27 Learning to Add: Are we Subtracting the Importance of the Home Environment?

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Since my early days in school my association with Mathematics in most of its forms, including Algebra, Geometry, and Statistics has always been very pleasant. In fact, Geometry, followed by Physics, was my favorite subject in school. Admittedly, there were some rough patches but right now they all seem too insignificant to even mention. To this day, I continue my healthy association with Math that I formed when I was young. A vast amount of my work today depends on applied quantitative research and I must say that on most days I can't get enough of it!

As I reflect on this association, and how it came about, I am surprised at how my individual experiences reflect a lot of what researchers from all over the world argue as well. So let me begin with my experiences as a student and now as a teacher of mathematical concepts.

Probably the single most important explanation for my positive relationship with Math is that Math was 'cool' in our house. Though not a mathematician, my mother loves Math too. She would talk passionately about Math and how much she enjoyed it as a student. She would show us simple yet cool things we can do with Math in our daily life, like figuring out the angle at which to slice the apple to make 5 exactly equal pieces! She taught me tricks to learn multiplication tables so that rather than becoming an endless series of numbers to memorize by rote, they are to me a logical sequence that I can construct in my head even today. Sometimes when the material taught in school became too complicated and filled with jargon and endless steps, she would help me out. She would usually break down the problem into several logical parts and in the process she often taught me easier ways to address the same questions.

This love for and excitement about Math also came through the books I got to read as a child and the books I demanded to read. I loved to read books about mathematical tricks, to solve mathematical puzzles, and to read about how Math applies to daily life. In short, in our house Math was fun, relevant, and by no means something to be scared of.

All this mathematical excitement in the house did not turn me into some kind of a Math genius, but it did do something very valuable. It gave me the confidence necessary to pursue complex mathematical concepts in my work and study. It ensured that whenever I encountered daunting mathematical expressions, rather than being turned off by them, I felt comfortable trying to play with those ideas and figure out the logic behind them. Those early positive experiences and interactions freed me to a great extent from 'mathematical apprehension'. Now as a university instructor of applied quantitative research, I regularly teach many PhD students. The biggest barrier for many of my absolutely outstanding students is that their prior interactions with Math have led them to be afraid of it or to see it as something unduly challenging and confusing, rather than relevant and fun. For many of them, once we break that barrier, the rest of the class becomes quite exciting and interesting.

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So moving on to the broader patterns identified by research, what does my experience reflect? It highlights the importance of making the Mathematics curriculum more relevant to a child's life; also the need to make Math more fun in the classroom and more importantly the need to ensure that we do not scare children with Mathematics - instead we find ways to share with them the joy and elegance of mathematical thinking. Together it emphasizes the critical role played by both teachers and a well-planned curriculum in enhancing a child's Mathematics competence.

But equally importantly, my experiences reflect the importance of something else: of parental involvement and the home environment. With my colleague, Professor Thomas Luschei of Florida State University, I recently analyzed large-scale data on Mathematics achievement in the 4th grade in 25 diverse countries; we did not have data on India (Chudgar & Luschei 2009). In all the countries we studied we found that the role of the family was potentially more crucial in improving Mathematics achievement, compared to the school. This is not to say that schools (and the curriculum and the teachers which are all subsumed under 'school' in our study) are not important. They indeed are very important too, especially when the country is poor and opportunities are unequal, as in India. But what our study highlighted, as many others have, is that family factors are crucial to a child's learning outcome. Within the family, research shows that indicators like parents' education and the number of books available at home are all strongly related to children's educational outcomes - (Buchmann and Hannum (2001). Separate research has also shown that the mother has a specific effect, and that her education is more strongly associated with the child's learning outcome (Schultz 2002).

In India, according to the 2001 census, close to 40% of Indian adults could not read or write, let alone being educated up to even primary level. More than 50% of adult women are illiterate. The limitations imposed by illiteracy are hard to comprehend for those of us who are fluent in not just one but often multiple languages. But for a parent who cannot even read or write their own name, this may mean a very limited participation with their children's education, textbooks, homework, and teachers in spite of their best intentions. Thus in India today, a vast majority of children currently in school continue to come from households where their parents, especially their mothers, may not be able to engage fully with their school experiences. And while not all the mothers have to enjoy Math or teach their children mathematical tricks, we can only imagine the disadvantage these children of illiterate parents experience as they navigate their school experiences, often with minimal help from adults. In fact, another large-scale data analysis project I undertook using data from India (Chudgar 2009) showed that parental illiteracy may be far more important than even poverty in determining a child's success and failure in the education system.

Improving children's school performance and retention is a multi-faceted problem that requires multi-faceted interventions. From the policy perspective, 'fixing' schools, teaching practices and curricula are all essential: a lot is broken and a lot needs amendment. In particular, research indicates that teachers and teaching practices may be the most important set of factors that policymakers can control to improve student performance (for example Goldhaber, Brewer, & Anderson, 1999). In fact, research from elsewhere shows that teachers may have a role to play in bridging some of the gaps between more and less privileged children (Hanushek & Rivkin, 2004). But as we march ahead addressing problems in the public domain that we can perhaps more readily see and address, I believe that we also need to pay more careful attention to how we can support and empower the parents of the children we want to see succeed. My personal experiences notwithstanding, more than enough evidence points to the importance of family, especially the mother. Data on limited adult literacy levels in India are incontrovertible. Together these numbers point toward yet another area needing attention and intervention as we strive to improve the education our children are receiving.

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Originally from Mumbai, **Amita Chudgar** received her PhD in Economics of Education from Stanford University. She is currently an assistant professor in the College of Education at Michigan State University where she teaches graduate classes in economics of education, international education and quantitative research methods. Her research aims to understand the determinants of school enrollment, retention and school performance in India and in the broader international-comparative context. She can be contacted at amitac@msu.edu

Logico Math Brain Teasers

There are 100 students in Hostel and there are 100 letter boxes. The letter boxes are all open to begin with. Each student is asked to go and change the status of each box – open it if it is closed or close it if it happens to be open. The first student has to change the status of each box (in his case, all are open so he has to close each of them). The second student has to change he status of every second box (ie change the status of he second, fourth, sixth box etc from closed to opened), the third one has to change the status of every third box (the third, sixth, ninth box etc from opened to closed or closed to opened as the case may be) and so on till all 100 students complete this task. When this is completed, how many of the 100 letter boxes will be closed?

(Hint: Try it out with a smaller number and see if any pattern emerges)

Use this space for calculation