
El Salvador	270,2	17,4		307,1	11,1	309,9	18,8	
Palestinian National Authority	294,5	13,7	↓	339,1	9,9	313,6	14,5	
Bahrain	326,8	18,5	↓	389,0	6,6	360,0	10,4	↓

There are three countries where the first generation students in the low category achieved statistically significant better than the first generation students in the medium category. But there are 14 out of 53 countries where the first generation students in the low category achieved statistically significant below the first generation students with mathematics teacher with a medium emphasis on mathematics homework.

On average across all countries the students in the low category achieved 39 score points below the students in the medium category. Again, when focusing only on the countries where there is a statistically significant difference, in these countries the average difference between the students in the low category and the medium category amount even to 49 score points.

Given the much smaller sample sizes and the consequently higher sampling errors for the achievement results of first generation immigrants students compared to the native students it is surprising that we can observe so many countries where the achievement of the first generation immigrant students in the low category is statistically significant lower than the achievement of the students in the medium category.

Also the differences are higher than to the ones found for the native students. This seems to indicate that giving infrequent and only little homework is related stronger to mathematics achievement for immigrant students than for native students. Considering that the overall mathematics achievement of first generation immigrant students is lower than the achievement of native students, this seems to contradict the results found by Hattie who stated "The effects [of homework] are greater for higher than for lower ability students…" (Hattie, 2008, p. 235) but rather supports Trautwein et-al. who stated: "This interaction effect indicates that low-achieving students gain more than high-achieving students from extensive homework assignments." (Trautwein et al., 2002, p. 45). Further research on the effect of homework on students with immigrant background is needed and could help understanding the effect found.

However, in terms of the researcher question six I conclude that in most countries there are no differences between native students and immigrant students in terms of the emphasize of the teacher on homework. But I find again Singapore, British Columbia and Quebec with differing results. In these countries, the percentage of first generation immigrant students in classes with a low emphasize on homework is statistically significant smaller than the percentage for native students. I found the relation between the emphasis on homework in mathematics and mathematics achievement of the students to be clearly positive in a good number of countries. Interestingly, in quite a number of countries the relationship seems to be even stronger for the first generation immigrant students.

Concentration of immigrant students

After having looked at class size and emphasize on homework, I will look at the distribution of immigrant students in classes. As discussed under "peer effects" in the literature review in chapter two, the concentration of the immigrant students across classes is often raised in public debates. As seen in chapter 2 the results in research are quite ambiguous. But there seems to be some evidence that there is a negative effect – at least on the immigrant students – when immigrant students are clustered together in classes.

For the following analysis the number of first generation immigrant students per mathematics class is calculated. Then the number of classes with a certain number of immigrant students is summarized.

Table 4.4.6 shows the absolute number of mathematics classes sampled in TIMSS 2007 with the number of first generation immigrant students. If there are ten or more first generation immigrant students then these classes are combined into the category "more than 9".

There is one caveat about this statistic. For larger classes the chance of finding an immigrant student in the class is higher. On system level this means that in countries where larger class sizes are found, the number of immigrant students per class will also be higher. To avoid this effect one could have calculated the percentage of immigrant students in the class but this resulted in statistics that were difficulty to interpret and the statistics especially for smaller classes were affected quite strongly even for very few immigrant students in the class. Since also the studies and articles cited in chapter two are looking at actual numbers, it was decided to accept the influence of the class size and work with actual numbers of immigrant students per class.

As can be seen in the table, in most countries there are very few classes with more than six or seven first generation immigrant students. But in Bosnia and Herzegovina, Palestine, Ghana, Hong Kong, Oman, Qatar, Syria, Egypt, and Dubai there is a good amount of classes with ten or more first generation immigrant students.

Interestingly, we see that the number of classes with a different number of immigrant students varies quite substantially. In countries with a high percentage of immigrant students one sees classes with few immigrant students but also classes with a medium and high number of immigrant students. But also for countries with similar percentages of immigrant students we see quite distribution of immigrant students in the classes. For example in Slovenia and Georgia we have quite similar percentages of first generation immigrant students as can be seen from table 4.1.1 (five and six percent respectively). But whereas in Slovenia about half of the first generation immigrant students are in classes with only one first generation immigrant student, in Georgia about three quarter of the first generation immigrant students are in classes with two or more first generation immigrant students.

Now, since we know that there are differences within and between countries in terms of the distribution of immigrant students in classes, I want to look if this impacts the mathematics achievement results. Next the achievement of all students and then also immigrant and native students is calculated separately for different numbers of immigrant students in the class.

Table 4.4.6 Number of classes with specfied number of first generation immigrant students

Country	First generation immigrant students in the class										
	0	1	2	3	4	5	6	7	8	9	>9
Armenia	55	77	58	28	10	11	1	2	0	1	7
Australia	60	69	54	25	10	8	5	2	2	2	1
Bahrain	32	28	41	31	15	12	18	7	5	6	6
Bosnia and Herzegovina	12	25	21	16	21	16	17	11	5	3	34
Botswana	54	37	32	12	5	3	4	0	0	1	3
Bulgaria	89	76	35	26	9	8	1	1	2	0	0
Canada (British Columbia)	26	40	30	23	9	18	9	6	10	3	13
Canada (Ontario)	88	51	27	10	9	6	10	8	1	1	3
Canada (Quebec)	80	65	34	19	13	5	2	3	2	1	2
Chinese Taipei	33	50	31	25	10	2	1	1	0	0	0
Colombia	55	36	26	13	10	4	3	1	0	0	1
Cyprus	63	85	49	27	16	7	4	3	3	1	1
Czech Republic	140	45	17	2	6	0	1	1	0	0	0
Egypt	4	9	10	19	18	21	16	7	11	14	109
El Salvador	49	42	27	21	6	1	0	1	1	0	0
England	89	73	39	16	13	6	1	1	0	0	0
Georgia	70	52	38	12	8	1	3	0	0	0	0
Ghana	21	15	23	18	16	16	13	6	12	7	27
Hong Kong, SAR	2	3	6	9	12	19	14	8	9	9	29
Hungary	165	53	25	1	1	1	0	0	0	0	0
Indonesia	21	22	18	16	19	19	7	8	2	4	13
Iran, Islamic Republic of	178	23	6	1	0	0	0	0	0	0	0
Israel	25	42	22	20	9	11	4	3	2	2	6
Italy	151	78	41	12	3	2	0	0	0	0	0
Japan	134	26	5	1	0	0	0	0	0	0	3
Jordan	29	24	28	29	23	21	14	12	5	6	9
Korea, Republic of	134	14	0	2	0	0	0	0	0	0	0
Kuwait	9	24	21	22	22	22	10	11	6	2	9
Lebanon	26	28	34	32	21	20	8	11	4	6	15
Lithuania	140	80	31	6	1	0	0	0	0	0	0
Malaysia	51	37	27	13	9	3	5	3	5	2	8
Malta	74	75	44	20	8	4	4	3	0	0	0
Mongolia	15	21	22	22	24	13	9	9	7	5	5
Morocco	57	24	22	11	7	5	1	1	1	0	2
Norway	94	88	50	25	1	3	3	0	0	0	0
Oman	17	25	25	10	18	9	9	9	7	5	24
Palestinian National Authority	6	17	24	12	13	17	14	8	9	9	24
Qatar	10	13	27	20	31	34	29	36	19	18	51
Romania	177	60	19	7	2	1	0	0	0	0	0
Russian Federation	119	68	38	29	11	5	1	0	0	0	0
Saudi Arabia	34	27	27	24	24	20	20	7	5	4	12
Scotland	104	74	43	12	6	4	0	0	1	0	0
Serbia	85	73	33	22	6	4	1	2	1	0	0
Singapore	95	105	57	33	15	9	6	6	0	0	0
Slovenia	113	102	30	12	3	0	0	0	0	0	0
Spain (Basque Country)	85	29	15	8	4	3	1	3	0	2	1
Sweden	112	87	51	33	13	8	2	0	1	0	0
Syria, Arab Republic of	2	5	7	14	15	21	10	10	12	13	41
Thailand	128	16	6	0	0	0	0	0	0	0	0
Tunisia	68	58	19	16	8	0	0	0	0	0	0
Turkey	101	26	12	6	0	0	1	0	0	0	0
Ukraine	58	45	41	15	10	7	5	1	1	0	1
United Arab Emirates (Dubai)	2	9	9	11	7	9	10	8	9	3	76
United States	209	136	63	28	29	21	5	10	2	1	6
United States (Massachusetts)	31	23	14	10	5	4	7	1	2	0	0
United States (Minnesota)	46	33	12	5	2	1	1	1	0	0	1

In the next analysis, the students are grouped by the number of immigrants in their mathematics class[8]. Three groups are created to make the results easier to visualize and interpret. The first group includes students attending classes without immigrants, the second group includes students who are in classes with one or two immigrants and the last group includes students attending classes with three or more immigrants. Then, the average mathematics achievement is calculated for each of the three student groups and the averages are compared for statistically significant differences. The reference group for the analysis is the group of students attending classes with one or two students and the significant differences of the other groups are shown in table 4.4.7.[9]

There are several countries where the classes without immigrant students outperform classes with immigrant students. For example in Chinese Taipei, the classes without immigrant students outperform the classes with at least one immigrant student by 20 score points, which on the other hand outperform classes with two or more immigrant students by another 15 score points – but not statistical significant as can be seen from the table.

Also in the United States, the classes with at least one immigrant student by 25 score points, which on the other hand outperform classes with two or more immigrant students by another 28 score points. Both differences are statistically significant in the United States. The most extreme case is Hungary where the classes with more than two immigrants students are outperformed by classes with only one or two immigrant students by 136 points and by 130 score points by classes without immigrant students but this is based on three classes and consequently should not be over interpreted.

But there are also countries where the achievement does not differ significantly, as for example Cyprus, England or Italy. And there are also countries, where the classes with immigrants outperform the classes without immigrants. In British Columbia, Canada, classes with at least one immigrant student outperform classes without immigrants by 12 score points and were outperformed by classes with two or more immigrant students by another 29 score points.

In Singapore classes with at least one immigrant student outperform classes without immigrants by 27 score points and were outperformed by classes with two or more immigrant students by another 36 score points. In Norway, the classes without immigrants and the classes with one immigrant score at about the same level (496 and 466 respectively) but the classes with two or more immigrants achieved 478 score points which is significantly higher than the 466 achievement of the classes with one immigrant student.

[8] As discussed in chapter three, the within sampling units within schools in TIMSS are mathematics classes, the class affiliation in this case reflects the mathematics classes. Since some of the educational systems are using course systems where the combination of students changes between their courses (e.g. the USA) having mathematics classes as sampling units enables the analysis shown here.

[9] Since classes with more students have a higher chance of including immigrant students than smaller classes if immigrants would be allocated to classes randomly and independent of the class size, the class sizes of the three groups of classes were calculated and compared to avoid this obvious source of bias since as shown before there are correlations between class size and achievement of the students.

Table 4.4.7: Mathematics achievement by number of immigrants in the class

	no immigrants			1 or 2 immigrants			3 or more immigrants	
Country	Math Ach	SE		Math Ach	SE		Math Ach	SE
Egypt	387	55,1	→	433	15,6	↓	390	3,5
United Arab Emirates (Dubai)	379	4,7	↓	415	13,2	↑	466	2,9
Singapore	566	7,2	↓	593	6,0	↑	629	8,2
Lebanon	446	8,5	↓	471	8,0	↓	441	5,4
Australia	481	6,7	↓	499	5,7	→	504	9,7
Israel	455	12,6	→	468	7,5	→	460	6,8
Canada (British Columbia)	484	6,2	→	496	4,0	↑	525	4,7
Palestinian National Authority	372	15,9	→	382	7,3	↓	362	4,6
Saudi Arabia	336	4,8	→	346	4,5	↓	323	3,5
Italy	475	4,6	→	483	3,7	→	480	8,8
England	508	8,9	→	516	7,0	→	515	13,3
Japan	567	2,7	→	575	12,3	→	563	15,9
Jordan	439	8,7	→	445	9,0	↓	414	5,6
Morocco	383	4,3	→	389	5,8	↓	370	6,9
Hungary	516	3,9	→	522	6,1	↓	386	39,1
Bosnia and Herzegovina	442	12,2	→	447	5,9	↑	460	3,1
Cyprus	462	3,3	→	466	2,3	→	465	3,2
Armenia	492	7,2	→	496	4,1	→	508	8,2
Russian Federation	512	5,0	→	515	5,8	→	498	9,1
Turkey	433	6,4	→	435	10,6	↓	396	15,1
Serbia	488	4,4	→	490	4,7	↓	464	7,6
Ghana	328	12,6	→	329	11,3	↓	302	5,5
Bahrain	409	3,7	→	408	3,7	↓	388	2,4
Iran, Islamic Republic of	403	4,1	→	402	11,5	→	423	0,0
El Salvador	342	4,3	→	341	4,7	→	336	7,6
Romania	464	5,3	→	463	6,9	→	416	26,2
Canada (Quebec)	527	4,3	→	525	5,6	→	528	12,0
Sweden	496	3,4	→	493	2,5	↓	477	4,8
Norway	469	3,3	→	466	2,5	↑	478	4,7
Oman	394	8,6	→	389	5,9	↓	363	4,7
Canada (Ontario)	513	7,0	→	509	4,6	↑	532	5,8
Czech Republic	505	3,1	→	500	5,4	→	489	6,4
Kuwait	367	13,4	→	360	4,2	↓	349	3,2
Georgia	416	9,9	→	407	8,3	→	402	10,4
Slovenia	506	3,0	↑	498	2,7	→	482	12,0
Tunisia	425	4,0	→	416	3,3	→	423	5,9
Ukraine	477	5,8	→	465	5,7	↓	434	9,7
Lithuania	511	2,7	↑	499	4,5	→	486	20,8
Scotland	496	5,6	→	482	6,0	→	473	14,5
Spain (Basque Country)	507	3,7	→	493	7,2	→	478	10,0
Botswana	371	3,4	↑	354	3,0	↑	373	8,7
Colombia	395	5,4	→	379	6,8	→	357	13,9
Indonesia	435	13,1	→	417	7,7	↓	380	5,2
Chinese Taipei	619	6,8	↑	596	6,3	→	581	7,1
United States	530	4,4	↑	505	3,8	↓	477	6,1
Malta	517	1,2	↑	489	1,3	↓	427	2,1
Hong Kong, SAR	622	0,8	→	592	23,6	→	569	6,0
Mongolia	478	10,2	↑	445	7,4	↓	423	4,4
Bulgaria	496	6,2	↑	458	8,3	↓	422	9,3
Malaysia	508	6,9	↑	469	8,1	↓	441	7,6
Syria, Arab Republic of	473	74,5	→	423	10,3	↓	393	3,8
Qatar	374	4,8	↑	320	2,1	↓	304	0,8

Overall I find 14 countries with a statistical significant lower mathematics achievement in classes with two or more first generation immigrant students compared to classes with only one immigrant student. On the other hand I find seven countries with a statistical significant higher mathematics achievement in classes with two or more first generation immigrant students compared to classes with only one immigrant student. And I find 10 countries with a statistical significant lower mathematics achievement in classes with one first generation immigrant students compared to classes with no immigrant student. But also there I find four countries with a statistical significant higher mathematics achievement in classes with one first generation immigrant students compared to classes with no immigrant student.

The last mentioned group of the four countries where the mathematics achievement in classes with at least one immigrant is higher compared to classes with native students only. This group consists of Singapore and Dubai – two countries where I know from chapter 4.1 that the mathematics achievement of immigrant students is higher than the achievement of the native students. But I also find Lebanon and Australia among these countries – two countries where the mathematics achievement of the first generation immigrant students is lower than the achievement of native students due to the results from chapter 4.1. It would be interested to learn what this is caused by.

Anyhow, based on this analysis the findings of previous research that there is a tendency that students in classes with a significant fraction of immigrant students achieve lower seems to be supported. But there are also exceptions to this. But since the analysis does not distinguish between the achievement of the immigrant students in the class and the native students' achievement, the differences are highly influences by the achievement differences between immigrant students and native students. The following analysis should dig a little deeper into this.

To examine the effect of the immigrant students on the achievement of classes further, the mathematics achievement was calculated for immigrants and non-immigrants separately by the three groups of classes; classes without immigrants, classes with one or two immigrants and classes with more than two immigrant students.

First, the effect on the immigrant students shall be evaluated. As discussed in chapter 2 so far research has shown that there is a negative peer effect of a high percentage of immigrant students in a class on the achievement of the immigrant students – majorly in language achievement.

Table 4.4.8 shows the mathematics achievement of the students in classes with one or two immigrant students compared to classes with two or more immigrant students. In Botswana, British Columbia, Dubai and Singapore, the students in classes with more than two immigrant students outperform the immigrant students in classes with only one or two immigrant students significantly.

In 11 countries the opposite is the case with Hungary being the most extreme case where immigrant students in classes with only one or two immigrants outperform the immigrant students in classes with more than two immigrants by 140 score points but again I should keep in mind that there are only three classes with more than 2 immigrants in the Hungarian sample.

Also in Malta and Japan the mathematics achievement difference between immigrant students in classes with only one or two immigrants and immigrant students in classes with more than two immigrants exceeds 70 score points but also in Japan there is a problem with the shire numbers because there is only one class with more than three immigrant students.

Table 4.4.8 Mathematics achievement of immigrant students by number of immigrants in class

Country	classes with 1 or 2 immigrants		classes with more than 2 immigrants		Difference		
	Math Ach	SE	Math Ach	SE	Math Ach	SE	
Hungary	481	13,0	341	40,6	140	42,7	↑
Japan	543	19,7	464	22,4	78	29,8	↑
Malta	467	8,5	395	8,2	71	11,8	↑
Romania	394	12,8	343	23,5	50	26,7	→
Palestinian National Authority	372	18,5	325	7,6	47	20,0	↑
Egypt	394	19,7	351	4,9	42	20,3	↑
Colombia	343	9,8	303	12,9	40	16,3	↑
Turkey	414	19,5	378	30,2	35	36,0	→
Indonesia	382	13,6	348	6,1	33	14,9	↑
Qatar	327	14,9	294	3,0	33	15,2	↑
Ghana	293	14,2	261	6,0	32	15,4	↑
Bulgaria	426	13,0	394	13,5	31	18,7	→
Lebanon	448	11,6	419	5,3	29	12,7	↑
Oman	342	16,2	313	6,5	29	17,4	→
Hong Kong, SAR	580	31,9	552	8,4	27	33,0	→
Serbia	468	13,7	442	11,5	26	17,9	→
Saudi Arabia	319	10,7	295	7,0	24	12,8	→
Morocco	337	10,2	313	8,7	24	13,4	→
Malaysia	447	13,0	423	9,7	24	16,2	→
Syria, Arab Republic of	387	15,4	363	6,0	24	16,5	→
Ukraine	411	11,3	388	12,3	23	16,7	→
Sweden	469	7,0	447	8,2	22	10,8	↑
United States	479	6,1	461	7,4	18	9,6	→
Israel	456	15,7	439	9,4	18	18,3	→
Jordan	398	12,2	382	10,3	17	15,9	→
Scotland	456	10,9	440	18,6	17	21,6	→
Lithuania	448	9,7	432	21,7	16	23,7	→
Spain (Basque Country)	455	14,2	443	11,4	12	18,2	→
El Salvador	303	10,6	291	17,0	12	20,0	→
Bahrain	385	11,8	375	4,7	10	12,6	→
Mongolia	397	12,5	388	6,1	9	13,9	→
Georgia	374	15,6	366	21,2	9	26,4	→
Slovenia	449	8,0	443	17,2	6	19,0	→
Canada (Quebec)	517	8,9	512	12,2	5	15,1	→
Russian Federation	501	9,8	498	13,8	3	16,9	→
Tunisia	407	6,5	404	11,4	3	13,2	→
Iran, Islamic Republic of	376	20,2	376	22,4	0	30,2	→
Kuwait	326	11,5	329	6,8	-3	13,4	→
Chinese Taipei	490	11,8	500	14,5	-9	18,7	→
Italy	449	7,4	459	9,3	-10	11,9	→
Norway	441	5,4	452	7,7	-11	9,4	→
Czech Republic	483	10,3	494	9,9	-11	14,3	→
Australia	488	8,8	503	11,5	-15	14,5	→
England	487	10,2	502	18,1	-15	20,8	→
Cyprus	417	9,0	435	6,7	-18	11,3	→
Canada (Ontario)	517	10,6	540	6,9	-23	12,6	→
Bosnia and Herzegovina	426	14,3	455	4,8	-29	15,1	→
Singapore	602	7,9	639	9,1	-37	12,1	↓
Armenia	483	10,1	523	19,4	-40	21,8	→
United Arab Emirates (Dubai)	442	17,9	489	3,5	-47	18,2	↓
Canada (British Columbia)	493	10,1	541	8,5	-49	13,3	↓
Botswana	312	11,4	380	15,0	-68	18,8	↓

Table 4.4.9: Mathematics Achievement of Non-Immigrants by number of immigrants in class

Country	No immigrants in class		Difference	1 or 2 immigrants in class		Difference	More than 2 immigrants in class	
	Math Ach	SE		Math Ach	SE		Math Ach	SE
Egypt	373	56,4	-64 ⇨	437	18,2	14 ⇨	423	3,5
Lebanon	445	8,7	-29 ⇧	474	8,0	18 ⇩	456	5,3
Singapore	567	7,2	-25 ⇧	592	6,1	-34 ⇧	627	8,4
Australia	483	7,1	-19 ⇧	502	5,9	-4 ⇨	505	9,8
United Arab Emirates (Dubai)	382	8,4	-14 ⇨	396	10,8	-50 ⇧	446	3,9
Canada (British Columbia)	484	6,4	-12 ⇨	496	4,1	-25 ⇧	521	3,9
Japan	569	2,9	-12 ⇨	580	12,3	25 ⇩	555	3,6
Italy	476	4,7	-12 ⇨	487	3,8	2 ⇨	486	10,3
Jordan	438	8,8	-12 ⇨	450	9,2	26 ⇩	424	5,9
Saudi Arabia	337	4,9	-11 ⇨	348	5,4	16 ⇩	331	3,5
Morocco	383	4,5	-10 ⇨	393	5,3	16 ⇩	377	6,7
England	511	9,1	-9 ⇨	520	6,9	0 ⇨	519	12,5
Hungary	517	3,9	-9 ⇨	526	6,1	115 ⇩	411	37,4
Palestinian National Authority	372	16,3	-9 ⇨	381	7,3	2 ⇨	379	4,8
Cyprus	464	3,5	-8 ⇧	472	2,3	-4 ⇨	476	3,6
Israel	466	12,6	-7 ⇨	473	7,4	-2 ⇨	475	6,5
Ghana	326	12,8	-7 ⇨	332	11,4	16 ⇨	317	5,8
Romania	464	5,3	-6 ⇨	470	6,7	36 ⇩	435	26,7
Bosnia and Herzegovina	443	12,6	-6 ⇨	449	5,9	-15 ⇧	464	3,5
Serbia	489	4,4	-4 ⇨	494	4,7	25 ⇩	468	7,6
Turkey	433	6,5	-4 ⇨	437	10,6	44 ⇩	393	14,9
Russian Federation	514	5,1	-3 ⇨	518	5,8	17 ⇩	501	9,2
Armenia	495	7,5	-3 ⇨	498	4,0	-6 ⇨	504	6,3
Iran, Islamic Republic of	404	4,3	-1 ⇨	405	11,5	-10 ⇨	415	13,1
Sweden	497	3,5	0 ⇨	497	2,6	9 ⇩	488	4,8
El Salvador	344	4,6	1 ⇨	343	5,0	0 ⇨	343	7,1
Bahrain	411	4,1	2 ⇨	410	3,8	17 ⇩	393	2,7
Canada (Quebec)	531	4,6	2 ⇨	529	5,3	-6 ⇨	535	12,3
Norway	472	3,4	2 ⇨	470	2,6	-15 ⇧	484	5,3
Georgia	418	10,4	4 ⇨	414	8,4	6 ⇨	408	10,6
Slovenia	508	3,2	5 ⇨	503	2,7	10 ⇨	493	11,9
Czech Republic	507	3,2	5 ⇨	502	5,4	13 ⇩	488	6,0
Canada (Ontario)	515	7,1	6 ⇨	509	4,6	-20 ⇧	529	6,1
Oman	395	7,9	6 ⇨	389	6,4	12 ⇨	377	5,0
Ukraine	477	5,9	6 ⇨	471	5,6	22 ⇩	448	9,2
Lithuania	512	2,8	6 ⇨	506	4,3	7 ⇨	499	20,7
Kuwait	371	13,8	7 ⇨	364	4,5	6 ⇨	358	3,4
Tunisia	425	4,1	7 ⇨	417	3,5	-9 ⇨	426	5,6
Spain (Basque Country)	508	3,8	10 ⇨	498	7,0	4 ⇨	494	9,6
Scotland	498	5,7	11 ⇨	487	5,9	1 ⇨	486	13,4
Botswana	372	3,6	13 ⇩	358	3,0	-14 ⇨	372	8,8
Colombia	395	5,5	13 ⇩	382	6,7	17 ⇨	366	14,1
Chinese Taipei	621	6,9	17 ⇩	604	6,3	10 ⇨	594	7,0
United States	531	4,4	22 ⇩	509	3,7	27 ⇩	482	6,1
Indonesia	442	14,6	22 ⇨	420	7,9	25 ⇩	395	5,3
Malta	519	2,1	27 ⇩	491	1,7	53 ⇩	438	2,7
Mongolia	479	10,9	30 ⇩	449	7,7	18 ⇩	431	4,5
Bulgaria	498	6,1	34 ⇩	465	8,5	27 ⇩	437	8,8
Hong Kong, SAR	629	9,1	35 ⇩	594	23,6	16 ⇨	578	5,8
Malaysia	508	6,8	37 ⇩	471	8,0	25 ⇩	446	7,8
Syria, Arab Republic of	469	74,6	49 ⇨	420	11,4	16 ⇨	404	3,9
Qatar	373	6,8	54 ⇩	319	3,3	11 ⇩	308	2,1

There seems to b e a tendency that a higher percentage of immigrant students and a lower achievement of the immigrant students go together. But there are also examples where the mathematics achievement of immigrant students is higher when they are together with other immigrant students in the class.

After I looked at the achievement differences for the immigrant students I want to look if there are any differences to be observed for the native students depending on the number of immigrant students in the class. Table 4.4.9 shows the mathematics achievement of the non-immigrant students by classes with none, one or two and more than two immigrant students in the class. Mostly there seems to be a negative peer effect on native students if the number of immigrant students in the class increases. This is line with most previous research. Unlike previous research there seems to be a stronger relationship for native students than for the immigrant students.

But there are also interesting counter examples. In Singapore, Australia, Dubai and British Columbia, the native students in classes with more than two immigrants are significantly better than their peers in classes with fewer or no immigrant students. Since in Singapore, Dubai and British Columbia the immigrant students are outperforming the non-immigrant students there seems to be a peer effect in favor of non-immigrant students who are taught together with the high performing immigrant students. This effect of higher performing students in a class who have a positive effect on their peers is also known as reflected glory effect as discussed in chapter 2.

Considering also these positive effect, one might interpret the results as the peer effects are less related to the fact that the peers have an immigrant background but rather peer effects of lower achieving students. In that sense increasing immigrant students' achievement can be regarded also as a measure to increase the achievement of their native peers.

All these statements must of course be treated with caution. The data is cross-sectional and there is no experimental design. There might be selection effects and other not known hidden factors. Consequently, I cannot examine real effects. But the results might give an indication of potential effects.

With respect to research question seven I can say that there are differences between countries in terms of the distribution of the immigrant students between classes. There are some countries with a very high number of immigrant students in the class. I also saw a tendency that students in classes with immigrant students perform less well in mathematics. But the picture is ambiguous. For the mathematics achievement of the first generation immigrant students I found that in a couple of countries (11) the mathematics achievement of immigrant students is higher when there are only one or two immigrant students in the class. Also for native students there seems to be a negative association between their mathematics achievement and the number of immigrant students in their classes. This relationship is even stronger as for the immigrant students. But the results for the countries where the mathematics achievement of the immigrant students is higher than for the native students suggest that the effect is more related to peers with lower performance than peers who are immigrants. Of cause I could not measure causal effects and the term effect is meant here in a statistical sense.

Summary

There is some evidence that smaller classes have a positive impact on students achievement – mostly supported by the STAR project conducted in the 1980s in the United States. For most countries I cannot find any differences in percentages of immigrant students and native students attending smaller classes. But there are some exceptions in both directions. In Bahrain, Bulgaria, Malta, Qatar, Romania and Scotland there is a statistically significant higher proportion of first generation immigrant students in smaller classes than native students. In the United States are statistically significant more native students in small classes than first and second generation immigrant students. Also in Jordan and Norway there are statistically significant more native students in small classes than second generation immigrant students.

In terms of relationship between class size and mathematics achievement overall I could not find a positive relationship between smaller classes and higher achievement. Contra intuitively the mathematics achievement of immigrant students in smaller classes tends to be lower than that of their peers in larger classes. There might be related factors like smaller classes found more often in rural areas where students tend to achieve lower but the data is not large enough to allow for more in-depth analysis of this.

For the emphasize on homework there is no difference between teachers of immigrant students and native student except the cases of Singapore and two of the Canadian provinces where there are less first generation immigrant students in classes with a lower emphasize on homework. The effect on the mathematics achievement is similar for native and immigrant students: students in classes with a higher emphasize on homework tend to achieve higher in mathematics.

When looking at the number of immigrant students per class we can see that in most countries there are very few classes with more than six or seven first generation immigrant students. Only in Bosnia and Herzegovina, Palestine, Ghana, Hong Kong, Oman, Qatar, Syria, Egypt, and Dubai there is a higher percentage of classes with ten or more first generation immigrant students.

There is also a tendency that students in classes with more immigrant students tend to perform lower. Counterexamples are Singapore, Dubai and British Columbia where the immigrant students achieve relatively high compared to the native students and there is a positive effect on mathematics achievement.

So far I found immigrant students achieving lower in most countries that I looked at. I found some interesting results when looking at the students' background and the school and class characteristics for native and immigrant students. These will be summarized and discussed in the summary at the end of the thesis. But I found also few countries with higher mathematics achievement of the immigrant students. In the following two chapters I will look deeper into the case of Singapore and Canada to find potential reasons for the higher performance.

Chapter 5A Immigrant students in Singapore[10]

The history of the educational system in Singapore

Singapore gained independence in 1959 and separated from Malaysia in 1965. In 1965 the literacy rate in Singapore was 60% (Chong & Cheah, 1997). Singapore has no natural resources or agriculture or industry. As table 1 shows, less than two percent of the population were working in the agricultural and fishery industry in 1980-1999; mining or other industries gaining from natural resources are not listed at all.

Table 1 (Yue, 2001, p. 28):

Composition of Employment by Occupation, 1980-99

(Percent)

	1980	1985	1990	1995	1997	1999
Legislative, administrative, managerial	6.3	7.6	8.6	12.8	12.6	12.4
Professional	0.0	4.5	4.2	7.3	9.0	9.9
Technical and associate professional	11.7	9.9	11.5	15.8	17.5	18.0
Clerical	13.8	14.4	13.1	12.9	15.2	14.0
Service, shop, and market sales	14.6	15.4	13.8	12.3	12.5	13.1
Agricultural and fishery	1.6	1.1	0.3	0.1	0.1	0.1
Production,, operators, cleaners, labourers	46.3	42.3	44.5	34.6	29.8	29.1
Other	5.8	4.7	4.0	4.2	3.3	3.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: *Singapore Yearbook of Statistics*, various years.

The Singaporean policy makers understood that their main resource is the country's population, which emphasized the need for it to be an educated one. "Apart from people, we have no other natural resources, hinterland or agriculture. Our livelihood depends on enterprise and hard work. It depends on our wits too, and our ability to adapt quickly every time the environment changes... to compensate for Singapore's natural resource deficiencies, (the government) emphasized the human factor: policies were designed to affect the behavior of people and to maximize their individual potential and contribution to the country"(Goh, 2005) (Chong & Cheah, 1997, p. 2). This resulted in big investments in education and said policies.

Immigration in Singapore

From the beginning of its independence Singapore has had a quite diverse and multicultural population. In 1970 77.0 percent of the population were Chinese, 14.8 percent Malays, 7.0 percent Indians and 1.2 percent others (Department of Statistics, Singapore, 2013). The Singaporean society was defined by a mixture of cultures; therefore, in order to avoid conflicts due to different cultural backgrounds but rather see the challenge of multiculturalism as a chance, policies were implemented to avoid conflicts. Even today the government is taking measures to mix cultures rather than foster the creation of subgroups within the population. For example when new areas are created for settlements or when existing settlements are enlarged, the Ethnic Integration Policy determines that a certain percentage of each ethnic group should live there. If a certain percentage of inhabitants from an ethnic group is living in one area, "… transactions that make the community more

[10] This chapter was written by me during a seminar about "Globalization and Educational Policy" at the University of Urbana-Champaign in Illinois in December 2012.

segregated will not be allowed" (Wong, 2013, p. 6). Moreover the schools usually have a mixture of the cultures as intakes. In school lessons not only the various cultures are respected but aims are undertaken to create multicultural groups, and to learn and benefit from each other. An example for this are music groups that are formed in various schools that use traditional instruments from all three cultural groups and combine them in one orchestra.

All these measures have probably had a positive impact on the acceptance of new immigrants as well. But some resistance of the Singaporean population on further immigration was observed anyhow which then impacted immediate actions from the policy's side to reduce this effect (Sidhu, Ho, & Yeoh, 2011).

Immigrants are an important factor for the Singaporean economy. The number of births per female Singaporean declined from 4.66 in 1965 to 1.24 in 2006 (Chong & Cheah, 1997). This results not only in an aging population but also in a reduced workforce stemming from native Singaporeans. Singapore is actively recruiting people from other countries with special emphasis on well-educated immigrants. The Singaporean law regulates the immigration. "Skilled workers and professionals and entrepreneurs are encouraged to take up a permanent residence and citizenship may be grated after two to ten years of residence. Unskilled foreign workers, on the other hand, are permitted to work only for a limited time period, after which they are expected to return home" (Brownlee & Mitchell, 1997) (Department of Statistics Singapore, 2011, pp. 5f, 24). To summarize this in Zygmunt Baumann's terminology (Baumann, 2003), Singapore encourages the tourists to come to the country and even to apply for permanent residency but allows vagabonds to come into Singapore only to work for a limited time.

Singapore's education system in international comparison

The Singaporean education system ranks high in all international large-scale system monitoring surveys. This pattern is observed not only in single points in time but it is a fact that is repeatedly shown in surveys. In the IEA Trends in International Mathematics and Science Study (TIMSS) 1995 Singapore ranked first in mathematics and in science in grade eight, and ranked first in mathematics and seventh in science in grade four (Beaton, Martin, et al., 1996) (Beaton, Mullis, et al., 1996) (Mullis et al., 1997) (Martin et al., 1997). In TIMSS 1999 Singapore ranked first in mathematics and second in science (Mullis, Martin, Gonzalez, et al., 2000) (Martin, Mullis, Gonzalez, et al., 2000). In TIMSS 2003 Singapore ranked first in mathematics and in science in both grades four and eight (Martin, Mullis, Gonzalez, & Chrostowski, 2004) (Mullis, Martin, Gonzalez, Gregory, & Chrostowski, 2004). In TIMSS 2007 Singapore ranked second in mathematics in grade four and third in grade eight but in both cases not statistically significantly below the first and second ranked country. For grade eight this was caused by a slight drop in the achievement of 13 score points compared to TIMSS 2003. For grade four the decrease was despite the fact that the Singaporean achievement increased slightly (Martin, Mullis, Gonzalez, et al., 2004) (Mullis et al., 2004). In TIMSS 2011 Singapore again had the highest mathematics achievement of grade four students and the second highest of grade eight students – not statistically significantly below first-ranked Korea. This improvement was caused by a slight increase of the grade four achievements and a remarkable and statistically significant increase of the grade eight performance of nearly one fifth of a standard deviation. In TIMSS 2011 in science, Singapore ranked first in grade eight – statistically better than all other countries – and second in grade four – not statistically significant below first-ranked Korea. The grade eight student achievement in science was 23 score points higher than in TIMSS 2007 – an increase of nearly a

quarter of a standard deviation (Martin et al., 2012; Mullis et al., 2012). In summary, one can conclude that the achievement of Singaporean students in mathematics and science was and is always in the top ranks and still increasing.

Immigrant students in Singapore

I will now summarize the results from the analysis of the TIMSS 2007 data for Singapore. As can be seen in table 4.xx there are eleven percent of first generation immigrant students and 19 percent of second generation immigrant students in Singapore. Table 4.xx1 shows that not only native students with an average mathematics achievement score of 588 are among the the highest performers – first generation immgrants even outperformed them with an achievement of 622 score points. Second generation immigrant students also perfomed statistically significantly higher than native students with an average of 597 score points. First generation immigrant students are on average ten months older in grade eight than native students (15.1 compare to 14.3 according to table 4.1.xx4), whereas second generation immigrants are of the same age as native students. Considering the results from (Cliffordson & Gustafsson, 2010) regarding the effect of maturing compared to schooling in terms of students' achievement, the higher achievement of first generation immigrant students is put into perspective to a certain extent. These results cannot, however, fully explain the great magnitude of the achievement gap.

When looking at the age of first generation immigrant students when coming to Singapore, we see that 38 percent of the students immigrated at the age of ten or above, 24 percent at an age between five and ten and 38 percent before the age of five (see table 4.1.x). The highest mathematics achievement of 631 score points is observed for those students who came to Singapore at the age of ten or later, the second highest for students who came before the age of five with an average of 624 points, and the lowest for students who came between the age of five and ten (see table 4.1.x). But due to great variance within these groups and consequent big standard errors, only the difference between students who came after the age of ten and students who came between the age of five and ten differs significantly, favoring the students who came to Singapore at a higher age. This is an interesting result since it is opposed to the theory that an earlier start in the educational system results in better achievement (see (Myers et al., 2009), which seems not to be true in Singapore.

When looking at the boy-girl differences we observe that the participation rate is almost the same for boys and girls among native students as well as among the immigrant student populations. Among native students girls are outperforming boys in mathematics achievement by 15 score points, among first generation immigrants by 24 score points, and among second generation immigrants by six score points; the latter difference being not statistically significant. This means that the highest achieving group is first generation immigrant girls and the lowest is native boys. The difference between these two groups is more than a quarter of a standard deviation and when looking at the grade seven-grade eight differences in TIMSS 1995, it equals nearly the learning gain of one school year.

When looking at the language that the students speak at home, I find that 56 percent of native students, 51 percent of first generation imigrant students and 67 percent of second generation immigrant students do not speak the language of the test at home. This is a very high percentage at first glance but less surprising when looking at this in-depth. As we see in exhibit 4.1 (Olson et al., 2008, p. 67) Singapore tested all students in TIMSS 2007 only in English. As explained above the

population of Singapore consists mainly of Chinese, but also of Malays, Indians, and a small group of other origins. In Singapore there are four official languages: English, Mandarin, Malay, and Tamil. Mandarin, Malay, and Tamil are regarded as the languages of heritage and culture (Silver 2004) but 'English was designated as the first language of the school and so it came to be referred as the "first language".' As a result, mother tongues were described as "second languages" (Silver, 2005, p. 55). This creates the curious effect that the language that children are learning first becomes their second language in later life. A big emphasis in Singapore is put on bilingualism – or in recent times even multilingualism. The literacy rate in 2010 was 96 percent; 80 percent of the Singaporean population is literate in English and 71 percent of the population is literate in two or more languages (Department of Statistics, Singapore, 2013). In school, mathematics and science are taught in English; therefore, Singapore decided to test their students' mathematics achievement in TIMSS in English. The fact that English is a language that most of the students start learning only in school makes the high achievement of Singaporean students in an international assessment even more surprising and respectable. For good job opportunities and communication across ethnic groups, English is the only tool. "English was treated as a necessity with regard to inter-ethnic communication and economic development" (Silver, 2005, p. 53). Only recently, due to the increasingly open economic market in China, has Mandarin also been regarded as having a role also in economics and consequently school policies changed. Singapore has a clearly streamed school system and only students with overall high achievement – and this means mainly mathematics, science, and English – were enrolled in the highest streams. In 2004 this was adapted and "[f]lexibility has been introduced in that students who fall into the lower stream for English and Math can take the regular mother tongue course rather than the simplified B Syllabus if their mother tongue scores merit this variation" (Silver, 2005, p. 60).

A very striking factor of Singapore' immigrant student is the parental background. Whereas only 33 percent of native students and 26 percent of second generation immigrant students have parents with an ISCED 5 edcation or above, 64 percent of first generation immigrants have parents with an ISCED 5 education or above. On the other hand only ten percent of first generation immigrant students have parents with an educational level of ISCED 2 or below compared to 19 percent of second generation immigrant students and 15 percent of native students. As described above, Singapore is very selective when it comes to immigration into the country and there is a clear distinction between skilled workers and unskilled ones. This causes the majority of immigrants to have a very good educational background. Dr. Ng Eng Hen, Minister for Education and Second Minister for Defence, said in a speech at the 5th Teachers' Conference 2010 on September 6, 2010: "New immigrants, and those who become PRs and new citizens, have higher educational qualifications too. Last year, 2 in 3 new citizens came with post-secondary educational qualifications. The trend for PRs is similar—nearly 8 in ten new PRs have post-secondary qualifications" (Hen, 2010). Previous research has shown, too, that the socioeconomic background of students explains a big portion of achievement differences between students (see for example (Sirin, 2005).

Looking at the Singaporean students' attitude I can conclude that among all immigration groups, 85 to 86 percent of the students like to go to school. But interestingly 75 percent of native students answered that they like mathematics, as did 72 percent of second generation immigrants, but even 82 percent of first generation immigrants. The attitudes towards mathematics are statistically significantly higher for first generation immigrants than for the other students. This result is coherent for boys and for girls. The self-perception of the students' mathematics abilities also shows a similar pattern with 81 percent of first generation immigrant students reporting to do well in mathematics

compared to 65 percent of native students and 66 percent of second generation immigrant students. Obviously the students' self-perceptions match the achieved results across these three groups.

Access to schools in Singapore

Another factor that created the positive achievement results of immigrant students in the schools is probably that access to the schools is restricted for students with an immigrant background. Before they are allowed to enroll in a school in Singapore they are required to pass an Admissions Exercise for International Students (AEIS) test. "AEIS consists of a centralized test on English and Mathematics that will assess the applicants' English literacy, numeracy and reasoning abilities. Applicants who pass the test will be offered a place in a suitable school, based on availability of school vacancies, their test performance and declared address in Singapore"(Ministry of Education, Singapore, 2013a). Since the requirements for the test are high, "International students are strongly encouraged to prepare themselves before taking the Admissions Exercise for International Students (AEIS) tests. They should be familiar with the English and Mathematics syllabi of the level preceding the one they are applying for" (Ministry of Education, Singapore, 2013a).

Support programs in Singapore

A third factor for the success might be that students who have learning difficulties are strongly supported in the educational system. The Learning Support Programme for English (LSP) started in twelve primary schools in 1992. In 1996, the program was implemented in 93 primary schools and in 1998 the LSP was rolled out to all primary schools. "The LSP is a specialized early intervention program aimed at providing learning support to students who enter Primary 1 with weak English language and literacy skills. Students are identified for the LSP through a systematic screening process carried out at the beginning of Primary 1. The objective of the LSP is to equip students with basic literacy skills so that they could access learning in the regular classroom"(Ministry of Education, Singapore, 2013b).

"Each year, 12 to 14 percent of the Primary 1 cohort is identified to require support in the LSP. Results have shown that the LSP has helped around 30 percent of these children to read at their age level and pass their school-based English Language examinations by the end of Primary 1. Students who were not able to do so continued to receive support in Primary 2. At the end of Primary 2, another 10 percent of students would have been able to read at their age level and pass their examinations" (Ministry of Education, Singapore, 2008).

The Enhanced learning support program (ELSP) at Primary 1 level has been introduced to all primary schools from January 2007, while the program at Primary 2 level started out 2008. 40% of the students who underwent the ELSP met the discharge criteria at the end of Primary 1. The other 60% went on to the Primary 2 ELSP where 25% met the discharge criteria, making it 65% who were discharged at the end of Primary 2. The remaining 35% were assessed for dyslexia or other forms of learning disability, and were given appropriate and specific forms of support (Hong, 2009).

"The original LSP provided remedial help to students in what is being taught in the regular English classes. The enhanced LSP, on the other hand, teaches skills which can be used to learn in the different subject areas. It was designed for Primary 1 and 2 students, and focuses on five major components that international research has found to be critical in helping students in early primary

grades learn to read and spell: Alphabetic knowledge, knowledge of sound-letter correspondences, fluency, vocabulary, and reading comprehension" (Ministry of Education, Singapore, 2008).

Other factors might relate to the general circumstances in Singapore. Since the population of Singapore is already multicultural and has a diverse background, and since ethnic conflicts are a known problem in the Singaporean history, Singapore has policies in place to overcome them. Some of these policies are policies addressing the whole population as the policy for mixing ethnics groups in new settlements or cultural festivals that help citizens to become familiar with other ethnics' cultures. Others are addressing schools that are required to have a mix of cultures as intake and school bands supporting intercultural activities like school bands consisting of students with different ethnical background playing classical instruments of their cultural origin. It can be assumed that new immigrants to Singapore are experiencing more openness than in other countries. Hence, integration in a multicultural population might be easier.

Summary

The Singaporean economy depends very much on human resources. Consequently, education has a high value, is in the focus of policy makers and is getting very good financial support. This results in Singapore achieving high scores in international comparisons. The results for students with an immigrant background are also very positive. This has probably multiple reasons: Firstly, immigrants to Singapore have in general a very high level of education; consequently, the students entering the educational system have parents with a high socio-economic status. Positive achievement resulting from this fact cannot, of course, be attributed to the educational system of Singapore. Secondly, immigrant students entering the educational system have to prepare in order to pass the admission test. Positive effects emerging from this can probably only partially be attributed to the Singaporean educational system's success, and only in the sense that private initiatives to learn are strongly encouraged. The factor that might have a positive impact on immigrant students' achievement that can mostly be attributed to the Singaporean educational system is the invention of support programs for students with low achievement in mathematics and in English. And last but not least the attitude towards immigrants and the value of ethnic diversity are probably also fostering the integration of immigrants in society and in schools.

In summary I conclude that the Singaporean educational system is probably facing fewer challenges related to immigrant students than other countries although the number of immigrant students is relatively high. However, this may also be due to initiatives assisting students with an immigrant background.

Singapore is an example where the challenges of immigration for the educational system seem to be reduced and met quite successfully, thus somewhat reducing the problems that students with an immigrant background are facing. In future research it would be interesting to determine more clearly what the impact of the different policies implemented is. For this purpose more longitudinal research projects and case studies targeting immigrants would be beneficial.

With respect to research question eight I conclude that the selective immigration policies of Singapore might have impacted the positive achievement results of their immigrant students and this can probably not help policy makers in other countries to learn how to improve the achievement of their immigrant populations. Also the experience that Singapore gained about how to deal with a diverse and multi-cultural society can probably not easily be mirrored in other countries but maybe

some of the specific policies could be used to inspire other countries' policies. The support programs for immigrant students might also have contributed to the positive achievement outcome and could be used to inform other countries' policies. We cannot disentangle which of the different aspects had which impact on the educational outcome of the immigrant students. Maybe additional data for example on the achievement of students enrolled in the support programs compared to those not enrolled in the support programs might shade some light on the different effects.

Chapter 5B Immigrant students in Canada

Educational system of Canada

Canada is a federal system with respect to immigration as well as education policies. Federal law is applied as well as legislation from the ten provinces and three territories in the North. According to Section 93 of the Canadian constitution education falls under the provincial jurisdiction and consequently education policies vary between provinces. But beyond this there is also a federal influence by allocating financial resources from the federal government. On the website of the Official Languages and Bilingualism Institute (OLBI) at the University of Ottawa it reads:

"Moreover, problems can arise between the provinces and central authorities when the latter use their spending power to intervene directly or indirectly in areas of provincial jurisdiction. For example, the federal government can use its financial clout to influence certain social services like pension funds, various areas of education (primary and secondary teaching, vocational education and universities), health and municipalities" (University of Ottawa, n.d.).

Immigration in Canada

Immigration in the Canadian system is a shared responsibility between the provincial jurisdiction and the federal jurisdiction. Section 95 of the Canadian constitution states:

"In each Province the Legislature may make Laws in relation to Agriculture in the Province, and to Immigration into the Province; and it is hereby declared that the Parliament of Canada may from Time to Time make Laws in relation to Agriculture in all or any of the Provinces, and to Immigration into all or any of the Provinces; and any Law of the Legislature of a Province relative to Agriculture or to Immigration shall have effect in and for the Province as long and as far only as it is not repugnant to any Act of the Parliament of Canada."

Although Canada has been an immigration country for centuries, the Canadian immigration policy changed significantly in the past. Going back about 150 years I find:

"According to the 1870-71 census, Canada's total population was 3.6 million. In addition to native peoples (about 136 000 in 1851) the 2 largest groups were the French (1 million) and the British (2.1 million). Excepting the Germans (203 000), other groups (Dutch, American blacks, Swiss, Italians, Spanish, Portuguese) were much smaller. During the next century, about 9.3 million people immigrated to Canada and, although many went on to the US or eventually returned to their native lands, by 1996 Canada's population had surpassed 29 million." (Dirks, 2006).

Today about 250,000 immigrants migrate to Canada each year and about 20 percent of the Canadian population consists of immigrants.

"Canada has welcomed, as you all know, an annual average of more than 250,000 immigrants since 2006, since our government came into office. This is the highest sustained level of immigration in Canadian history. But to ensure that immigration will fuel and drive our future prosperity, we need to select immigrants who are ready, willing and able to integrate into Canada's labour market and to fill roles where we have existing skills shortages. We have to make sure that the skilled immigrants we choose are the ones Canada needs and are the most likely to succeed when they arrive." (Alexander, 2013).

Similar to Singapore, also Canada gives preference to immigrants with a higher education – and even more so in more recent times. The immigration admission program is based on a credit point system which determines preferences for immigration. Up to 100 points can be obtained by potential applicants. 69 credit points are required to apply for admission. Between 1985 and 2004 up to 15 points could be obtained for a vocational training, twelve for education, and 15 for language skills in English or French. In 2004 the credit system changed. From then on vocational education was not rewarded anymore but the education counted for up to 25 credit points. As Simmons described: "After these most recent changes, a person with a post-secondary diploma or degree involving two or more years of study automatically receives 20 points or roughly 30 percent of the 69 points required for admission. Anyone with less than a high school studies completed would get 0 points on the education criteria." (Simmons, 2010, p. 95). The language expertise was increased to 25 credit points. This means that about half of the credit points could be obtained by a high education and the mastery of English or French. Or in other words, without the credit points in education and language competencies a potential applicant will not be able to achieve the 69 credit points needed for admission (see (Simmons, 2010)).

Another aspect that regulates the immigration flow is that since March 1992 immigrants are charged a fee. For a couple with two children the total amount of the fees sums up to 3,200 Canadian Dollars. For less resourced people this poses an obstacle to the immigration application. Also this policy puts a preference for immigrants with a higher socio economic status.

However, not only economic aspects are driving the immigration policies of Canada. One has to admit that also humanitarian aspects influence the immigration policies. Chris Alexander, Canadian Minister of Citizenship and Immigration, said in a presentation on Canada's immigration policies in September 2013:

"We see the tide of humanity that has sought to escape conflict in Syria and other parts of the world, some of whom – the most vulnerable among whom – will of course be welcome in Canada." (Alexander, 2013).

And indeed, Canada is the country accepting the third most refugees in the world. The immigration fee, however, is also applicable to refugees. Whereas some of the refugees are applying for immigration under refugee aid programs others apply and are accepted by applying for immigration based on the credit point system that prefers skilled workers.

As in Singapore, in Canada the public opinion regarding immigrants is rather positive. 'In terms of public opinion, Canadians have a more positive view of immigrants and immigration than do Americans and Western Europeans. They are less likely to view immigrants as "stealing" jobs or committing crimes, and the majority of Canadians view immigration as an opportunity, not a problem. Furthermore, only 17 percent of Canadians think there are "too many" immigrants in their country, compared to 37 percent of Americans and 59 percent of the British.' (Statistics Canada, n.d.).

This positive public opinion might also influence the living conditions for immigrants and might it make easier for them to integrate into the society. Students, for example, can integrate into the schools system more easily. It might also foster the willingness to accommodate the needs of students with an immigrant background more openly.

But as stated above the immigration policies are partly subject to provincial legislation and consequently the immigrant policies and consequently also immigrant population differ between the provinces and territories. Table 5.2.1 displays the number of immigrants for Canada as well as the Canadian provinces and territories and the country of origin of the immigrants based on the 2006 census data. Table 5.2.2 displays the distribution of immigrants' countries and regions of origin for Canada and for each province and territory.

Table 5.2.1: Immigrant population by place of birth, by province and territory (2006 Census)

	2006													
	Canada	N.B.	Que.	Ont.	N.L.	P.E.I.	N.S.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.
	number													
Total — Place of birth	6.186.950	26.395	851.555	3.398.725	8.380	4.780	45.195	151.230	48.160	527.030	1.119.215	3.010	2.815	450
United States	250.535	8.655	26.575	106.405	1.400	1.255	7.960	7.090	5.425	28.325	56.560	600	235	40
Central and South America	381.165	845	78.010	216.640	395	150	1.020	17.765	2.545	31.160	32.455	60	95	20
Caribbean and Bermuda	317.765	470	80.835	211.380	145	90	980	4.085	725	10.365	8.575	15	60	30
Europe	2.278.345	10.835	306.515	1.307.885	4.040	2.465	22.565	62.545	21.615	187.675	349.410	1.675	915	195
United Kingdom	579.625	5.210	16.035	321.650	2.335	1.165	11.665	15.225	7.690	60.215	137.460	555	345	90
Other Northern and Western Europe	489.540	3.790	92.555	209.610	945	960	6.640	15.845	5.670	53.020	99.225	860	340	70
Eastern Europe	511.095	805	72.765	304.495	420	145	2.110	18.875	5.255	46.610	59.320	150	115	25
Southern Europe	698.080	1.030	125.165	472.130	345	190	2.150	12.605	3.000	27.830	53.400	110	115	15
Africa	375	1.225	123.990	164.795	560	165	2.125	7.660	3.540	35.525	34.575	75	285	35
Asia and the Middle East	2.525.160	4.095	233.000	1.376.595	1.780	485	9.910	51.490	13.860	225.410	606.730	515	1.165	115
West Central Asia and the Middle East	370.515	950	81.035	213.980	270	160	3.950	3.965	1.715	24.775	39.605	10	90	10
Eastern Asia	874.370	1.440	52.655	417.985	545	225	2.735	7.635	5.055	72.330	313.415	135	180	25
Southeast Asia	560.995	735	56.420	270.710	245	35	1.115	31.290	4.765	73.675	120.865	275	820	50
Southern Asia	719.275	965	42.890	473.915	725	65	2.115	8.600	2.335	54.630	132.845	90	70	30
Oceania and other countries	59.410	265	2.620	15.025	65	165	630	580	435	8.570	30.910	70	60	15
Source: Statistics Canada, 2006 Census of														
Last modified: 2007-12-11.														

Table 5.2.2: Immigrant population by place of birth, by province and territory (2006 Census)

	2006													
	Canada	N.B.	Que.	Ont.	N.L.	P.E.I.	N.S.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.
	Percentage													
United States	4,05%	32,79%	3,12%	3,13%	16,71%	26,26%	17,61%	4,69%	11,26%	5,37%	5,05%	19,93%	8,35%	8,89%
Central and South America	6,16%	3,20%	9,16%	6,37%	4,71%	3,14%	2,26%	11,75%	5,28%	5,91%	2,90%	1,99%	3,37%	4,44%
Caribbean and Bermuda	5,14%	1,78%	9,49%	6,22%	1,73%	1,88%	2,17%	2,70%	1,51%	1,97%	0,77%	0,50%	2,13%	6,67%
Europe	36,83%	41,05%	35,99%	38,48%	48,21%	51,57%	49,93%	41,36%	44,88%	35,61%	31,22%	55,65%	32,50%	43,33%
United Kingdom	9,37%	19,74%	1,88%	9,46%	27,86%	24,37%	25,81%	10,07%	15,97%	11,43%	12,28%	18,44%	12,26%	20,00%
Other Northern and Western Europe	7,91%	14,36%	10,87%	6,17%	11,28%	20,08%	14,69%	10,48%	11,77%	10,06%	8,87%	28,57%	12,08%	15,56%
Eastern Europe	8,26%	3,05%	8,54%	8,96%	5,01%	3,03%	4,67%	12,48%	10,91%	8,84%	5,30%	4,98%	4,09%	5,56%
Southern Europe	11,28%	3,90%	14,70%	13,89%	4,12%	3,97%	4,76%	8,33%	6,23%	5,28%	4,77%	3,65%	4,09%	3,33%
Africa	0,01%	4,64%	14,56%	4,85%	6,68%	3,45%	4,70%	5,07%	7,35%	6,74%	3,09%	2,49%	10,12%	7,78%
Asia and the Middle East	40,81%	15,51%	27,36%	40,50%	21,24%	10,15%	21,93%	34,05%	28,78%	42,77%	54,21%	17,11%	41,39%	25,56%
West Central Asia and the Middle East	5,99%	3,60%	9,52%	6,30%	3,22%	3,35%	8,74%	2,62%	3,56%	4,70%	3,54%	0,33%	3,20%	2,22%
Eastern Asia	14,13%	5,46%	6,18%	12,30%	6,50%	4,71%	6,05%	5,05%	10,50%	13,72%	28,00%	4,49%	6,39%	5,56%
Southeast Asia	9,07%	2,78%	6,63%	7,97%	2,92%	0,73%	2,47%	20,69%	9,89%	13,98%	10,80%	9,14%	29,13%	11,11%
Southern Asia	11,63%	3,66%	5,04%	13,94%	8,65%	1,36%	4,68%	5,69%	4,85%	10,37%	11,87%	2,99%	2,49%	6,67%
Oceania and other countries	0,96%	1,00%	0,31%	0,44%	0,78%	3,45%	1,39%	0,38%	0,90%	1,63%	2,76%	2,33%	2,13%	3,33%
Source: Statistics Canada, 2006 Census of														
Last modified: 2007-12-11.														

In table 5.2.1 I can see that in 2006 more than six million immigrants were living in Canada. Nearly 3.4 million of them are living in Ontario which is more than half of the total immigrant population in Canada. The second largest group of immigrants - with about 1.1 million – can be found in British Columbia followed by Quebec that accommodates 850,000 immigrants. Consequently, these three provinces that participated in TIMSS cover nearly 90 percent of the Canadian immigrant population.

As can be seen in table 5.2.2 in the different provinces and territories there is a different distribution of source countries of immigrants. In British Columbia more than 50 percent of the immigrants come from Asia – this is the highest percentage of Asian origin among the Canadian provinces and territories. Within the Asian group the majority of immigrants come from Eastern Asia (28%). The second largest group of immigrants in British Columbia comes from Europe (31.2%) with the majority originating from the United Kingdom (12.3%).

The situation in Ontario is quite similar although there are fewer immigrants from Asia (40.5%) and more immigrants from Europe (38.5%), from Central and South America (6.4%) and from the Caribbean (6.2%). Compared to British Columbia the majority of the European immigrants' origin is Southern Europe and not the United Kingdom.

Somewhat different is the situation in Quebec. Whereas British Columbia and Ontario are - as all other provinces and territories - Anglophone, Quebec is mostly francophone which reflects in that Quebec's immigrant population is mostly from francophone areas. We observe only half of the percentage from Asia (27.4%) compared to British Columbia. The majority of Asian immigrants come from the West Central Asia and the Middle East (9.5%), which is the highest among all Canadian provinces and territories. Quebec also has the highest percentage of immigrants from Africa (14.6%) and the Caribbean (9.5%) among all Canadian provinces and territories, and the second highest percentage of immigrants from Central and South America (9.2%). In terms of countries of origin the immigrant population in Quebec seems to be more diverse than in Ontario and British Columbia and more affected by a common language background.

Another factor affecting the situation for immigrants in Quebec is that due to language situation within Canada – with a minority of citizens speaking French -, the francophone citizens of Quebec are regarded as more isolated and linked closer together which might make it more difficulty for foreigners to integrate into the society. Simmons writes: „French speaking Quebecers in small towns are less familiar with immigrants in general, particular those of non-European origin. They live among ethnic kin with whom they are closely linked by intermarriage, have common religious practices, and a long history of living together." (Simmons, 2010, p. 54). This might also be a reason for the fact that there are significantly less immigrants in smaller communities in Quebec (see table 4.3.1). Whereas there are 14 percent of immigrants in communities with more than 500,000 inhabitants and six percent in communities with 3001 to 500,000 inhabitants, there are only two percent in communities with 3,000 or less in habitants in Quebec. In Ontario and British Columbia the percentage of immigrants is higher in general but also in communities with less than 3,000 inhabitants we find five percent of immigrants in Ontario and even nine percent of immigrants in British Columbia.

Immigrant students in Canada

I have seen in table 4.1.3 that in British Columbia the first generation immigrant students' mathematics achievement in TIMSS 2007 is 33 score points higher than the mathematics achievement of native students – exactly the difference between the grades eight and nine in TIMSS

1995 in Canada. The second generation immigrant students in British Columbia performed 18 score points above the native students in mathematics in TIMSS 2007. In Ontario the first immigrant students were eleven score points ahead of the native students in TIMSS 2003 and 22 score points ahead in TIMSS 2007. The second generation immigrant students in Ontario were at about the same level in mathematics as native students in TIMSS 2003 and TIMSS 2007 with three, respectively nine score points ahead. In Quebec the first generation immigrant students were 30 score points behind the native students in mathematics in TIMSS 2003 but the difference was reduced to only 17 score points in TIMSS 2007. The second generation immigrant students in Quebec were only slightly behind with seven score points in TIMSS 2003 and one score point in TIMSS 2007.

In science the results for the immigrant students were not that positive. In British Columbia the first as well as second generation immigrant students were one score point better than the native students in TIMSS 2007 – which was certainly within the measurement error. In Ontario the first immigrant students were 15 score points below the native students in science in TIMSS 2003 but one score points ahead in TIMSS 2007. The second generation immigrant students in Ontario were eight score points behind the native students in TIMSS 2003 and in TIMSS 2007 three score points ahead. In Quebec the first generation immigrant students were 55 score points behind the native students in science in TIMSS 2003 and still 21 score points behind in TIMSS 2007. The second generation immigrant students in Quebec were 22 score points behind in TIMSS 2003 and still 13 score points behind the native students in TIMSS 2007.

Statistics Canada did research on the language abilities of immigrant students. They found in their statistics: “The language skills of children of immigrant parents just entering the school system were weaker than those of Canadian-born parents, but the longer the children lived in Canada, the smaller the gap in performance became, until it disappeared. In fact, in later years, the academic performance of many of these students surpassed that of their Canadian-born counterparts.” (Statistics Canada, n.d.).

Also the research from Worswick supported his observation. He concluded: “Overall, children of immigrants generally do on average at least as well as the children of the Canadian-born along each dimension of school performance. The children of immigrant parents whose first language is either English or French have especially high outcomes. The children of other immigrant parents have lower performance in reading than do other children; however, their performance in other areas is comparable to that of the children of Canadian-born parents. Evidence is also found that, with more years in the Canadian education system, the performance of these children in reading converges to that of the children of Canadian-born parents. In general, the results indicate that the children of immigrants have predicted performance in virtually all areas that is at least as good as the performance of the children of the Canadian-born by age 13. In a number of cases, this standard is met at much earlier ages.” (Worswick, 2001, p. 13).

In summary, I conclude that the situation in mathematics is more positive for the immigrant population than in science but that in both mathematics and science the trends are positive. Other research supported the positive results for students with an immigrant background in Canada.

Factors found in the quantitative research

After investigating the general outcome, I want to look more in depth into the results from chapter 4 for Canada. Especially differences between the provinces are in focus here.

When looking at the age immigrants at immigration, we can observe that in British Columbia the immigrant students tend to come to Canada at a later age than it is the case in Ontario. The immigrant students in Quebec were even younger when immigrating to Canada. In Quebec we see that the immigrant students that migrated at a younger age performed better than the students who migrated at a later age. In Ontario the result is exactly the opposite and the immigrant students who migrated later are scoring higher. In British Columbia the picture is ambiguous and no clear pattern could be observed.

When examining the differences between girls and boys, we find that only in Ontario there is a slightly smaller percentage of first generation immigrant girls enrolled in schools (46 percent). Also the mathematics achievement is very similar for boys and girls in the three Canadian provinces for all immigration groups and for native students. Only in Ontario the first generation immigrant students achieved significantly better than their female peers (543 versus 523 score points).

As already indicated above in terms of the language spoken at home I see from chapter 4.1 that in all three provinces that participated in TIMSS 2007 there is a very large number of first generation immigrant students that do not speak the language of the test at home. In British Columbia 42 percent of first generation immigrant students do not speak English at home. In Ontario where most of the test were conducted in English[11] (and some in French) 37 percent of first generation immigrant students do not speak the language of test at home and in Quebec where most of the tests were conducted in French (and some in English) 35 percent of first generation immigrant students do not speak the language of the test at home. These are among the highest percentages across all countries. Countries with a higher percentage are mostly countries that have also a high percentage of non-immigrant students that do not speak the language of the test at home. In the Canadian provinces there are six percent and less native students not speaking the language of the test at home. In Singapore, for example, 67 percent of the first generation immigrant students do not speak the language of the test at home but this is also true for 51 percent of the native students. As described in chapter 5.1, in Singapore this is mostly driven by the fact that the population consists of three major ethnics groups with different native languages – Chinese, Malays, and Indians. In Ontario and in British Columbia there are language support programs on a decentralized level. Schools are offering English Literacy Development (ELD) programs or English as a second language (ESL) programs. The programs can be integrated classroom programs, intensive or partial support programs, tutorial support or other forms of support programs (Settlement.org, 2012), (Province of British Columbia, 2013). However, the provinces are giving clear guidelines for these courses. In Ontario the ministry of education published: “The document provides practical strategies and models for integrating language and content instruction for ESL/ELD students in those classrooms.” (Ministry

[11] It should be noted here that although the language of the test was primarily French in Quebec and English in Ontario and British Columbia, children who were taught in English in Quebec were also tested in English and children who were taught in French in Ontario and British Columbia were tested in French in TIMSS. But these were only small percentages in each of the provinces. However, we can conclude that the English minorities in Quebec and the French minorities in Ontario and British Columbia do not affect the results presented here.

of Education, Ontario, 2001, p. 6) and promotes a holistic approach that includes the parents, the teachers as well as the whole school environment. It suggests:

"**Promoting an Inclusive and Supportive School Environment**
All school staff members should work towards creating a welcoming and supportive atmosphere for ESL/ELD students. School administrators can help to create such an atmosphere by implementing some of the following suggestions:
• post visual images that represent all students in the school;
• provide signs, notices, and announcements in the languages of the school community;
• honour the various cultural and faith celebrations within the school;
• encourage and recruit bilingual volunteers;
• have staff who provide ESL/ELD support collaborate in program planning;
• promote professional development opportunities for ESL/ELD staff and classroom teachers;
• take ESL/ELD considerations into account when creating timetables;
• include time for ESL/ELD progress reports in the agenda for staff meetings;
• make resources for effective implementation of ESL/ELD programs accessible to staff;
• allocate budget funds for the purchase of inclusive curriculum resources;
• consult regularly with board and community resource personnel about additional ways to support and strengthen ESL/ELD programs." (Ministry of Education, Ontario, 2001, p. 15).

The initiative is targeted to students with an immigrant background as well as students grown up in a non-English speaking environment. This includes students with Franco-Canadian background as well as students from native Canadian families. Here, a parallel to the situation in Singapore can be observed. Similar to Singapore, also Canada has different language groups living in the country and needed to find ways to accommodate their needs and to find a cooperative way to live in one country. Also parallel to Singapore, Canadian policies appreciate the non-dominant languages (other than English) and find it important to protect them. On page seven of the Ontario resource guide I find: „Research indicates that students benefit academically, socially, and emotionally when they are encouraged to develop and maintain proficiency in their first language while they are learning English. Language skills and conceptual knowledge are readily transferable from one language to another, provided there are no learning exceptionalities. The first language provides a foundation for developing proficiency in additional languages, serves as a basis for emotional development, and provides a vital link with the student's family and cultural background."

When comparing the percentage of first generation and second generation students who are not speaking the language of the test the result for the Canadian states is very different. In Quebec there are 23 percent of second generation immigrant students who do not speak the language of the test at home compared to only 15 percent in British Columbia and only ten percent in Ontario. There are two interpretations of this aspect. One is that the populations who immigrated to the different provinces and territories changed significantly in the last 20 to 30 years. Another interpretation is that although British Columbia's and Ontario's immigrant populations include a high percentage of people not speaking English after a couple of years, the language spoken at their homes in Canada changes to English after immigrating to Canada. Whereas in Quebec there is a higher percentage of immigrants that already speaks French but those who do not speak French from the beginning also don't speak French after a couple of years living in Canada. If the latter is the case, policy makers in Quebec might reflect on policies that help immigrants to integrate better – especially in terms of language. Language courses for immigrants and especially for children of immigrants might be advisable. Based on these figures – with the caveat that the immigrant population might have

changed over time due to the immigration policies but also other factors – one can assume that the immigrant population seems to be well integrated after less than a generation – at least in terms of the language especially in British Columbia and Ontario.

When looking at the education of the parents, I see in chapter 4.1 that similar to Singapore also in the Canadian provinces there are significantly more immigrant students whose parents completed an education of ISCED level five or above. In all three provinces there are more than 70 percent of first generation immigrants' students whose parents completed an education of ISCED level five or above compared to native students with less than 50 percent of the parents having completed an education of ISCED level five or above. On the other hand, the percentage of students with parents who finished an education of ISCED level two or below is quite low in all three groups – the native students, the first and the second generation immigrant students – with a maximum of six percent among the second generation immigrant students in Quebec. Obviously, also Canada attracts better educated immigrants – as in Singapore - also steered by their immigration policies of the country as described above.

Another aspect related to the parental background is the socio-economic status of the parents. The number of books at home was used as a predictor for the socio-economic status. As also found by (Brese, F. and Mirazchiyski, P., 2010) the number of books at home is not a good predictor of SES between countries but works quite well within countries. So, although the students in British Columbia and Ontario are among the students with the highest average number of books at home, this does not mean that their socio-economic status is among the highest of the participating countries. But we can see in chapter four that the difference between the immigrant students and the native students is rather small in all three provinces. Thus we can assume that the socio-economic status is very similar between the native and the immigrant students. Interestingly, also Statistics Canada found in its research: "In Canada, parental education is less important as a determinant of educational attainment among the children in immigrant families than among those with Canadian-born parents. Less educated immigrant parents are more likely to see their children attain higher levels of education than are their Canadian-born counterparts." (Picot & Hou, 2011). This is an interesting finding that shows that there is more about the impact of immigrant students' parents than their own educational background.

Other literature also identifies parents as one of the factors for the success of immigrant students in Canada. Li did quantitative research on Chinese parents of immigrant students in Canada. He found that the Chinese parents have very high expectations for the achievement of their children which impacts the children's achievement positively (Li, 2001). In fact, on the official Canadian website the positive results of the immigrant students are explained with their parent's attitude towards their children's education. They state: „Such a fact may not be a surprise to immigrant parents – many of whom chose Canada because of its top-ranked education system. Some experts say that for numerous families, enrolling children in school is one of the first tasks performed upon arrival." And in the following: '"Education is the most important thing for most of these parents, it's why they come here," says Sharaline Joseph, a settlement worker at the Peel District School Board. Joseph notes that many of her clientele include families with high levels of education, who place extreme value upon learning.' (Immigration Canada, 2012).

The attitudes towards school in all three Canadian provinces are more positive in the case of first generation immigrant students than for native students as can be seen in table 4.1.11. Also the

second generation immigrant students in British Columbia and Quebec answered more frequently than their native peers that they like going to school. This can on one hand be regarded as a positive outcome for the immigrant students but also as a factor that influences the high achievement of the immigrant students in Canada. The same is true for liking mathematics. Also for this question a higher percentage of the immigrant students indicated to like mathematics.

An interesting aspect is the self-rating in mathematics reported in table 4.1.14. In Quebec and Ontario the percentage of students who agree or strongly agree to doing well in mathematics is similar for the immigrant and the native students. In British Columbia the percentage of students who agree or strongly agree to doing well in mathematics is significantly higher for the immigrant students compared to the native students. This is a surprising result when considering the countries of origin. In British Columbia more than half of the immigrants come from Asia and the Middle East with 28% coming from Eastern Asia as can be seen in table 5.2.2. The students in the Eastern Asian countries in general rate their mathematics abilities rather low as can be seen in table 4.1.14. This gap between the higher achieving in Eastern Asia and the students' self-efficacy is already reported by Lin et al (Lin, Hung, & Lin, 2013) or Mullis et al. (Mullis et al., 2008). In the TIMSS 2003 mathematics report the authors explicitly find: "It is noteworthy that the four countries with lowest percentages of students in the high self-confidence category – Chinese Taipei, Hong Kong SAR, Japan and Korea – all had high average mathematics achievement. Since all of these countries are Asian Pacific countries, they may share cultural traditions that encourage modest self-confidence." (Mullis, Martin, & Foy, 2005, p. 135) Consequently, the question arises why especially in British Columbia, the Canadian province with the highest percentage of immigrants from the Eastern Asian region; I observe the most positive self-esteem of the immigrant students compared to native students.

Summary

The achievement results for students with an immigrant background were very positive in British Columbia and Ontario and somewhat less in Quebec. This seems to be affected to a big proportion by the parental background. The immigration policy in Canada is highly selective and immigrants that have a high education and that are financially affluent are advantaged. The parents of immigrant students also seem to have a positive direct influence on their children's achievement because they put a strong emphasis on high education – this is in particular the case for immigrants from East Asia. Interestingly, this effect seems to be independent of the immigrant's social background.

Also the general positive atmosphere towards immigrants in Canada might have an impact on the positive outcome for immigrant children. This positive attitude towards non-English or non-French speaking residents might be caused by the fact that – similar to Singapore – Canada is a multi-language and multi-cultural society that had to find ways to deal with the diversity before modern immigration started.

The education system of Canada is decentralized and the different provinces have different educational policies. Canada has support programs for students that do not speak the language used for teaching in the schools. These programs target immigrants as well as English speaking students in francophone provinces and French speaking students in Anglophone provinces as well as aborigine students. The English Literacy Development (ELD) programs or English as a second language (ESL) programs give guidance to schools but leave it to schools to implement them in a way customized to the situation.

With respect to research question eight I conclude that as in Singapore also in the Canadian provinces the selective immigration policies of the country seem to have impacted the positive achievement outcome of the immigrant students. Also Canada is a rather multi-cultural society which seems to create a fruitful ground for integrating and educating immigrant students. All these aspects can probably not inform other countries' policies to improve immigrant students' achievement. But again, also some of the initiatives might be used as a model for other countries policies. As in Singapore, I found support programs for students who have difficulties with the language of instruction which seem to have a positive effect on the students' achievements. Also for Canada it would be valuable to be able to disentangle the effects of the different policy measures.

Chapter 6 Discussion and Conclusion

The dissertation has dealt with one aspect of globalization: the increasing amount of immigrant students in various countries. Also as can be seen from the increasing amount of literature the topic has an increasing relevance in educational research. A good education of immigrant students is not only a question of financial competitiveness but majorly a question of social justice.

The research in this dissertation draws on the most recent research results based on quantitative research. Some of the results of other researchers could be replicated but also some new aspects could be evaluated and might inspire further research.

Unless other research, this dissertation does not only conduct quantitative analyses of large-scale assessment data but also conducted in-depth analysis of countries' policy to help finding the policies behind certain research results.

This dissertation should not only enhance the knowledge about the situation of immigrant students in various educational systems but also demonstrates how quantitative research using large scale assessment results can be augmented with policy study results. With this work I hope to have made a contribution to the current discussions in educational research about social justice and immigrant students in particular.

In this chapter I will discuss the results I achieved; I will answer the research questions and evaluate the limitations of the research.

Summary of the results

In this dissertation I have recognized children with an immigrant background as one aspect of todays' global processes. Immigrant children do have different backgrounds and different reasons why they became immigrants. For example some are accompanying their parents that are looking for better job opportunities and others might be refugees. I have seen that there is an increasing amount of immigrant students enrolled in a number of educational systems. In 21 countries out of 32 participating countries in grade eight in TIMSS 1999 and TIMSS 2003 I found an increase of the percentage of immigrant students. This clearly poses a challenge to educational systems and different countries have applied different measures to react to this.

But what I have found in the overall trend is that the achievement difference between students with an immigrant background and native students is increasing. I found that whereas in TIMSS 1995 in 17 out of 37 participating countries native students outperformed their first generation immigrant peers

in mathematics in grade eight , in TIMSS 2007 in 42 out of 51 participating countries first generation immigrant students were achieving statistically significantly below their native peers. The average gap between first generation immigrant students and native students increased in this time from 14 to 35 score points – a difference that accounts for about one year of schooling. For the science achievement I find similar trends.

For the second generation immigrant students, the results were not that clear. I found some countries with a significant increase in second generation immigrant students but also a good amount of countries with stable statistics and even some countries with a decrease in second generation immigrant students in the schools in grade eight. In terms of achievement, the second generation immigrant students were lacking behind native students in fewer countries and to a lesser degree than the first generation immigrant students. The results were also quite stable over time.

Then I examined some selected background characteristics of the immigrant students and compared them to the native students. I found that immigrant students- and in particular the first generation immigrant students – were older than their native peers in grade eight. I also examined the hypothesis that immigrant students who arrived at a younger age in the host country perform better than immigrant students who arrived at a later age. This hypothesis could not be confirmed with the TIMSS data.

I then investigated the percentages of girls and boys among the immigrant students in the educational systems compared to the native students. There, I found the most alarming results. For example, I found that in 34 out of 56 educational systems, the first generation immigrant girls are underrepresented in the schools. Out of the 18 countries with the most extreme differences between first generation immigrant boys and first generation immigrant girls participating in school education, nine are Islamic countries. The differences are as extreme as in Iran where only 26 percent of the first generation immigrant students in the schools are girls and 74 percent boys. This means that if I assume 100 percent participation of the first generation immigrant boys and the same amount of boys and girls among the total first generation immigrant population, that probably only every third immigrant girl is enrolled in a school. If also some first generation immigrant boys are not enrolled in school then the percentage of first generation immigrant girls enrolled in school would be even lower than the estimated one out of three.

But this issue is not limited to Islamic countries. I found also Asian and eastern European countries among the countries with low percentages of first generation immigrant girls in the schools. In Bulgaria and Slovenia only every second first generation immigrant girl seems to be enrolled in school and in Georgia and Lithuania there are even lower percentages of first generation immigrant girls enrolled in schools. This is clearly a matter of concern and the background of this result should be evaluated and measures for achieving a high participation of first generation immigrant girls should be sought. This is not only a question of social justice but simply a matter of human rights.

For the second generation immigrant boys and girls the picture is much more diverse. I found countries with a lower enrollment of girls but also countries with a lower enrollment of second generation immigrant boys. But there were substantially fewer cases and the differences not that pronounced. But also for the second generation immigrant girls I found educational systems where the percentage of the enrolled girls go as low as only every second girl seems to be enrolled in the

educational system. But clearly, also this is not acceptable in any given country and further research also on this fact is necessary to fight this injustice.

When I investigated the mathematics achievement of the immigrant boys and girls separately, I found that in grade eight the achievement difference for mathematics between immigrant native students is much more pronounced for boys than for girls. On average, first generation immigrant girls were lagging behind native girls by 29 score points, but first generation immigrant boys were lagging behind native boys by 39 score points. For the second generation immigrant students the results were not that extreme but also for them I found second generation immigrant girls lagging behind native girls by 10 score points and second generation immigrant boys by 14 points.

But beside these averages I found some countries with quite extreme differences between immigrant boys and immigrant girls in terms of their mathematics achievement. This concerns countries with a higher participation of immigrant boys like Iran where probably only every third first generation immigrant girl is enrolled in school but the ones enrolled in school are ahead of the native girls in terms of their mathematics achievement but the first generation immigrant boys are lagging behind native boys be 47 score points – a difference accounting for about one and a half school years. But also in a country like Turkey where the first generation immigrant girls are at about the same level as the native girls with respect to their mathematics achievement but first generation immigrant boys achieved 52 points below native boys – again a difference accounting for about one and a half school years. Also here, the mechanisms behind need further research and measures especially to support immigrant boys in the schools should be thought about.

When analyzing whether students are speaking the language of instruction at home I found that there are more immigrant students speaking a different language at home than native students. This is probably not very surprising. But an interesting aspect is that the difference in mathematics achievement for students not speaking the language of instruction at home is bigger for native students than for immigrant students. Further analysis of the reasons behind this fact might reveal some interesting further results.

I looked at two aspects of socio-economic background of the students. One aspect was the education of the parents and the other the number of books at home – both are relatively good predictors of socio-economic status due to the literature. With respect to the parental education I found a good number of countries where the educational background of the immigrant students was higher than for the native students. This is majorly true for first generation immigrant students, but also for second generation immigrant students I found a good number of countries where this is the case. I found in particular countries among this group where the achievement of immigrant students was rather good compared to the native students. I suspected that the immigration policies may give preference to potential immigrants who have a better educational background and apply selection criteria for immigration.

In terms of the number of books at home I found clearly that native students have more books at home than their immigrant peers. We might suspect that the number of books at home might work differently as a predictor for the socio-economic status for native students and immigrant students. But I clearly found that also within each of the groups of immigrant students the number of books at home is strongly correlated to the mathematics achievement of the students.

I evaluated the attitudes of the students towards mathematics, and towards school in general, as well as their self-esteem in mathematics. The students attitudes are an important an interesting aspect of education since they can on the one hand be interpreted as an educational outcome and on the other hand as a mediator for learning and consequently educational achievement. Although I found some differences for some countries, in general no difference between native students and immigrant students could be found. Notably is that also no difference between first generation immigrant boys and girls regarding their attitudes towards mathematics could be found. Whereas I found in 15 countries native boys' attitudes towards mathematics more positive than their native peers, I found in only three countries first generation immigrant boys with more positive attitudes towards mathematics.

Considering these findings in connection with the achievement differences for immigrant boys and girls, one might suspect that relatively positive attitudes of immigrant girls contributed to the relatively positive outcome in mathematics. (Or, when considering the bi-directional causality of attitudes and achievement, the relatively positive achievement having contributed to the relative positive attitudes of immigrant girls.) Which way ever, trying to influence the immigrant boys' attitudes towards mathematics might have a positive impact also on their mathematics achievement.

Regarding the self-esteem I found in general the native students' self-esteem higher than for that of immigrant students. And I found a similar set of countries with relatively high self-esteem among immigrant students than the set of countries with relatively high mathematics achievement. An interesting difference could be observed in some Arabic countries where the self-esteem of immigrant students was relatively lower compared to the native students although their mathematics achievement was relatively high compared to the native students. It could be interesting to know if this controversy is especially pronounced in mathematics or if this is a more general pattern in these countries of relatively low self-esteem of immigrant students.

I also analyzed where in the countries to find the immigrant students. For a good number of countries I found more immigrant students in more urban areas. This is true for first generation immigrant students as well as for second generation immigrant students. And although the data was sparse I found that in some countries the differences in mathematics achievement between immigrant students and native students was less pronounced in urban areas than in rural areas. And I did not find any country with a relative higher achievement of immigrant students in rural areas. This is true for first generation immigrant students as well as for second generation immigrant students.

I could not investigate the background of the immigrant students living in rural areas and those who live in urban areas more in-depth with the data available. Consequently, I cannot conclude that the populations are comparable. But with all these caveats I might conclude that some countries seem to be able to accommodate the needs of immigrant students better in more urban areas than in the rural areas. One might investigate if special support programs in rural areas could help immigrant students in these countries.

Different aspects of the school characteristics were analyzed in terms of differences between schools attended by native students and by immigrant students. The aspects of interest here were schools that appear problematic because of low school attendance of the students, schools that are less well resourced, schools with the school climate rated less well - either by the principal or the mathematics teacher- , and finally schools where the students feel less save.

In terms of schools with a low student' attendance, I found no major differences for native and immigrant students but a slightly higher percentage of first generation immigrant students in schools with low school attendance. School attendance is associated with mathematics achievement for all students but for the first generation immigrant students in some countries the association tends to be stronger. Also the resourcing of the schools attended by immigrant students is comparable to the resourcing of schools attended by native students but the resourcing of the schools is positively associated with the students' mathematics achievement in some countries.

Furthermore with respect to the school climate I found the school climate being positively related to mathematics achievement for native students as well as for immigrant students. This is true for the principals' rating as well as for the teachers' rating. I found native students and immigrant students in general attending schools with similar ratings of the school climate.

The most serious result on the school level was found for the school safety. In TIMSS 2007, students were asked if in the last month something was stolen from them, if they were hit or hurt by other students, if they were made to do things I didn't want to do by other students, if they were made fun of or called names, and if they were left out of activities by other students. I found that in the majority of countries there is a statistically significant lower percentage of first generation immigrant students compared to the native students who answered "No" to these five questions. In nearly one third of the participating educational systems I found the percentage of second generation immigrant students to be statistically significantly lower than for native students.

This is in particular worrisome as the analysis has shown that for native students as well as for first and second generation immigrant students there is a positive correlation between this measure of students feeling safe at school and the mathematics achievement of the students. Although I cannot conclude a causational relationship between the students feeling save and the mathematics achievement, measures should be taken to improve the immigrant students' feeling of safety in school. This is simply a question of humanity and immigrant students' well-being.

In terms of class level factors, I investigated the class size for immigrant and native students, the emphasis of teachers on homework and the concentration of immigrant students in the classes. With respect to the class sizes of the classes attended by immigrant students and native students I found some differences for a few countries but in general no differences. Also surprisingly, I could not find a clear association of class size and students' mathematics achievement. Also for the emphasis on homework there was no difference for immigrant ad native students. But the emphasis on homework was clearly positively related to the students' mathematics achievement.

More interesting results could be found for the concentration of immigrant students in the classes. There are some countries with a high number of immigrant students in some classes. I found 11 countries where the mathematics achievement of first generation immigrant students was statistically significant higher when there are only one or two first generation immigrant students in the class.

Also for native students I found their mathematics achievement being higher in classes with fewer immigrant students in several countries. Interestingly the association between number of immigrant students in the class and mathematics achievement is stronger for the native students than for immigrant students. But for the countries where the mathematics achievement of the immigrant

students is higher than for the native students I found the mathematics achievement being positively associated to the number of immigrant in the class.

This suggests that the association found is more an example of the assimilation effect than directly related to the fact that classmates are immigrants. With that conclusion one could argue that any measure taken to improve the achievement of the immigrant students has also a positive effect on the achievement of the native students.

Despite some interesting results about differences between native students and immigrant students on individual level as well as on school and class level, it was found that a few countries always stood out in the results throughout all chapters. Especially Singapore and the Canadian provinces didn't only show positive achievement results for the immigrant students but also were noticeable different in several analysis.

In Ontario and Quebec immigrant students liked going to school more than native students. In Ontario, British Columbia and Singapore immigrant students also enjoyed learning mathematics more than their native peers. In Singapore and British Columbia immigrant students had a higher self-efficacy in mathematics than their native peers. Neither in British Columbia, Ontario, Quebec nor Singapore I could find a higher percentage of immigrant students not feeling save at school – in British Columbia it was rather the opposite and 53 percent of the immigrant students were in the highest category of feeling safe at school compared to only 48 percent of the native students. In British Columbia, Quebec and Singapore a statistically significant lower percentage of first generation immigrant students attend classes with a low emphasize on homework. In Singapore and British Columbia immigrant students in classes with more than two immigrants score statistically significantly higher than classes with only one or two immigrant students. Also in Singapore and British Columbia as well as in Ontario I found the native students achieving statistically significantly higher when attending classes with more than two immigrants.

All these aspects made it interesting to investigate further the situation in Canada and Singapore. Consequently, the last two chapters include a more in-depth analysis of the situation of immigrants – and immigrant students in particular – in these countries. The immigration policies and special treatments of immigrant students were investigated.

For Singapore I found a rather strict and selective immigration policy that grant permission only to well-educated immigrants – in particular when grating permanent residence. An interesting aspect of the Singaporean society is that Singapore is already a multi-cultural society with three different cultural groups living together. And since conflicts between the different cultures occurred also in the past, Singapore has already policies in place to facilitate the communication between citizens with different cultural background. Since the Singaporean economy requires additional labor force from abroad, also policies are in place to increase the acceptance of immigrants by the native citizens.

In Singapore there are also policies in place to help immigrant students to get a good start into their school careers. For example there are rather strict exams in place to grant immigrant students access to the Singaporean educational system which requires them to learn even before entering into the school system. But there are also governmental programs that help students with difficulties in the language of instruction but also in other subjects. As for society in general there are also policies in

place to increase the communication between students and the understanding of students with different cultural backgrounds.

For the Canadian provinces I found some similarities. Also Canada has very selective immigration policies that give preference to well-educated and also more affluent candidates. In Canada there is even a trend in immigration policies that put more emphasis on the education of potential immigrants. Also Canada can be regarded as a multi-cultural society – probably not to that extent as Singapore but also in Canada there is a Francophone and an Anglophone part of the population. Also the original Indian population is respected as a part of the population and their rights are protected. It should also be noted here that the immigrant populations in Canada vary quite substantially between the provinces with respect to their countries of origin.

In Canada there are also language support programs for students not being fluent in the language of instruction. This could be either students in Francophone schools not being fluent in French or students not being fluent in English in Anglophone schools. Since the educational system of Canada is a federal system, the programs differ between provinces and in some provinces even between schools. An interesting aspect for the province of British Columbia is a rather big group of immigrant students with an Asian background. For this group there seems to be a high value of education transmitted from the parents to the students and a pressure of achieving well at school independent of socio-economical background was found.

Summarizing the experiences from the analysis but especially from the two country examples, a disappointing result is that countries with higher achieving immigrant students seem to have in common that their immigration policies are rather restrictive and selective. And consequently the immigrant students in these countries have a better home background than immigrant students in some other countries.

But it seems also to be important that these countries were already multi-cultural societies before the modern immigration started. Public policies but also policies and traditions in schools paid attention to people with different cultural background and tried to integrate these people into the schools and into the society as a whole.

I also found support programs to assist especially students who are not fluent in the language of instruction. Maybe the mixture of all these aspects led to the success in teaching immigrant students.

In general, the approach of combining quantitative research of the IEA TIMSS data and policy analysis has proven to help finding and understanding differences in immigrant students' education. Quantitative research – especially with cross-sectional data – has the disadvantage that no causal relationships could be found. But finding phenomena in a representative data set can contribute to understanding the existence of differences in the population. This can foster the further search for answers and connections between causes and effects.

Analyzing the TIMSS data revealed some interesting aspects and differences in the education of immigrant students. Several aspects have shown to be worthwhile to investigate further to find recommendations for policymakers to improve the situation of immigrant students.

Answers to the research questions

This dissertation is framed by seven research questions that were presented in chapter 1. Let's now look at the answers to the research questions posed.

R1: Did the percentage of first and second generation immigrant students enrolled in grade four and grade eight increases between 1995 and 2007 based on the TIMSS data?

I found that there are 20 countries that participated in TIMSS 1995 and in TIMSS 2007 in the grade eight assessments. For 11 countries I found in table 4.1.1 an increasing number of first generation immigrant students. The biggest increase was found for Hong Kong (11 percent) and for Kuwait (nine percent). In two countries I found a decrease of one percent and in the remaining seven countries I found no statistically significant difference of the percentage of first generation immigrant students. **This means that overall** I **found based on the TIMSS data an increase of the percentage of first generation immigrant students in the majority of countries that participated in both study cycles.**

For the second generation immigrant students I found for grade eight in table 4.1.3 a statistically significant increase of second generation immigrant students in six out of 20 countries. The biggest increase was found for Cyprus (six percent) and Sweden and the United States of America (each five percent). In seven out of the 20 countries the percentage of second generation immigrant students decreased between 1995 and 2007. The biggest decreases were found for Israel (19 percent), Romania (15 percent), Kuwait (14 percent) and Hong Kong (11 percent). In the remaining seven countries there was no statistically significant difference of the percentages of second generation immigrant students. **This means that overall the percentages of second generation immigrant students tend to decrease between 1995 and 2007 based on the analysis of the TIMSS data.**

For grade four the data in table 4.1.2 has shown unreliable data in terms of the percentages of immigrant students. The grade four students seem to have been not able to answer this question reliably. **Consequently,** I **could not answer the research question one for the grade four students.**

The next research question dealt with the achievement difference between immigrant students and native students and was phrased as:

R2: How does the mathematics and science achievement of immigrant students compare to the achievement of native students in the various countries in TIMSS and how does it change over time compared to the changes observed for native students in the countries?

As shown in table 4.1.4 in TIMSS 1995 the first generation immigrant students performed statistically significantly below the native students in 17 out of 37 participating countries and in 10 out of the 37 countries the second generation immigrant students achieved statistically significant below the native students. In TIMSS 2007 in 42 out of 55 countries the first generation immigrant students achieved statistically significantly below the native students. Also in TIMSS 2007 I observed in 21 out of the 55 countries that the second generation immigrant students achieved statistically significantly below the native students.

Also the magnitude of the differences increases over time. Whereas the average differences across all participating countries between first generation immigrant students and native students in mathematics achievement was 14 score points in TIMSS 1995, it increased to 35 in TIMSS 2007. For

the second generation immigrant students the difference increased from five score points to 12 in the same time span.

Therefore I conclude that overall the immigrant students in this study achieved lower than the native students in mathematics in TIMSS and the achievement gap widened between 1995 and 2007. The difference is higher for first generation immigrant students than for second generation immigrant students.

For the science achievement, the results look very similar to the results in mathematics as can be seen in table 4.1.5. In TIMSS 1995 in 17 out of 37 participating countries the first generation immigrant students were outperformed by their native peers. This figure increased in TIMSS 2007 to 44 out of 56 countries. For the second generation immigrant students I found in TIMSS 1995 that in 12 out of 37 countries a statistically significant higher achievement of the native students. Again, this figure increased to 23 out of 56 participating countries.

Also the magnitude of the differences increased. The mathematics achievement of the first generation immigrant students was 18 score points in 1995, 23 in 1999, 35 in 2003 and went up to 39 in TIMSS 2007. The difference for the second generation immigrant students when being compared to the native students increased in the same time span from 8 to 10 to 13 to 14 score points.

I conclude that overall the immigrant students in this study are performing below the native students also in science in TIMSS. And again, the differences are more pronounced for the first generation immigrant students.

But tables 4.1.4 and 4.1.5 show also some examples of countries with immigrant students performing as well as native students or even better in mathematics or science in one or more cycles of TIMSS. When focusing on countries where both groups of immigrant students performed at least as good as native students in the last cycle of TIMSS in scope in mathematics and science, I find Armenia, the Canadian provinces of British Columbia and Ontario and Dubai of the United Arab Emirates. This means that there are also positive examples that could be investigated further later.

After looking at the overall achievement of immigrant students and the trends on mathematics and science achievement, the next research question focused on the TIMSS 2007 results for a more in depth look. The basic student demographics like age, age at immigration, sex, language spoken at home, parents' education, SES background and students' attitudes - were analyzed. The third research question was:

R3: Are there differences in basic demographical information between immigrant and non-immigrant students in TIMSS 2007 and does the mathematics achievement differ between groups of immigrant students with a different demographical background?

The answer to this question could be found in chapter 4 B. First I looked at the age of the students. In table 4.2.1 I found that in 29 out of the 56 countries the first generation immigrant students are statistically significant older than their native peers in TIMSS 2007 grade eight. Only in Dubai, the first generation immigrant students are statistically significant younger than their native peers. In 12 out of 56 countries, the second generation immigrant students are statistically significant older than their native peers. In five countries the second generation immigrant students are statistically significant younger than their native peers.

Then the age when migrating to the country of residence was explored. No clear pattern for the age when students came to the country of residence and the immigrant students' mathematics achievement could be found. But there was a tendency in table 4.2.2 showing in 19 countries that the mathematics achievement of the immigrants declined with age when migrating to the country. Only in two countries the opposite pattern was found.

Next the sex of the immigrant students and the relation to mathematics achievement in TIMSS 2007 was analyzed. As table 4.2.3 has shown in the majority of countries (34 out of 56) there are statistically significant fewer first generation immigrant girls than boys enrolled in the schools. In Iran only 26 percent of the first generation immigrant students are girls. Assuming an even number of boys and girls among immigrants in general, this would mean that only half of the immigrant girls are enrolled in school. In Saudi Arabia only 28 percent of the first generation immigrants in school are girls.

When I looked at the mathematics achievement of the immigrant boys and girls the results in table 4.2.4 show that in 42 out of the 56 countries the first generation immigrant boys are performing statistically significant below the native boys whereas the first generation immigrant girls perform statistically significant below the native girls in only 35 countries. On the other hand in five countries the first generation immigrant boys performed statistically significant better than the native boys and in three countries the first generation immigrant girls outperformed the native girls statistically significant.

When looking at the differences I found that on average the first generation immigrant boys are lacking behind the native girls by 39 score points and the first generation immigrant girly are lacking behind the native girls by 29 score points.

When looking at the language spoken at home I found that – not surprisingly – the percentage of students not speaking the language of instruction at home was over all higher among second generation immigrant students than among native students and even higher for first generation immigrant students. But when looking at the mathematics achievement I found the interesting result that the difference in mathematics achievement for students speaking the language of instruction at home and those who don't is bigger for native students than for first and second generation immigrant students.

The next analysis was on home background. I found that neither for the first generation immigrant students nor for the second generation immigrant students the parents being less educated than the parents of the native students. I found that the number of books at home being a good predictor of mathematics achievement for native students as well as for first and second generation immigrant students. And I found the first generation immigrant students having a significantly smaller number of books at home than the native students.

With respect to the research question three, I conclude that there are some differences between immigrant and native students in terms of their demographics based on the TIMSS data. In TIMSS 2007 immigrant students in grade eight are in tendency older than their native peers. Among the immigrant students enrolled in school there are fewer girls in some countries. Immigrant students speak the language of school instruction to a lesser degree at home than native students in some countries. The education of the parents is similar for immigrant and native students in most

countries. The number of books at home as a predictor of SES showed fewer books at home of immigrant students but being good predictor for achievement among all students in several countries.

Next I looked at students' attitudes towards school in general, the attitudes towards mathematics in particular and the students' self-esteem in mathematics. The research question four was:

R4: Are there differences between immigrant and non-immigrant students in TIMSS 2007 in terms of the attitudes towards the school in general and mathematics in particular as well as their self-esteem in mathematics?

Tables 4.2.11 to 4.2.15 show the results for several questions about students' attitudes and their self-esteem in mathematics. For the attitude towards mathematics and the attitudes towards school I found the same result: **For most countries there are no differences between native students and immigrant students in the TIMSS 2007 data but there are some countries where there are more positive attitudes towards mathematics among the native students and others with more positive attitudes towards mathematics among the immigrant students in the TIMSS 2007 data.** When comparing boys' and girls' attitudes towards mathematics I couldn't find general patterns among any of the student groups (natives, first and second generation immigrants) showing a higher percentage of boys than girls who like mathematics. Although I found some differences between countries there was no general pattern.

For the self-esteem in mathematics I found - especially for the first generation immigrants - a number of countries with lower self-esteem in mathematics than for the native students in the TIMSS 2007 data. The difference in self-esteem follows in several countries the difference in mathematics achievement.

Since the aim of this dissertation is to find conditions under which students with an immigrant background achieve relatively well, the next area of research is the school level perspective. Since school conditions vary substantially between urban and rural schools in many countries the first analysis is on types of community. The fifth research question was:

R5: Are grade eight immigrant students more often found in rural or urban communities in TIMSS 2007 and are the mathematics achievement differences between immigrant and native students different in the different community types?

Table 4.3.1 and 4.3.2 show the percentage of the immigrant students in different community types in TIMSS 2007 grade eight. Although there is no consistent pattern across countries there are a couple of countries with more immigrant students in more urban areas but not a single country with a statistical significant higher percentage of immigrant students in more rural communities. This difference is more pronounced for second generation immigrant students than for first generation immigrant students. Across all countries, there are 11 percent first generation immigrant students in small and mid-size communities and 13 percent in bigger cities. There are eight percent of second generation immigrant in communities with less than 3000 inhabitants, 11 percent in communities with up to 500.000 inhabitants and 14 percent in communities with more than 500.000 inhabitants. **So, in tendency I conclude that immigrant students are concentrated more in urban areas – especially the second generation immigrant students based on the TIMSS 2007 data**.

Tables 4.3.3 and 4.3.4 show the mathematics achievement differences between immigrant students and native students in the different community types. As can be seen in these tables there are a few countries where the achievement difference is smaller in more urban areas. Also on average the first generation immigrant students are lacking behind the native students in communities with more than 500.000 inhabitants by 30 score points, in communities with more than 3000 inhabitants by 38 score points and in communities with 3000 and less inhabitants by 39 score points. For the second generation immigrants the differences are 12, 11, and 15 score points respectively. **This means that that based on the TIMSS 2007 data that although the pattern is not consistent across countries, there appears to be a tendency that immigrant students are lacking less behind native students in more urban communities.**

The next research question dealt with some general school characteristics of schools and was phrased as:

R6: Are there differences in basic school characteristics between immigrant and non-immigrant students in TIMSS 2007 and does the mathematics achievement differ between immigrant students attending schools with different characteristics?

The first school characteristic analyzed was the school attendance. As can be seen in table 4.3.5 there are five countries with a statistically significant higher percentage of first generation immigrant students in schools with a low school attendance but one with a statistically significant lower percentage. Across all countries there are 21 percent of first generation immigrant students in schools with low school attendance but only 19 percent of native students. There is no country with a statistically significant higher percentage of second generation immigrant students in schools with a low school attendance than native students but two countries with a statistically significant lower percentage. Across all countries there are 20 percent of the second generation immigrant students in schools with a low school attendance. is a slightly higher percentage of first generation immigrant students in schools with low school attendance. In the results in table 4.3.6 we saw that the average achievement of first generation immigrant students in schools with a high school attendance is 449 score points, in schools with medium school attendance 429 score points and in schools with low school attendance 412 score points. Consequently the difference between the high and low group is 38 score points but for native students this difference in only 29 score points.

I conclude that there is a tendency of immigrant students attending more schools with a low school attendance based on the TIMSS 2007 data. This is more pronounced for the first generation immigrant students. I could also show that the school attendance is associated with mathematics achievement and that the association is mostly stronger for the first generation immigrant students than for native students in the TIMSS 2007 data.

Table 4.3.7 shows the percentage of students attending high resourced schools for the different immigrant student populations and tables 4.3.8 and 4.3.9 show the mathematics achievement of first and second generation immigrant students in differently resourced schools. There are five countries with a statistically significant lower percentage of first generation immigrant students than native students in high resourced schools but across all countries there are 31 percent of the students attending high resourced schools in all the student populations – native students, first generation immigrant students and second generation immigrant students. Tables 4.3.8 and 4.3.9 show clearly that first and second generation immigrant students attending better resourced schools score higher

in mathematics. In the tables 4.3.10 and 4.3.11 further analysis were shown that evaluated how much of the achievement differences could be attributed to the students SES background and show that the achievement differences found in tables 4.3.8 could not only be attributed to the students' SES background although it explained some of the differences.

Consequently, I conclude that based on the TIMSS 2007 data immigrant students attending in general similar resourced schools compare to native students. But resourcing is positively related to the students' achievement for first and second generation immigrant students in the TIMSS 2007 data – even after considering differences students' differences in their socio-economic status.

The school level analysis that followed addressed the school climate rated by the principal and the teacher. The results are shown in tables 4.3.12, 4.3.1, and 4.3.14.

I found in the TIMSS 2007 data that in general immigrant students attending schools where the principal rated the school climate positive to a similar degree as native students. In general the school climate is associated to a mathematics achievement for immigrant students as well as for native students in the TIMSS 2007 data.

The final school level analysis was done on students feeling safe in school. The results were presented in tables 4.3.15 and 4.3.16. I found that in the majority of countries statistically significant lower percentage of first generation immigrant students with a high level of feeling safe at school compared to the native students. And also for the second generation immigrant students in nearly one third of the participating countries there is a statistically significant lower percentage of students in the high category of feeling less safe in school. For native students as well as for first and second generation immigrant students there is a clear positive association between the students feeling safe at school and their mathematics achievement.

Thus I conclude immigrant students have the tendency to feel less safe at school and feeling safe at school is associated with higher mathematics achievement for all students based on the TIMSS 2007 data.

To summarize the answers to research question six I come to the conclusion that there are differences in terms of school level characteristics between schools attended by immigrant students and schools attended by native students[12] based on the TIMSS 2007 data. I also showed that the mathematics achievement of immigrant students differs for some countries with respect to some of the school characteristics in the TIMSS 2007 data.

The research question seven dealt with class level differences and was phrased as:

R7: Are there differences in class level characteristics between immigrant and non-immigrant students in TIMSS 2007 and does the mathematics achievement differ between immigrant students attending classes with different characteristics?

In terms of class level characteristics, three aspects were analyzed: the class size, the emphasis of the teacher on homework, and the number of immigrant students in the class.

[12] To be precise one has to mention that this is meant in statistical terms. There are none or very few schools that serve immigrant students only. Consequently, what is compared is the average school characteristic of schools attended by immigrant students and native students.

For the class sizes of classes attended by immigrant students and native students I found several countries with differences in the TIMSS 2007 data. In some countries immigrant students are attending smaller classes and in some countries native students attend smaller classes based on the TIMSS 2007 data.

The relation between class sizes and mathematics achievement is not consistent across countries. In some countries immigrant students attending smaller classes perform better in mathematics, but I found more countries where the opposite is the case. I found some associations of class sizes with community sizes which were also shown to be related to students' mathematics achievement.

I conclude that there is an association between class size and immigrant's mathematics achievement in the TIMSS 2007 data. This association is not consistent but mostly higher mathematics achievement of the immigrant students is associated to larger class sizes.

Table 4.4.3 shows the percentage of students attending mathematics classes where the teacher has a low emphasis on homework. The average percentage across all countries is 23 percent for first generation immigrant students as well as for native students. For second generation immigrant students the average percentage is 22 percent. Interesting is that for the Canadian provinces of British Columbia and Ontario as well as for Singapore – three countries that have shown before more positive mathematics achievement of immigrant students - the percentage of first generation immigrant students in classes with a low emphasis on mathematics homework is statistically significant smaller than for the native students.

However, in general I conclude that there is no difference in terms of emphasis on mathematics homework between classes attended by immigrant students and by native students based on the TIMSS 2007 data.

Tables 4.4.4 and 4.4.5 show the mathematics achievement of native and first generation immigrant students depending on the emphasis on mathematics homework. The tables show for a good number of countries higher mathematics achievement for students with a higher emphasis on homework – for native as well as for immigrant students. The average mathematics achievement for native students in classes with a high emphasis on mathematics homework is 471, for native students in classes with a medium emphasis on homework 464 and in classes with a low emphasis 446. For first generation immigrant students the average scores are 436, 430, and 414 respectively.

This means that based on the TIMSS 2007 data that for native students as well as for immigrant students a higher achievement can be observed if they attend classes with a higher emphasis on homework. The biggest decrease could be seen for students attending classes with a low emphasis on mathematics homework.

The remaining tables in chapter 4 D show the distribution of immigrant students in the classes and the mathematics achievement depending on the number of immigrant students in the class. As can be seen from table 4.4.6 the number of classes with a different number of immigrant students varies quite substantially. Since there are substantial differences, I calculated the mathematics achievement for all students in the classes with different number of immigrant students but also the achievement of native and immigrant students separately for the classes with different number of immigrant students. I found that students in classes with immigrant students tend to perform lower in mathematics. But there were also counterexamples. This negative association between the number

of immigrant students and mathematics achievement is stronger for native students than for the immigrant students. For the countries where the mathematics achievement of the immigrant students is higher than for the native students the association is weaker or even positive which suggest that the association is more related performance level of the students rather than their immigration status.

Based on the TIMSS 2007 data the immigrant students are distributed quite unevenly across countries. There is a clear tendency that in countries where immigrant students achieve below native students, students in classes with a higher number of immigrant students achieve worse whereas in countries with immigrant students achieving above native students, students in classes with a higher number of immigrant students achieve similar or even better. This association is stronger for native students than for immigrant students in the TIMSS 2007 data.

Summarizing the results for research question seven I found in the TIMSS 2007 data some class level differences for the different countries with respect to the class sizes of immigrant and native students, no major differences in terms of emphasis on mathematics homework and varying concentrations of immigrant students in classes. All these aspects have shown some association with the mathematics achievement of the students in the TIMSS 2007 data.

The analyses of the TIMSS data have shown substantial differences between countries in terms of the percentages of immigrant students in the educational system, the background characteristics of the immigrant students, their attitudes and their achievement. Also the situations on school and class level were found to be different. Obviously, the situation of countries in terms of immigration and how to deal with it differs between countries. The results show that some countries seem to be more successful than others in terms of creating a positive learning environment for students with an immigrant background. But the TIMSS data has its limitations when I wanted to evaluate what makes some countries appearing more successfully. Despite some countries that appeared to be successful in some of the aspects that were evaluated, Singapore and the Canadian provinces of British Columbia and Ontario appeared as quite positive throughout most of the analyses. Interestingly, the Canadian province of Quebec has shown less positive results than the other two Canadian provinces. These results seem to make it valuable to look at Singapore and Canada from a broader policy perspective in order to find policies that other countries can learn from. The final research question is:

R8: What are the policies leading to positive achievement results for immigrant students in Singapore and in Canada and can these inform the policies in other countries to improve the achievement of immigrant student?

For Singapore we found the immigrant population to be quite different from immigrant populations in other countries. The immigration policy is quite selective. Also the admission to the educational system has certain requirements. This results in a high socio-economical background of the immigrant students and their parents being well educated – as already seen in chapter 4B. This limits the transferability of educational policies to other systems.

Also general attitudes towards immigrants but also education are rather positive in Singapore. There are policies in place that influence these attitudes positively. These positive attitudes towards immigrants and diversity seem to make it easier for immigrants – and in particular immigrant

students – to integrate into the educational system. Also the appraisal of education has the potential to influence all students' – including immigrant students' – attitudes and achievement.

There are also policies for schools to support integration and respect for diversity. These are not targeted especially to immigrant students but majorly to all students which in Singapore already come from different ethnic backgrounds. Due to the different backgrounds of students – also in terms of languages spoken at home – schools seem to be well prepared for immigrant students with different language backgrounds.

There are also support programs in place to help lower performing students. Also these programs target all students and not only immigrant students but might also especially help lower performing or newly integrated immigrant students.

In the case of Singapore I conclude that the initial situation is rather different from many other countries in terms of immigrant students and the positive results for immigrant students can be attributed to educational policies only to a lesser degree. However, there are general policies in place that support positive attitudes towards immigrants and education. The positive impact of these might be used to inspire other countries. There are also educational policies in place that support lower performing students – especially in the language of instruction - and other policies to influence respect for diversity positively. Also these might inspire other countries' policies. Finally drawing also on the results seen in the analysis of the TIMSS data, a stronger emphasis on homework might also impact the immigrant students' achievement positively. And we should not forget that Singapore was among the highest ranking countries regarding the immigrant students feeling safe at school which has shown to be strongly associated to the students mathematics achievement.

Similar to Singapore I also found rather strict immigration policies in Canada which impact the background of immigrant students enrolled in the educational system. A particular aspect of the immigrants – especially in British Columbia – seems to be a strong emphasize on high educational outcomes.

Also similar to Singapore the Canadian population is multi-cultural and multilingual in itself. There are policies in place to increase awareness towards people with different languages and cultures. These probably also impact the immigrants positively. In Canadian less evidence for valuing high education and policies to support these opinions than in Singapore could be found.

The education system of Canada is decentralized and the different provinces have different educational policies. Canada has support programs for students that do not speak the language of instruction as mother tongue. The programs target English speaking students in francophone provinces and French speaking students in Anglophone provinces as well as aborigine students but also support immigrant students with a different mother tongue. The implementations of these programs are different between schools since there is general guidance but schools are encouraged to implement them customized.

In case of Canada I found a selective immigration policy that leads to immigrant students with a strong socio-economic and educational background as in Singapore. Again, this limits the transferability of educational policies that lead to positive outcomes of immigrant students. As in Singapore, also the Canadian society seems already to respect diversity and seems to be more

open to immigrants. But also in Canada this is supported by general policies that support these positive attitudes. To find this same pattern again seems to support the importance of general policies that promote a positive attitude towards diversity. And again, language support programs that target all students with difficulties in the language of instruction are in place and seem to have a positive impact also on immigrant students. Maybe this is an approach that could also inspire other countries. And again, also British Columbia and Ontario - together with Singapore - stood out in the analysis of the TIMSS data as the only ones with few students in classes with a low emphasis on homework, which might have also a positive impact on the immigrant students' achievement. And also in British Columbia and Ontario the immigrant students rated their feeling safe in school higher than nearly all other countries which has shown to be strongly associated with the students' mathematics achievement.

Discussion

Today's world is a globalized world which also impacts the educational systems. An increase of immigrant students – as shown in this dissertation - is only one aspect but one that poses a challenge to the educational systems.

But immigrant students form a quite diverse group of children. Some come from more affluence homes others are victims of war and are counted among the most vulnerable children. What they all have in common is that they deserve a good education and care for their special needs. This is not only a matter of economic advantages but majorly a question of social justice.

The analyses of the TIMSS data have revealed some of the differences in the background characteristic of the immigrant students – especially in terms of their socio-economic and parental background but also in terms of how much the language that they speak at home matches the language of instruction at school.

In this dissertation we have seen that the achievement of immigrant students is in general lacking behind the achievement of native students. And this achievement gap even seems to increase showing that most educational systems seem not to be able to cater adequately for their immigrant student population.

But we have also seen in this dissertation that the situation of the countries is quite diverse. Not only do they have immigrant student populations with different backgrounds and of different size but also where they life in the country – in more rural or more urban areas – varies substantially and consequently poses different challenges to the educational systems.

It could be also seen that there are major differences within the countries that were analyzed here. Some countries seem to be more successful in achieving better learning opportunities in urban than in rural areas. Some countries seem to be less successful in including immigrant girls than immigrant in the educational system. In other countries the immigrant boys seem to show a bigger achievement gap.

As could be seen in this piece of research, different countries seem to have also different ways of dealing with the challenge of catering adequately for the immigrant student population. In some countries immigrant students attend smaller classes or their teachers seem to have a stronger emphasis on homework. Some countries seem to be more successful than others.

Singapore and the Canadian provinces of British Columbia and Ontario seem to be among the more successful ones. But when examining the situation more in depth it turned out that a big portion of this "success" seems to stem from the fact they all have rather selective immigration policies in place. Consequently, the aim of this dissertation to find positive examples that other countries could learn from was limited and the results somewhat disappointing.

But at least some characteristics and policies could be found which might also have contributed to the good achievement of the immigrant students in these countries. There is on one hand to mention the general positive attitudes towards diversity and the awareness towards people with different languages and the policies supporting this. On the other hand also educational policies to make students aware of peers with a different cultural background and educational policies that assist lower performing students and students with difficulties in the language of instruction seem to have some positive effect. From the analysis of the TIMSS data it became also apparent that in these three regions the teachers have a higher emphasis on homework for immigrant students and the immigrant students rated their safety at school very high and both aspects have shown a strong association with the mathematics achievement in most countries.

Although this dissertation could not find clear answers to the question how countries should face the challenge of globalization and its impact on the educational systems – especially in terms of the increased immigrant student population - at least some hints could be found that deserve some further investigations and finally might lead to an improved education for immigrant students.

Limitations

There are several aspects that must be mentioned as restriction for the research presented here. First it should be mentioned that the TIMSS data used in the quantitative analyses has some limitations. TIMSS is a cross-sectional large scale assessment survey and consequently no causal inferences can be drawn from the data. The analyses could also only use the data available in the TIMSS database. Some aspects that have shown to be very relevant but that were not asked to the students, teachers and principals could not be used. As one important aspect the country of origin of the immigrant students should be mentioned here.

Another aspect is the available data itself. Although the questions were translated into all target languages and rigorous quality measures were implemented to ensure a high quality of the translations, respondents in different cultures tend to answer questions differently. No cultural invariance of the data from different countries can be assumed and consequently comparisons of data from respondents with different cultural background might be subject to artifacts stemming from different response behaviors. Consequently, differences were interpreted very carefully and a major emphasis was put on within country comparisons. In several cases the analysis was done for immigrant students and native students separately to ensure that results were not dominated by cultural differences between native and immigrant students.

As also could be seen when analyzing the immigrant students' backgrounds, the immigrants in different countries also have quite different backgrounds – especially in the socio-economic status, the education of their parents and the language used at home. All these are aspects that have shown to impact educational outcomes. One could have tried to find comparable subpopulations of

immigrant students in the different countries for comparisons but that would have left sample sizes too small to be compared meaningfully. As an alternative used here the student background was analyzed and the results shown. When interpreting differences these results were always considered. Also when interpreting the results in chapter five, the differences in the students' background played were considered.

Finally the dissertation has a rather narrow focus and analyzed majorly mathematics achievement of the students. Clearly educational outcomes are much more manifold and a good education of immigrant students does not mean that they can compete with native students in terms of their mathematics achievement. And although also science achievement was considered in chapter 4A and the students' attitudes and self-efficacy – which can also be interpreted as educational outcomes were analyzed in chapter 4B, it is clear that the main focus is one the mathematics achievement of the students. This was necessary to achieve a manageable dissertation. And even though this narrow focus somewhat challenges the aim of finding ways for improving the education of immigrant students, I am willing to argue that if this dissertation could help to improve at least this aspect of the education of immigrant students, it has helped to improve the situation for this vulnerable group.

Further research

Since the analyses and results at hand could not conclude any causal relationships, more research on effects of the aspects found to be different between higher achieving and lower achieving immigrant students are needed. Are there causal relationships and if so what are the mechanisms that for example lead to students' feeling safe at school. Or does the higher emphasis on homework in Singapore, British Columbia and Ontario for immigrant students really helped their mathematics achievement – and if so, why?

The research in this dissertation used data of students enrolled in the schools. As seen for some countries – for example for immigrant girls – some immigrant students seem not to be enrolled in the educational system. It is important to find out more about this group. How many immigrant students are not enrolled in the educational system of the host countries and what are their characteristics? Are they taught outside the schools – maybe privately?

More research projects – especially with more qualitative or longitudinal approaches – should be launched to find ways to better understand the situation of immigrant students and in the best case help improving their situation.

Chapter 7 Literature

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Appendix A Abstract German

Der Anstieg von Schülern mit Migrationshintergrund ist ein Aspekt der heute stattfindenden Globalisierung. Dieser Anstieg wirft die Frage auf, welche Rahmenbedingungen und politische Maßnahmen gute Leistungen von Schülern mit Migrationshintergrund in Bildungssystemen befördern.

Diese Dissertation versucht zur Beantwortung dieser Frage beizutragen und betrachtet dazu die mathematischen Fähigkeiten von Schülern mit Migrationshintergrund in mehreren Ländern. Unterschiede zwischen und innerhalb von Ländern sollen besser verstanden werden. Aus den durchgeführten Analysen werden Empfehlungen abgeleitet, die einer besseren Schulbildung von Schülern mit Migrationshintergrund dienen können.

Die Dissertation beginnt mir einer generellen Einführung in das Thema der Globalisierung, die gefolgt wird von einer Literaturübersicht zu den untersuchten Bereichen.

Anschließend werden Analysen von mathematischen Fähigkeiten von Schülern mit Migrationshintergrund vorgestellt. Als Grundlage dienen Daten aus Studien zu mathematisch-naturwissenschaftlichen Kenntnissen von Viert- und Achtklässlern aus mehr als 50 Ländern weltweit, die durch die IEA, eine unabhängige Forschungsinstitution, seit 1995 alle 4 Jahre durchgeführt werden – die TIMSS-Daten. Die Analysen betrachten zunächst alle TIMSS Zyklen von 1995 bis 2007 und untersuchen die Entwicklung der Anteile von Schülern mit Migrationshintergrund und deren Testergebnissen in mehr als 50 Ländern. Danach werden tiefergehende Analysen der TIMSS 2007 Daten vorgenommen.

Hierbei liegt zunächst der Fokus auf den Schülerhintergrundinformationen, wie Alter, Geschlecht, sprachlicher Hintergrund oder sozio-ökonomischer Hintergrund, um besser zu verstehen, wie sich die Schülerpopulationen mit Migrationshintergrund in den einzelnen Ländern zusammensetzen. Danach werden Schulfaktoren, wie Schulstandort, Unterrichtsteilnahme, Schulressourcen, Schulklima und Sicherheit und Faktoren auf Klassenebene, wie Klassengröße, Hausaufgaben und Mitschüler-Effekte untersucht.

Darauf folgen Politikstudien über zwei Länder, die bei den quantitativen Analysen der TIMSS Daten als positiv in Bezug auf die Leistungen der Schüler mit Migrationshintergrund aufgefallen sind. Zuletzt werden die Ergebnisse zusammengefasst und diskutiert.

Durch diese Herangehensweise soll die Dissertation ebenfalls zeigen, wie quantitative Analysen von großen internationalen Bildungsmonitoring-Studien genutzt und durch tiefergehende Politikstudien ergänzt werden können.

Appendix B Abstract English

This dissertation examines the mathematics achievement of immigrant students in several countries. An increase of students with an immigrant background is one aspect of the globalization that takes place in our world today.

This dissertation aims to contribute to the discussion on immigrant students in educational systems. Differences between and within countries shall be understood. Especially circumstances and policies that might lead to a better education of immigrant students will be searched for. The aim is to find recommendations for policies that promote a better education for students with an immigrant background.

The dissertation will start with a general introduction into the topic of globalization followed by a review on the current state of research in the areas addressed.

The analyses will first focus on all cycles of TIMSS from 1995 until 2007 and investigate the trends on percentages of students with an immigrant background and their achievement in more than 50 countries. TIMSS is a series of large-scale assessment studies about the mathematics and science achievement of grade four and grade eight students that is conducted in more than 50 countries every four years. Then the focus will be on the TIMSS 2007 data only to get more in-depth results.

The first focus here will be on students' backgrounds as students' age, students' sex, socio-economic background and students' attitudes and aspiration to better understand what the immigrant student population looks like in the different countries and to better understand differences within the countries.

Then differences between schools in terms of location, school attendance, school resources, school climate and school safety will be examined followed by an analysis of differences between classes in terms of class size, emphasize on homework and peer effects.

This will be succeeded by policy studies on two countries that came out as successful in the quantitative analysis of the TIMSS data. Finally the different results will be brought together and discussed.

With this approach the aim of this dissertation is also to demonstrate how quantitative analysis of large-scale assessment data can be used and augmented with more in-depth policy studies.

Appendix C Authors Biography

Dirk Hastedt was born in Hamburg, Germany on February 16th 1965. After graduating from the Gymnasium and completing his military service, Dirk studied Mathematics at the University of Hamburg where he graduated with a Diploma in Mathematics in 1994. Since 1989 Dirk works for the International Association for the Evaluation of Educational Achievement (IEA) where he served as study director for several international educational research projects and as Co-Director of the IEA Data Processing and Research Center in Hamburg. His work for the IEA includes educational research to be conducted and presented at international conferences consultancies as well as lecturing and conducting seminars for educational researchers. Since 2007 Dirk is – together with Matthias von Davier - editor in chief of the IEA-ETS Research Institute's monograph series which is from 2013 on published as a Springer open Access Journal "Large-Scale Assessments in Education". From April 2014 Dirk serves as the Executive Director of the IEA.

Appendix D Summary German

Die Dissertation “Mathematics Achievement of Immigrant Students” analysiert die Leistungen von Schülern mit Migrationshintergrund und untersucht die Faktoren, die möglicherweise einen Einfluss darauf ausüben.

Schüler mit Migrationshintergrund werden als ein Symptom der zurzeit stattfindenden Globalisierung begriffen. Dabei setzt sich die Population der Schüler mit Migrationshintergrund aus sehr unterschiedlichen Sub-Populationen zusammen. Zum einen handelt es sich zum Beispiel um Schüler mit gut gebildeten Eltern, die zur Aufnahme einer gut bezahlten Tätigkeit in ein Land gekommen sind, zum anderen aber auch zum Beispiel um Flüchtlinge aus Kriegsgebieten. Baumann unterscheidet dabei zwischen tourists and vagabonds Baumannv (2003). Die Hintergründe der Migranten unterscheiden sich dabei deutlich zwischen den Ländern und selbst innerhalb der Länder. Es wird jedoch eine Zunahme der Migrationsströme und daher auch daraus resultierende Herausforderungen für die Bildungssysteme vieler Länder beobachtet (Castles, 2009). Ziel sollte es dabei sein, eine gute Schulbildung für alle Schüler zu erreichen und dies nicht nur aus ökonomischen Gründen, sondern primär aus Gründen der sozialen Gerechtigkeit.

In der Dissertation werden die Daten von TIMSS (Trends in International Mathematics and Science Study) analysiert. TIMSS ist ein zyklisch alle vier Jahre durch die IEA (International Association for the Evaluation of Educational Achievement) durchgeführte Studie, die die mathematischen und naturwissenschaftlichen Kompetenzen von Viert- und Achtklässlern untersucht. TIMSS erhebt dabei auch umfangreiche Hintergrunddaten von Schülern, deren Lehrern sowie über deren Schulen. Durch das komplexe Studiendesign ist es nötig, bei den Analysen adäquate Analysemethoden zu verwenden, welche in den technischen Berichten der Studien beschrieben sind(Olson, Mullis, & Martin, 2008).

Zunächst werden die Daten der TIMSS Zyklen 1995, 1999, 2003 und 2007 analysiert. Die erste Forschungsfrage, die in dieser Arbeit beantwortet wird, ist, wie sich die Population der Schüler mit Migrationshintergrund nach TIMSS entwickelt. Unterschieden wird hier und im Folgenden zwischen Migranten der ersten Generation, also solchen Schülern, die im Ausland geboren wurden, und Migranten der zweiten Generation, also solchen Schülern, die selbst im Land, in dem sie zur Schule gehen, leben, deren Mutter oder Vater jedoch im Ausland geboren wurden. Es wird gezeigt, dass der Anteil der Schüler der ersten Generation von Migranten in vielen Ländern, die in TIMSS 1995 und 2007 teilgenommen haben, ansteigt, der Anteil der Schüler der zweiten Generation abzunehmen scheint.

Die zweite bearbeitete Forschungsfrage fragt nach den Trends in Bezug auf die mathematischen und naturwissenschaftlichen Leistungen der Schüler mit Migrationshintergrund in TIMSS im Vergleich zu Schülern ohne Migrationshintergrund. Hier zeigt sich in den TIMSS-Daten, dass Schüler mit Migrationshintergrund in Mathematik und Naturwissenschaften tendenziell schlechter abschneiden, als Schüler ohne Migrationshintergrund und dass sich der Abstand zu den Schülern ohne Migrationshintergrund zwischen 1995 und 2007 tendenziell vergrößert hat. Dabei sind die Resultate für Migranten der ersten Generation schlechter als die von Migranten der zweiten Generation. Es finden sich jedoch auch Länder, bei denen die Schüler mit Migrationshintergrund besser abschneiden

als Schüler ohne Migrationshintergrund. Insbesondere Singapur, jedoch auch die Kanadischen Provinzen British Columbia und Ontario lassen sich hier nennen.

Danach wurden die Hintergrundinformationen für die Schüler mit Migrationshintergrund in TIMSS 2007 weitergehend untersucht. Ziel war es, zunächst einmal die Unterschiede zwischen den unterschiedlichen Migranten in den einzelnen Ländern darzustellen. Dabei wird der Fokus auf Alter, Geschlecht, sprachlicher Hintergrund oder sozio-ökonomischer Hintergrund gelegt.

Hierbei zeigt sich, dass die Schüler mit Migrationshintergrund in TIMSS 2007 tendenziell etwas älter sind als Schüler ohne Migrationshintergrund. Unter den Migranten der ersten Generation scheinen in einigen Ländern weniger Mädchen als Jungen in die Schule zu gehen. Schüler mit Migrationshintergrund sprechen die Unterrichtssprache weniger häufig zu Hause. Der Bildungshintergrund der Eltern ist nach TIMSS 2007 zwischen Schülern mit und ohne Migrationshintergrund relativ gleich. Die Anzahl der Bücher im Haushalt, welche häufig in internationalen Studien als Maß für den sozio-ökonomischen Status von Schülern genutzt wird, ist bei Migranten tendenziell geringer als bei Nicht-Migranten (siehe zum Beispiel (Postlethwaite & Ross, 1992, p. 22)), stellt jedoch tatsächlich bei beiden Gruppen eine gute Vorhersage-Variable für die mathematischen Leistungen der Schüler dar.

Weiterhin wurden die Einstellungen der Schüler zur Schule und zum Fach Mathematik in TIMSS 2007 untersucht, ebenso wie deren Selbsteinschätzung zur Mathematikleistung. Es zeigen sich in TIMSS 2007 in vielen Ländern keine Unterschiede zwischen Migranten und Nicht-Migranten hinsichtlich ihrer Einstellungen zur Schule und zur Mathematik. Es gibt jedoch Länder, in denen die Einstellungen der Migranten positiver sind, als auch solche, in denen die Einstellungen der Nicht-Migranten positiver sind. Auch gibt es hinsichtlich der Jungen-Mädchen-Unterschiede zwischen Migranten und Nicht-Migranten kein einheitliches Bild über alle Länder. Bezüglich der Selbst-Einschätzung finden sich in TIMSS 2007 einige Länder, in denen insbesondere die Migranten der ersten Generation eine geringere Einschätzung ihrer Mathematik-Leistungen abgeben. Diese Tendenzen folgen jedoch den in TIMSS tatsächlich gemessenen Leistungsunterschieden zwischen Migranten und Nicht-Migranten.

Danach werden Schulfaktoren, wie Schulstandort, Unterrichtsteilnahme, Schulressourcen, Schulklima und Sicherheit untersucht.

Zum Schulstandort finden sich in TIMSS 2007 Tendenzen, dass Schüler mit Migrationshintergrund – und hier insbesondere die Migranten der zweiten Generation – eher in städtischen Regionen zur Schule gehen. Beim Vergleich der mathematischen Leistungsunterschiede zwischen Migranten und Nicht-Migranten in städtischen und ländlichen Regionen gibt es in TIMSS 2007 kein einheitliches Bild. Es finden sich jedoch einige Länder, in denen der Leistungsunterschied in mehr städtischen Regionen geringer ausfällt als in ländlicheren Regionen.

Die weitere Untersuchung von Schulcharakteristika und deren Zusammenhang mit mathematischen Leistungen der Schüler in TIMSS 2007 erbringt noch folgende Resultate. Zum einen zeigt sich in den TIMSS 2007 Daten eine Tendenz, dass Schüler mit Migrationshintergrund vermehrt Schulen besuchen, in denen Schüler weniger am Unterricht teilnehmen. Dies ist in TIMSS 2007 insbesondere für Migranten der ersten Generation zu beobachten. Auch ließ sich ein Zusammenhang zwischen dem Besuch von Schulen, an denen weniger am Unterricht teilgenommen wird, und schlechteren

Mathematikleistungen in TIMSS 2007 zeigen. Dieser Zusammenhang war stärker für Migranten der ersten Generation als für Nicht-Migranten.

Bei der Betrachtung von Schulressourcen und deren Zusammenhang mit Schülerleistungen bei Migranten und Nicht-Migranten zeigen die TIMSS 2007 Daten keine Unterschiede zwischen Migranten und Nicht-Migranten, was die Ausstattung der Schulen, die sie besuchen, betrifft. Jedoch zeigen Migranten in besser ausgestatteten Schulen bessere Leistungen als Migranten, die schlechter ausgestattete Schulen besuchen. Dieser Zusammenhang besteht auch noch nach Herauspartialisieren des sozio-ökonomischen Hintergrundes der Schüler.

Bezüglich des Schulklimas lässt sich in TIMSS 2007 kein Unterschied zwischen den Schulen von Migranten und Nicht-Migranten feststellen, jedoch sowohl für Migranten als auch Nicht-Migranten ein positiver Zusammenhang zwischen Schulklima und mathematischer Leistung der Schüler.

In TIMSS 2007 zeigt sich jedoch ein deutlicher Unterschied in vielen Ländern bezüglich der Einschätzung der Sicherheit in der Schule zwischen Migranten und Nicht-Migranten. Migranten scheinen laut der TIMSS 2007 Daten in diesen Ländern eher Schulen zu besuchen, in denen sie sich nicht sicher fühlen. Positive Ausnahmen sind hier Australien, British Columbia und Singapur, wo sich Schüler mit Migrationshintergrund ebenso sicher in der Schule fühlen wie Schüler ohne Migrationshintergrund. In TIMSS 2007 zeigt sich in nahezu allen Ländern ein deutlicher Zusammenhang zwischen dem Sicherheitsgefühl in der Schule und den mathematischen Leistungen der Schüler.

Es zeigen sich also in einigen Bereichen deutliche Unterschiede in den Schulcharakteristiken der Schulen, die von Migranten und Nicht-Migranten besucht werden. Ebenso lassen sich Zusammenhänge zwischen den Schulcharakteristiken und den mathematischen Leistungen der Schüler in TIMSS 2007 nachweisen.

Zuletzt werden die Klassencharakteristiken in TIMSS 2007 untersucht. Als erstes steht die Klassengröße im Fokus. Dabei zeigt sich in einigen Ländern, dass Schüler mit Migrationshintergrund tendenziell Klassen mit weniger Schülern besuchen, in anderen jedoch Nicht-Migranten Klassen mit weniger Schülern besuchen. Auch gibt es in den TIMSS 2007 Daten in einigen Ländern einen Zusammenhang zwischen der Anzahl der Schüler in der Klasse und den mathematischen Leistungen in der Hinsicht, dass Schüler in Klassen mit mehr Schülern bessere Mathematikleistungen in TIMSS 2007 zeigen. Dies ist im Widerspruch zu anderen Forschungsergebnissen – zum Beispiel des STAR Projektes in den USA, wo ein klarer positiver Zusammenhang zwischen Schülerleistung und Klassengröße nachgewiesen werden konnte (Word et al., 1990, p. 26). Daher sind hier die dahinterliegenden Mechanismen noch weiter zu beleuchten. Wurden zum Beispiel bereits Maßnahmen in diesen Ländern ergriffen, so dass schlechtere Schüler zur Förderung in kleinere Klassen eingeschult wurden?

Ein weiterer Fokus der Klassencharakteristiken besteht in dem Gewicht, das der Mathematiklehrer auf Hausaufgaben legt. Hier zeigt sich in TIMSS 2007 generell kein Unterschied zwischen Migranten und Nicht-Migranten, jedoch für alle Schüler ein klarer Zusammenhang zwischen dem Gewicht, das der Mathematiklehrer auf Hausaufgaben legt, und den Mathematikleistungen der Schüler.

Zuletzt wird die Anzahl der Migranten in einer Klasse und die Mathematikleistungen der Schüler in der Klasse untersucht. Insgesamt zeigt sich in TIMSS 2007 eine recht amorphe Verteilung von

Schülern mit Migrationshintergrund in den Klassen in den unterschiedlichen Ländern. Es zeigt sich eine Tendenz, dass in Ländern, in denen die Migranten schlechtere Mathematikleistungen als Nicht-Migranten zeigen, Schüler in Klassen mit mehr Migranten schlechter abschneiden als Schüler in Klassen mit weniger Migranten. In den Ländern, in denen Migranten in TIMSS 2007 in Mathematik besser abschneiden als Nicht-Migranten, zeigt sich das entgegengesetzte Muster. Dieser Zusammenhang zwischen Anzahl der Migranten in der Klasse und den Mathematikleistungen der Schüler zeigt sich für Migranten als auch für Schüler ohne Migrationshintergrund – und für Schüler ohne Migrationshintergrund sogar stärker.

Nachdem die TIMSS Daten in Hinblick auf das Abschneiden der Migranten und deren Charakteristiken und hinsichtlich des Zusammenhangs zwischen schulischen Leistungen und Schüler-, Schul- und Klassencharakteristiken untersucht sind, wurde die Politik in Singapur und Kanada – zwei Länder, die in den Analysen der TIMSS Daten als positiv für Migranten aufgefallen sind – eingehender betrachtet.

In beiden Ländern zeigt sich eine restriktive Einwanderungspolitik, die Migranten mit besserem Bildungsabschluss bevorzugt. Beide Länder zeichnen sich jedoch auch dadurch aus, dass sie Länder mit einer multikulturellen und multilingualen Population sind. Es gibt Initiativen, die das Bewusstsein der Bevölkerung – und in Singapur insbesondere auch der Schülerschaft – für kulturelle Unterschiede und den Respekt vor anderen Kulturen und Sprachen befördern sollen. Insbesondere wird die wirtschaftliche Notwendigkeit für Bevölkerungszuwachs durch Migration thematisiert und versucht, ein positives Klima für Migranten zu schaffen. In beiden Ländern gibt es Programme, die Schüler mit Problemen in der jeweiligen Unterrichtssprache unterstützen – unabhängig von deren Migrationshintergrund. Aus den Analysen der TIMSS Daten zeigte sich auch ein höheres Sicherheitsgefühl der Schüler mit Migrationshintergrund in diesen Ländern sowie eine stärkeres Gewicht auf Hausaufgaben.

Wenngleich auch die selektiven Migrationspolitiken und die besonderen kulturellen Hintergründe der beiden untersuchten Länder die Übertragbarkeit der positiven Resultate auf andere Länder fraglich machen, so können eventuell andere Länder einige der in Singapur und Kanada bestehenden Initiativen als Anregung aufgreifen. Wichtig sind hier jedoch weitere Studien, die die Mechanismen und den kausalen Zusammenhang beleuchten.

In dieser Dissertation wurde die Situation der sich im Wachsen befindliche Gruppe der Schüler mit Migrationshintergrund beleuchtet. Dabei wurden die neuesten Untersuchungen von großen Bildungsstudien berücksichtigt und auf deren Forschungsergebnisse aufgesetzt. Einige Ergebnisse konnten bestätigt werden, wie zum Beispiel ein geringerer sozio-ökonomischer Status von Schülern mit Migrationshintergrund, wenn man die Anzahl der Bücher in TIMSS 2007 als einen Indikator dafür betrachtet. Andere in der Literatur zu findende Ergebnisse, wie ein geringerer Bildungsstand der Eltern von Schülern mit Migrationshintergrund, konnten jedoch in den TISS 2007 Daten nicht bestätigt werden. Weiterhin wurden Ergebnisse gefunden, die in der existierenden Literatur keine Beachtung gefunden haben, wie zum Beispiel die erschreckend geringe Beteiligung von Mädchen mit Migrationshintergrund in den Bildungssystemen einiger Länder, die sich aus den TIMSS 2007 Daten zu ergeben scheint. Letztlich konnten auch einige Hinweise für Möglichkeiten gefunden werden, die positiv zur Schulbildung von Schülern mit Migrationshintergrund beitragen könnten.

All diese Ergebnisse unterliegen gewissen Einschränkungen, da die untersuchten Daten auf Querschnitt-Untersuchungen beruhen und daher keine kausalen Schlüsse zulassen. Auch ist die in den TIMSS Daten vorliegende Information lückenhaft; so fehlen insbesondere Informationen zu den Herkunftsländern der Schüler mit Migrationshintergrund. Weiterhin ist bei einigen Ergebnissen nicht auszuschließen, dass sie durch nicht bestehende interkulturelle Invarianz beeinflusst sind.

Letztlich ist auch die in weiten Teilen erfolgte Einschränkung der Untersuchung auf mathematische Fähigkeiten der Schüler ein sehr enger Fokus. Eine gute schulische Bildung für Schüler mit Migrationshintergrund beinhaltet sehr viel mehr und konnte im Rahmen dieser Arbeit nicht abgedeckt werden. Jedoch kann eine Verbesserung der mathematischen Fähigkeiten von Schülern mit Migrationshintergrund als ein Aspekt einer verbesserten Schulbildung von Schülern mit Migrationshintergrund betrachtet werden.

Weitere Studien, die die gefundenen Ergebnisse bestätigen, wären sicher wünschenswert. Weiterhin könnten Studien mit einem Längsschnitt –Design oder qualitativ angelegte Studien über die zugrunde liegenden Mechanismen der Einflüsse Auskunft geben und eventuell auch Kausalzusammenhänge nachweisen.