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MATHEMATICS IS FOR EVERYONE

Mathematics is a very important subject in our lives. Mathematics has been part of humanity's eternal search for understanding the universe that surrounds us. The science of numbers and calculations is the most used discipline in our world. Even though not all jobs require high levels of mathematics expertise, every career uses some sort of mathematics. Mathematics helps the human mind to reason and organize difficult situations or problems into clear, simple, and logical steps that lead us to solutions. A person who is mathematically proficient can rationalize and develop logical strategies to solve any challenging circumstances. Since mathematics is an important part in our daily life, all people must have enough mathematical knowledge that makes our society functional. Moreover, every single person must have the right to develop their mathematical skills and be mathematically literate to understand the hypothesis and theories used to explain our world. In order to reach that mathematical proficiency, we need to have an education system that leads us to that goal. This document discusses the actual situation of mathematics education in the U.S., and the role that other social factors play in this issue; also, it compares the U.S. education with the methods and situations of other countries, and gives some suggestions to improve the mathematics education in our country.

In our course we had the chance to explore the situation towards education in other countries. Every member in our class did presentations about countries from different continents. These seminars gave us some general ideas about the situation of these countries in mathematics. The main problems that developing countries face to offer a good quality of education are economics and demographics. For instance, the population in Mexico is more than 13 million people and the universities with high quality are just a few. The economy is very uneven in this country, and just a few of them have the economic resources to provide high education to their kids. The infrastructure, the educational resources such as books of recent editions and the internet, and the opportunity to attend a university of good quality are some of the problems that result from a poor income. Similar situations are facing other developing countries such as the Dominican Republic and Ecuador. Although the economy plays a very important role in education, it has not a direct effect on it. There are other countries such as Singapore and India that are doing a very good job in education and these countries are not part of the "first world" list. We all know that the U.S. is one of the best economies in the world. This country has the infrastructure, the resources and all the elements to be one of the most competitive nations in education. The question is, why is the U.S. not doing that well?

It is a reality that there exists an achievement gap in the U.S. towards mathematics. The results of international test comparisons focused in mathematics show that the U.S. is doing a poor performance in this topic. Some international tests, such as the TIMSS (Third International Mathematics and Science Study), PISA (Program for International Study Assessment) and NAEP (National Assessment of Educational Progress) show that the mathematics achievement in America is really low in comparison with other countries such as Singapore and Japan. Moreover, the assessments discover a huge attainment gap in mathematics among our students.

This achievement gap in our country has its origins in many factors. The list of the aspects that represents a difficulty to a better performance of mathematics is vast. Although many of these reasons belong to schools and other educational agencies, there are many other circumstances that affect the achievement of knowledge such as cultural and social factors. The main characters when we talk about the educational agencies are: the curriculum, the teachers and the students.

The curriculum towards mathematics has been built to make mathematics a science of learning processes instead a subject of understanding. In the document "Common Core State Standards Initiative," we can discover the curriculum's philosophy. "The Standards for Mathematical Practice describes varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies with longstanding importance in mathematics education;" however, the expected number of topics to cover, and the main focus of the mathematical education rests in the process level, and not in the proficiency. The difference between the U.S. and countries with a better success in mathematics is that these countries pay a lot of attention to the importance of understanding of the topics. While the U.S. students cover a big amount of themes in one semester, their counterparts in other countries cover a small number of topics and try to comprehend them as much as possible. In her article "Knowing and Teaching Elementary Mathematics," Liping Ma emphasizes that this philosophy is one of the main reasons for a better performance of other international students than those from the U.S.:

> Chinese students typically outperform U.S. students on international comparisons of mathematics competency. Paradoxically; Chinese teachers seem far less mathematically educated than U. S. teachers. (…) My data suggest that Chinese

> teachers begin their teaching careers with a better understanding of elementary mathematics than that of most U.S. elementary teachers.

It seems that the curriculum problem is a fact of quantity versus quality. While the students in the U.S. are covering a huge number of ideas, their counterparts in China learn a smaller number of ideas but they try to master them. Perhaps the first idea that comes to our mind is to take the models of those countries that have success in mathematics and copy them; however, is this good idea?

Such as any other country, the U.S. has its own characteristics that differentiate it from the rest of the world. Since its origins, the U.S. has been built by immigrants. Here is when demography plays an important role in education. While other countries have a significant number of habitants of one race, the U.S. is a multicultural country. Some of the racial problems that the U.S. has dealt with have affected education as well. The National Achievement of Educational Progress (NAEP) underlined the achievement gaps of Hispanic and Black groups in comparison with whites: "Achievement gaps occur when one group of students outperforms another group and the difference in average scores for the two groups is statistically significant (that is, larger than the margin of error)." The results of the tests applied by the NAEP show that the Hispanic and Black students are not doing well in mathematics and reading in comparison with the White students. Moreover, it seems that this poor performance has developed a bunch of cultural myths that also affect the perception of mathematics from these groups.

The problems of race and language are two huge barriers that contribute to the achievement gap in school. There exists a false belief that some ethnic groups are better in math than others. The problem is that even the members of these groups start to believe that myth. In his article "Mathematics Learning and Participation in the African American Context: The Co-

construction of Identity in Two Intersecting Realms of Experience," Danny Bernard Martin interviewed an Afro-American woman called Gina who explained about her experience about choosing mathematics as her career: "I didn't have any aspirations [in high school}. I said, well, I'm just going to keep going to school since I'm doing well. I kept going and then I noticed you have to pick a major. The ones with math and science, I can't choose that because I know I'm going to fail." In the interview Gina explained that even some teachers and counselors support that idea. Every year, a substantial number of immigrants came from other countries. Some of them are not fluent in English, but they have mathematical knowledge because they had an education in their original countries. Judit Moschkovich explains in her article "Bilingual Mathematics Learners: How Views of Language, Bilingual Learners, and Mathematical Communication Affect Instruction" that the lack of knowledge in language is not directly related with mathematics. After an exhaustive study about how bilingual students deal with mathematics, she arrived at the conclusion that some students are excluded from being proficient in a mathematical career because of their problems with language; however, some of these students could prove they have the skills to have a career in math. "Hearing mathematical ideas and uncovering mathematical competence is only possible if we move beyond limited views of language and deficiency models of bilingual learners." But not only demography is an important characteristic in our country; another issue that we can observe is economy.

Even though the economy in the U.S. is one of the best in the world, education is not the most important point in the budget's list. Education is always mentioned as a very important part of the development of this country. Every single politician explains that education is the key to success. The reality is that when the budget is not enough, education is the first victim. In

Chapter One, "Social Justice, Equity, and Math Education," from his book *The World with Mathematics,* Eric Gutstein explains one classroom activity he put in one of his classes:

> I gave to my students the first of what I call real-world mathematics projects titled "The Cost of the B-2 Bomber (…) The essence of the project was to use U.S. Department of Defense data to find the cost for one B-2 bomber, then compare it to a four-year, full scholarship to the University of Wisconsin. (…) Eventually, they disover that the cost of one bomber could pay for the full, four-year scholarships for the whole graduating class (assuming constant size and costs) for the next 79 years!

Of course this country has the economy and the resources to provide good education to everyone; however, the focus of this country is in the daily life, and the investments in future are not the best. The U.S. is investing in the problems on a daily basis and cutting the budget from education that is the main key to maintain a good international status of every country. In order to maintain a good economy, we need to prepare people for the future. How many geniuses are left behind because their families do not have the money to pay for their education?

The core of every society is family. That is the nucleus of a society in the search of success. The emotional and economic aid that a family could do to its members is essential in education. Chapter Three "The Trouble with Geniuses, Part 1," from the book *Outliers* portrays the cases of two kids who are good in mathematics, two geniuses that came from a different background. While one receives the support from his family and has the opportunity to attend a good school and dream with a promising career, the other one, from a poorer background, won't have the chance to have a professional career in spite of his amazing IQ coefficient. The chapter summarized this fact in a last significative sentence: "No one – not rock stars, not professional

athletes, not sofware billionaires, and not even geniuses- ever makes it alone." The family and society support are important factors in education. The idea must be to unify forces in the search of a better future to our nation. How could we find that unity in a country whose ideal of independence make strangers of people from one state to another?

The unity of the U.S. must be reflected in an education program that adressess all the neccesities of the population in this country. One of the main problems in our country is that every state develops its own standards in education. The comparison between states has the same variety than the comparison of several countries. A better idea could be to join forces to create a curriculum that fulfills the goals of education to make our students competitive in the international field. This country needs to elaborate an educational system that ensures literacy of all its citizens in the most basic concepts and help them to continue with their professional careers. The uneven economy in this country – such as the countries we studied in our course- obey the achievent gap of education among its citizens. In his article "Whose Problem is Poverty," Richard Rothstein states one of the basic tools we can use to make our society a better place to live: "Closing achievement gaps require combining school improvement with reforms that narrow the vast socioeconomic inequalities in the United States." There is no doubt about how important education is in the future of our kids. That is the key to better pay jobs and professional development. Of course a well-educated person will have a better income than one who does not have a career. Moreover, careers in mathematics are in high demand and are very well paid. The main question is: how can we provide a better and competitive education to our country at the international level?

We need to create an educational model that covers all the necessities of our country. Some of the ideas from countries like Singapore, China, Japan, and other countries with good

results in mathematics could be used to create this model; however, we need to be careful! We are not Singapore, China, Japan or another country. Any implementation of new ideas will have their consequences. For instance, by covering a small amount of standards and understanding them very well, instead of a big amount with a poor comprehension, will have its consequences. The school calendar is not the same for every country. In the presentations in class we discovered that most of the Asian countries have a calendar with fewer vacations and more classes than the American school's calendar. It is not that easy to make a change of huge dimensions that would affect our culture. The system has been used for years, and it is not simple to wake up one day and change it. The process must be slow, and most of the branches in our society must be enrolled and fully understand the purpose. That is perhaps the most difficult challenge: change the culture and the perception of education in our country. In order to do that, we need the enrollment of all the important factors: society, schools, family, teachers and students.

The mission to provide a good education for everyone is a responsibility of all. We already discover that the performance in mathematics of our country is not the best in the international field. Education towards mathematics must have a huge change. The government in this country must be serious about the importance that education has. It is not fair that schools and resources for students appear only in the speeches of politicians' agenda, and then disappear when they are in the govermnent places. This country must invest in his future, and that future is based in the education of our kids. By providing the economic tools to our schools, the educational system must work in finding a program that fits the U.S. needs. The responsabilities of the educational system is to find the adequate program that helps our students to suceed in all areas, especially mathematics, and prepare them for the new millenium. Every family should

focus on the education of their members. The parents must be enrolled in the activities of their kids, and be flexible about the changes that new programs could have. The teachers' role is to be conscious about the importance of comprehension of all subjects. We need to be aware that not all our kids are going to be mathematicians, nor historians, or other things, but we must provide them the tools to become literate in all those areas. The proficiency in all the branches of education will help to reduce the gap of the uneven economy and the injusticies in society. The students' responsibility is to learn to work in society. They must learn that the beauty of knowledge is not to keep it for yourself, but sharing what you know with the world. Although all these factors could be take as a dream impossible to make it true, many of the most famous discoveries and invents started like that.

Why is mathematics so important? Someone that knows mathematics is able to ask questions, to find answers, to investigate and explore problems; that person is able to prove something that is persistent in the search of a solution, and that could comprehend more than one way to find an answer. A person who knows how to interpret and communicate mathematics knows how to use many symbols to explain the universe and is able to develop a new language that has been used for centuries to understand our world. A person that has the capacity of mathematical reasoning has the power to think logically; that person is able to discern similitudes and differences among problems and objects, and to choose the best options in base of that. You don't need to be a mathematician to use mathematics to improve your life. Mathematics is in the universe; it is in every single thing that surrounds us. Mathematics is one of the most important tools of success. That is why all of us need to be literate in mathematics. That is why we need to educate our kids in mathematics. Mathematics is a wonderful tool for everyone that could be used to have a better life for those that love it, and also for those that hate it.

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