

## **Bangladeshi rural secondary school girls' participation in higher mathematics optional course: What are the influences?**

K. M. Nabiul Alam

*UCL Institute of Education, University of London*

Previous research has shown that women are still underrepresented in the Science, Technology, Engineering and Mathematics (STEM) field compared to men in many countries, including those from the European Union and the United States but the cause remains debated (Halpern et al., 2007). The negative effect of gender stereotypes relating to women's perceived lower ability in domains such as mathematics and reasoning is considered to be the one possible explanation for this underrepresentation. This paper reports on a pilot study based on three Focus Group Discussions (FGDs) with 30 girls of grades 9 and 10 of three rural secondary schools in Bangladesh. The thematic analysis of FGD data explores these girls' attitudes towards mathematics, perceived usefulness of studying higher mathematics, their school experiences, career aspirations, and parents' professions.

**Key words: Bangladesh; FGD; girls; higher mathematics; influences; pilot study; rural secondary school; STEM**

### **Introduction and context**

It is widely reported that women are underrepresented in the STEM careers in most countries of the world (Nagy et al., 2008) and engineering is still seen as a male-dominated field (Buschor, Berweger, Frei, & Kappler, 2014). For getting access to the STEM careers, candidates must acquire competency in science and/or higher mathematics. Thus to compete with boys in accessing such careers, girls' active presence in the study of higher mathematics courses is highly important.

Several studies (e.g. Nath, 2008; Thornton, Sultan, Huda & Munsura, 2005) have reported that, Bangladeshi girls are underperformed in secondary mathematics compared to boys. In Education Watch-2007 study, Nath (2008) found that the gender difference with a bias against girls persisted in all types of schools. However, it was smaller in state schools than others. The worst gap was observed in rural madrasahs (Islamic schools). In general, the gender gap was less in Bangla than the other subjects. The boys demonstrated significantly better performance than the girls in mathematics along with everyday science, Bangla, and English. Similar findings are also reported by Thornton et al. (2005): Bangla is the most popular and Mathematics and English are the most problematic subjects to the Bangladeshi rural secondary school girls. Thornton et al. focus on the underlying factors such as: girls' difficulty in understanding of mathematics, their dislike of the subject and personality of the teacher due to the fact that the girls performed badly in the mathematics exams.

As a result of the implementation of female stipend projects in Bangladesh, girls' overall enrolment in secondary schools has increased up to 53.22% in 2014 from 34% in 1990 (Asadullah & Chaudhury, 2013; BANBEIS, 2015) which is certainly a remarkable achievement. This increased rate of participation in secondary education seems to have significant impact on Bangladeshi girls' socio-economic status by reducing the number of early marriages, getting access to the locally

available NGO based and garment industry jobs, although most of these are low paid. Some young women also get the opportunity to establish their family businesses or firms (e.g. poultry firm, dairy firm, grocery shop) with small financial loans or grants provided by the local banks or microcredit organizations. However, rural girls are less competent in getting jobs in the sectors where mathematical competence is required, such as: science, engineering and technology, mathematics, physics and computer science, and accounting and statistics. A practical example of such is given in the next paragraph.

In appointing new teachers in Bangladesh, a 60 percent quota has been preserved for women at the primary level. At secondary school, college and madrasa level in rural areas 20 percent and in urban areas 30 percent quotas have been preserved for women teachers. Despite this fact, during appointment in rural areas suitable and eligible candidates are not found always. To increase the supply of female teachers, especially in the three shortage subjects, mathematics, science and English language, a seven year long project named PROMOTE (Program to Motivate, Train and Employ female teachers in rural secondary schools in Bangladesh) has been implemented by the Ministry of Education (Thornton, 2002) but the situation demands the continuation of such projects for longer periods.

Mathematics is a compulsory subject in the secondary school curriculum in Bangladesh but there is an extra opportunity to study 'Higher Mathematics' as an optional subject for those who want to carry on with their study of higher maths at post-secondary level. This course is only available for the children who are in the science stream of secondary education. The subject is studied throughout grades 9 and 10 by the children who are interested and competent in maths. At the end of grade 10, there is a public examination named, Secondary School Certificate (SSC) Examination. The marks gained above forty percent in the optional subject will be added to the aggregate marks of the compulsory component to help children achieve a better grade in their SSC exam. Children in the science stream can choose to study any one of the optional subjects: Agricultural Education, Anthropology, Art and Craft, Basic Trade, Biology, Geography, Higher Mathematics, Home Economics, Music, and Physical Education and Sport according to their interest and ability.

My main research question is: Why do girls in Bangladeshi rural secondary schools choose or reject the study of the 'Higher Mathematics' optional course? I want to explore the likely influences on girls' participation in 'Higher Mathematics' such as: their attitudes towards mathematics, perceived usefulness of studying higher mathematics, school experiences, career ambitions, and parents' profession.

## **The study**

As part of my PhD research, I have recently conducted a pilot study using the techniques: survey of attitudes towards mathematics, maths lesson observation, semi-structured interviews with parents and teachers, and FGDs with girls. This report only draws on thematic analysis of 3 FGDs with 30 girls of grades 9 and 10 of three rural secondary schools in Bangladesh. The upcoming reports will present the findings from the other parts of the pilot study. The FGDs covered the topics such as popularity of maths as a subject of girls' choice, stereotypical belief about maths as a male dominated subject, perceived usefulness of mathematics, career ambition, parents' profession, school and family support for studying higher maths, and any other problems they encounter that affect their study of higher maths. All the three FGDs were audio-recorded and then transcribed using a literary style by, for example,

ignoring pauses, fillers, intonations during conversations (adopted from Wright, 2014) as my intention is to analyse and report girls' experiences as a "readable public story" (Kvale and Brinkmann, 2009, p181). By re-reading and listening again to the original audio recordings, the transcripts were then summarised by breaking down the text into units of meaning and summarising these as simply as possible, including some exact quotations and descriptive texts (adopted from Wright, 2014). However, some aspects of the data have also been analysed numerically such as girls' most and least favourite subjects, their career choices and parents' professions. These are to see the popularity of 'Higher Mathematics' as a subject and to find out how influential parents' profession is in girls' career choices.

The following section examines the FGD data under four sub-headings that represent the same category of data in order to explore the similarities, differences and relationships between the units of meaning.

### Attitudes towards mathematics

To explore girls' attitudes on whether or not they agree on the stereotypical belief about maths as a male dominated subject, I asked them, "Who are better in maths: boys or girls?" In response they told:

G1: I think boys and girls both are good in maths, if they try. Why should the girls be weaker in maths? Is there any chemical substance or hormone within anyone?

G2: Both are good, it is unlikely that boys will always be good in maths and girls will not.

G3: Sometimes boys can't solve maths problems but the girls can. It may slightly vary. We can see it when the result sheets are displayed in the board. Is there any evidence that boys are good and girls are bad in maths?

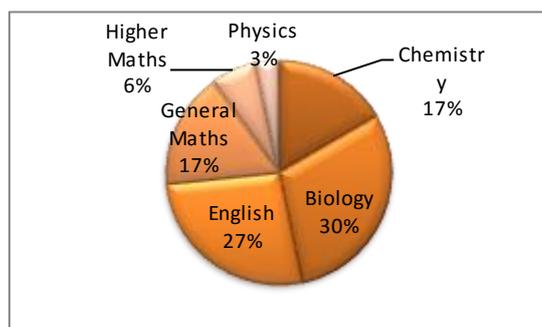
G4: Our teachers' comment would be more appropriate. Our teachers say that girls are better in maths than boys. I think, one third of the boys are good and the rest are bad in maths.

G5: I am not good at maths, that why I chose to study 'agriculture' as an optional subject.

G6: When I see most of them understood maths well except me, and then I feel shy asking questions to the teacher.

Therefore, most of the girls do not seem to agree that boys are superior in maths although they did not claim themselves as superior. Rather they are likely to agree on equal domination on maths although a few girls agreed that they themselves are not good at maths or feel shy expressing their weakness about the subject.

Figure 1: Girls' most favorite subjects



In response to my query about their most favourite subjects, highest number of girls mentioned 'Biology' (30%, n=9) followed by 'English' (27%, n=8), 'General Maths' (17%, n=5), 'Chemistry' (17%, n=5), 'Higher Maths' (6%, n=2) and 'Physics' (3%, n=1). Surprisingly, no one mentioned 'Bangla' which contradicts the finding of Thornton et al. (2005). Therefore, the

popularity of the subject might have been judged in terms of pass rates in the case of

Thornton et al. (2005) study or 'Bangla' was actually the most popular subject to the study participants at that point of time. The second surprise is that 'English' is mentioned as girls' 2<sup>nd</sup> popular subject after 'Biology'. This also contradicts the finding of Thornton et al. (2005). Therefore, it may be that Bangladeshi rural girls' perspectives have changed overtime and/or their interest and ability seem to be changed. However, I am not surprised to see that 'Biology' is the most favourite subject of the girls as it is aligned to the findings from my literature review (for details see Institute of Physics, 2013).

In response to my query about the topics in mathematics that girls like most, they have mentioned: sets, statistics, trigonometry, perimeter, algebraic expression, finding values, solving equations, probability (in higher maths), ratio and proportion, and series are their most liked topics. A few mentioned vectors and geometry (in higher maths) as their least favourite topics. However, although girls' attitudes seemed positive while they were comparing themselves with boys, in terms of their choice or popularity of the subject of their study, 'Higher Maths' and 'General Maths' are among the least favourite. In the following sections girls' attitudes related to their career ambition and perceived usefulness of maths will be discussed.

### **Perceived usefulness of studying higher mathematics**

As perceived usefulness of maths seems to have positive correlation with mathematics achievements and a very important predictor of students' election of optional mathematics courses (Meece, Parsons, Kaczala, Goff & Futterman, 1982; Fennema & Sherman, 1977) therefore, I have asked the girls to share their thoughts about how they see the use of mathematics in their lives? Some of their responses were as follows:

G1: Although I am not good at maths and not interested about it but due to family pressure, I had to choose to study higher maths. My family told me that, for getting admission in good quality college, studying higher maths would be helpful.

G2: I want to be an Air Pilot but my father wants me to be a Police Officer. However, I hope that, studying higher maths would help me to become any of them.

G3: As I want to be an Engineer, therefore, I need to study higher maths.

G4: Although I want to be a Lawyer, but it requires mathematical brain for accurate justification....as like, how 2 plus 2 becomes 4?

G5: I believe that study of higher maths (in secondary level) would flourish my merits although; there is less use of higher maths in medical profession. In the higher secondary level, I might not study higher maths because; studying 'Biology' would be my preferred subject to become a doctor.

The responses indicate that girls who have chosen to study higher maths have positive view of the usefulness of the subject. On the other hand most of the girls who are not studying 'Higher Maths' as an optional subject, come up with very short answers such as, "while we go for shopping, we need to calculate and pay the amount of money", "to measure anything, we need maths", "to measure our lands, we use geometry". Therefore, it seems that, girls' perceived usefulness of mathematics is related to their decision to study or not to study higher maths optional subject. The girls who find maths as useful in their life are likely to choose to study higher maths optional subject at secondary level. Alternatively, girls who do not have clear idea about the

usefulness of studying higher maths appear to see it unlikely that they will study the subject.

### School related issues that influence the study of higher mathematics

Many girls have mentioned that higher maths lessons take place mostly in the last period of the day due to small number of students. Sometimes lessons are cancelled. Therefore, most of the girls depend on paid private tuition from their own school maths teacher or from a maths tuition centre. In most cases teachers are interested in private tuition before or after school as a source of extra income. Sometimes schools arrange extra lessons for Maths, English and Science but children need to pay for them. I asked them whether or not they can afford the cost. They replied, “We must need to manage the cost as we can’t think of studying higher maths without private tuition”. In one case someone mentioned, “My aunty is a primary school teacher, she helps me with maths during the school vacation”. Another girl said,

My father is a maths and science teacher of a secondary school, but I study in a different school which is about 15 km away as because my school is better than my father’s one. Also, I can get a good quality private tuition here. So, I stay with my grandparents. However, my parents come and visit me frequently.

During the discussion about teachers’ gender, many of them mentioned that female teachers are seen as like their mothers to share any of their problems. Some girls said that male teachers are also like their fathers so, both are respectful and both expect to see their improvements. Therefore, the girls do not seem to have a strong argument for one or the other. About studying in single sex girls’ school, most girls prefer to study in mixed school as they think mixed schools have better quality teachers, extra private tuition facility or provide extra coaching classes. One girl mentioned that, in girls’ only school, the lessons are like meetings due to the small number of students and this is good for getting the teacher’s attention. However, there is shortage of science and maths teachers in girls’ only schools. For that reason, one girl had moved from a girls’ school to a mixed school. No girl complained about boys’ behaviour in mixed schools.

### Parents’ profession versus girls’ career aspirations

I asked the girls about their parents’ professions and their own career ambitions. Most of the girls’ ambition is to become a ‘doctor’ (n=20) followed by ‘teacher’ (n=4), ‘engineer’ (n=2) and ‘others’ (n=4, pilot, police, army & lawyer). However, most of the teacher’s daughters (n=8) want to be ‘doctor’ but none of them want to be

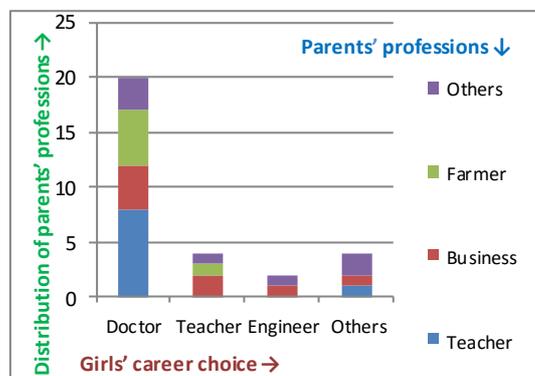


Figure 2: Analysis of girls’ career choice and parents’ profession

‘teacher’. Eight girls whose fathers are farmers also want to be ‘doctor’. Similarly, 4 business person’s daughters also want to be ‘doctor’. However, it is also remarkable that the girls studying or not studying ‘Higher Maths’ both have a tendency towards the career as a ‘doctor’. I hope, my final study would be able to find whether any further correlation exists between parents’ profession and girls’ career ambition.

## References:

- Asadullah, N. A. and Chaudhury, N. (2013). *Primary Schooling, Student Learning, and School Quality in Rural Bangladesh (Working paper)*. Washington, DC: Centre for Global Development.
- Bangladesh Bureau of Educational Information and Statistics (BANBEIS). (2015). *Enrolment in Secondary School by Management & Sex, 1970-2012*. Available: [http://www.banbeis.gov.bd/webnew/index.php?option=com\\_content&view=article&id=316&Itemid=171](http://www.banbeis.gov.bd/webnew/index.php?option=com_content&view=article&id=316&Itemid=171). Last accessed 4 March 2015.
- Buschor, C.B., Berweger, S., Frei, A.K., & Kappler, C. (2014). Majoring in STEM- What Accounts for Women's Career Decision Making? A Mixed Methods Study. *The Journal of Educational Research*. 107, p167-176.
- Fennema, E. and Sherman, J. (1977). Sex-related differences in mathematics achievement, spatial visualization, and affective factors. *American Educational Research Journal*. 14, p51-71.
- Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest*, 8, p1-51.
- Institute of Physics. (2013). *Closing Doors: Exploring gender and subject choice in schools*. London: Institute of Physics.
- Kvale, S. & Brinkmann, S. (2009). *Interviews: learning the craft of qualitative research interviewing*. London: Sage Publications.
- Meece, J. L., Parsons, J. E., Kaczala, C. M., Goff, S. B., and Futterman, R. (1982). Sex differences in math achievement: Toward a model of academic choice. *Psychological Bulletin*. 9, p324-348.
- Nagy, G., Garrett, J., Trautwein, U., Cortina, K. S., Baumert, J., & Eccles, J. S. (2008). Gendered high school course selection as a precursor of gendered careers: The mediating role of self-concept and intrinsic value. In: Watt, H. M. G. & Eccles, J. S. (Eds.), *Gender and occupational outcomes: Longitudinal assessments of individual, social and cultural influences*. Washington D.C.: American Psychological Association. p115-143.
- Nath, S.R. (2008). *Education Watch 2007: The State of Secondary Education, Quality and Equity Challenges*. Dhaka: Campaign for Popular Education (CAMPE).
- Thornton, H., Sultan, M., Huda, A. and Munsura, U. (2005). *Pushing the Boundaries: Girls and Secondary Education in Bangladesh*. Dhaka, Bangladesh: Department for International Development (DFID).
- Thornton, H. (2002). *The teaching and learning of mathematics in teacher training colleges in Bangladesh*, Unpublished report for PROMOTE, Dhaka.
- Wright, P. (2014). Teaching mathematics for social justice: translating theory into classroom. In: Pope, S. (Ed.). *Proceedings of the 8th British Congress of Mathematics Education*. (p375-382). Nottingham, UK: University of Nottingham