RECOLLECTION OF MARYAM MIRZAKHANI'S LOVE FOR MATHEMATICS: IGNITING FEMALE STUDENTS' PASSION IN MATHEMATICS

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Abstract

Many of the famous women mathematicians experienced a spark. Something happened, and a love of mathematics began. This paper is on Maryam Mirzakhani who was the only woman and Iranian to be awarded with the Fields Medal, the most prestigious award in mathematics. Recollecting her love for mathematics may ignite female students' passion in mathematics. Perhaps, through her story, teachers can provide that inspiration. Mathematics teachers can present the beauty of mathematics to the students, helping engage them in a lifelong passion.

Keywords:*Mathematics, Maryam Mirzakhani, Role Model*

INTRODUCTION

The language of mathematics has changed the way we think about the world. Most of our science and technology would have been literally unthinkable without mathematics. This is so because mathematics is the cornerstone of national development without which no nation can excel scientifically and technologically (Ogbonna, Obasi&Duru, 2018). As a result, nations that aspire to develop scientifically and technologically should give great attention to the teaching of mathematics at all the levels of education. Despite the usefulness of mathematics in national development, it is observed that female students are still not measuring up with their male counterpart in the subject. Wiest (2009) argues that female high school and college students studying mathematics need to be exposed to female mathematicians. Female mathematicians have played an important role in the field of mathematics since ancient times. Such people as Hypatia, EmmyNoether, Sonya Kovalevskaya, Maria GaetanaAgnesi, and Mary Fairfax Sommerville, just to mention a few. This paper focused on Maryam Mirzakhani.

Maryam Mirzakhani is the only woman and Iranian to be awarded with the Fields Medal, the most prestigious award in mathematics. Mirzakhani initially wanted to be a writer. In high school, however, she fell in love with mathematics. As a junior, Mirzakhani and her best friend became the only Iranian women to qualify for the International Mathematical Olympiad. The following year, Mirzakhani earned a gold medal with a perfect score. Later, she moved to the United States for graduate school at Harvard University. After becoming a research fellow and professor at two institutions, she became a professor at Stanford University, where she would work until her death.Mirzakhani's work concentrated on several branches of theoretical mathematics: hyperbolic geometry, symplectic geometry, Ergodic

theory, moduli spaces, and Teichmüller theory. She was particularly fascinated with the geometric and dynamic complexities of curved surfaces, like doughnut shapes, spheres and amoebas. Her Ph.D. thesis was notable, as it led to the young mathematician being published in top mathematical journals across three separate papers. One paper contained a new proof for the Witten conjecture, which connected mathematics and quantum gravity. In 2014, Mirzakhani received the Fields Medal, a mathematical award often compared to the Nobel Prize.Thus, mathematics teachers can utilize her profiles and contributions in the classroom to ignite female students' passion in mathematics and to motivate female students to study mathematics for sustainable mathematics development.

A BRIEF BIOGRAPHY OF MARYAM MIRZAKHANI

Maryam Mirzakhani was born in 1977 in Tehran, Iran. She went to high school in Tehran at Farzanegan, National Organization for Development of Exceptional Talents (NODET). In 1994, Mirzakhani won a gold medal in the International Mathematical Olympiad, the first female Iranian student to do so. In the 1995 International Mathematical Olympiad, she became the first Iranian student to achieve a perfect score and to win two gold medals. She obtained her BSc in mathematics (1999) from Sharif University of Technology in Tehran. She went to the United States for graduate work, earning a PhD from Harvard University (2004), where she worked under the supervision of the Fields Medalist Curtis McMullen. She was also a 2004 research fellow of the Clay Mathematics Institute and a professor at Princeton University.

Mirzakhani has made several contributions to the theory of moduli spaces of Riemann surfaces. In her early work, Mirzakhani discovered a formula expressing the volume of a moduli space with a given genus as a polynomial in the number of boundary components. This led her to obtain a new proof for the formula discovered by Edward Witten and Maxim Kontsevich on the intersection numbers of tautological classes on moduli space, as well as an asymptotic formula for the growth of the number of simple closed geodesics on a compact hyperbolic surface, generalizing the theorem of the three geodesics for spherical surfaces. Her subsequent work has focused on Teichmüller dynamics of moduli space. In particular, she was able to prove the long-standing conjecture that William Thurston's earthquake flow on Teichmüller space is ergodic. Most recently as of 2014, with Alex Eskin and with input from Amir Mohammadi, Mirzakhani proved that complex geodesics and their closures in moduli space are surprisingly regular, rather than irregular or fractal. The closures of complex geodesics are algebraic objects defined in terms of polynomials and therefore they have certain rigidity properties, which is analogous to a celebrated result that Marina Ratner arrived at during the 1990s.

The International Mathematical Union said in its press release that, it is astounding to find that the rigidity in homogeneous spaces has an echo in the inhomogeneous world of moduli space. Mirzakhani was awarded the Fields Medal in 2014 for her outstanding contributions to the dynamics and geometry of Riemann surfaces and their moduli spaces. At the time of the award, Wisconsin professor Jordan Ellenberg explained her research to a popular audience: Her work expertly blends dynamics with geometry. President Hassan Rouhani of Iran

congratulated her. She is married to Jan Vondrák, a Czech theoretical computer scientist who works at IBM Almaden Research Center. They have a daughter named Anahita. Many awards and honours were given to her. She is now late. May her soul rest in peace.

IGNITING FEMALE STUDENTS' PASSION IN MATHEMATICS

Since men have traditionally outnumbered women in the mathematics departments, women are mostly likely to benefit from the example of a female professional mathematician who provides evidence that females can achieve success (Lockwood, 2009). This is because successful female figures function as inspirational, and they convey the idea that success is achievable by all females. Female role models also demonstrate that it is possible to overcome patriarchal ideologies and gender stereotypes, indicating to other women that success is attainable. Wiest (2009) argues that female high school and college students studying mathematics need to be exposed to female role models through inviting female guest speakers to address classes, showing films about female mathematicians and (infusing) information about women mathematicians and their work into relevant course content (Wiest, 2009). In looking at the role models influence on the educational attainment of young women, Nixon and Robinson (1999) found that the educational attainment of female students is positively and significantly correlated with the percentage of faculty and professional staff at their high school who are female, although the magnitude of the effect is relatively small. However, Ogbonna et al (2018) revealed that mathematics teachers rarely and inconsistently utilize history of women mathematicians as role models in the classroom to motivate female students to study mathematics. It is important to note that this has consequently resulted in low female participation in mathematics, especially in Nigeria. Therefore, recollecting Maryam Mirzakhani's love for mathematics may ignite female students' passion in mathematics. Perhaps, through her story, teachers can provide that inspiration. Mathematics teachers can present the beauty of mathematics to the students, helping engage them in a lifelong passion.

SUGGESTIONS

1. This paper suggests that teachers should expose girls to female role models who have succeeded in mathematics and provide information, advice and guidance on mathematics careers for sustainable mathematics development.
2. It is invaluable to have a friend who shares your interests, and helps you stay motivated.
3. Students should spend time on mathematics. This is because, the more you spend time on mathematics, the more excited you become.
4. Students should have problem-solving sessions and informal reading groups with classmates. The friendship and support of all the people you meet in school can help you a lot in many different ways.
5. Discussing mathematics with colleagues of different backgrounds is one of the most productive ways of making progress.
6. Study mathematics patiently. Because the beauty of mathematics only shows itself to more patient followers.

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