Critique Paper in History and Philosophy of Science and Technology Education

The Man Who Knew Infinity

Orville D. Hombrebueno

Ph.D. in Science Education: Mathematics

October 19, 2018

# Introduction

As a math teacher, there is nothing quite amusing and inspiring than watching a movie, based on true events, about a famous mathematician. In this case, the life story of Mr. Srinivasa Ramanujan. I have encountered him in teaching number theory. Little did I know that his story is quite the story. It is a tragic one. It showed his struggles with his culture and beliefs, his being Indian, his being “ill-educated”, and his sickness which, after his success took his life. Nonetheless, the movie showed how he succeeded despite all of these struggles. And from these, I was truly inspired.

# Issues

In explaining his notes to his wife, he said that it is like a painting with colors you cannot see. He further explained to his wife that there are patterns in everything – the color in light, the reflections on water – and that these patterns reveal themselves in mathematics in the most incredible form and that it is quite beautiful. This is a Pythagorean way of seeing things.

His ideas and formulae – brilliant they may be – lacked proofs and this is what Mr. Hardy and Mr. Littlewood wanted him to learn and incorporate in his works. This proved to be a difficult task for Mr. Ramanujan. Mr. Littlewood speculated that Mr. Ramanujan did not like proofs because they may be disagreeable to his formulae. Mr. Ramanujan think that doing proofs is a waste of time. He argues that he has the formulas and that the only thing left to do is publish his claims. This is an issue on HPS. According to Slezak (n.d.), proofs or explanations are central to the philosophy of science and that proofs determine whether a claim belongs to science or pseudo-science. Mr. Ramanujan who did not have any degree and who I suppose, don’t have any background on HPS did not know the importance and the place of proofs in his works, formulae and claims.

Furthermore, having no proofs for a claim is in contrast with Aristotle’s scientific inquiry approach. Formulae with no proofs or claims with no proofs are merely intuitions as argued by Mr. Hardy. He continued by emphasizing the need of proofs to hold these formulae and claims accountable.

To reconcile this conflict, Mr. Hardy gave a brief lecture about Euler and Jacobi. He even pointed out that Mr. Ramanujan is as good as these two mathematicians. He added that what they have in common is the love of form; an art unto itself. He added that like all art, it reflects truth. However, he emphasized that this art that he posses means nothing to those who doubt him unless he shows or provides proofs for this art. He also brought Mr. Ramanujan to the Wren library and showed him Mr. Isaac Newton’s Principia Mathematica. He pointed out that just as Newton represents the physical aspect of their work, Mr. Ramanujan’s notebooks represent the abstract. He then pointed out the importance of proofs just as it is important to Newton’s work. He then motivated Mr. Ramanujan that with proofs, his notebooks might one day find their place in the Wren library. Moreover, he also provided some proofs to Ramanujan’s claim on highly composite numbers and published it just to show him how important proofs are.

In a different light, Mr. Ramanujan said that he gets his formulae from his god when he sleeps and pray. Mr. Ramanujan can be quoted in the movie saying “An equation has no meaning to me unless it expresses a thought of God”. This raises the issue of history of science as subversive (Slezak, n.d.). This part of the movie might prove to be conflicting to someone who sees in science a model of objectivity and rationality. Nonetheless, the movie was able to make its effect subtle by attributing this aspect of Mr. Ramanujan to his profound and invincible originality. In addition, Mr. Hardy confirmed what Mr. Ramanujan said – despite his being an atheist – as their justification in their pursuit for pure mathematics.

On the other hand, the film captured much of the spirit of mathematical research in the past. The mathematician is guided by curiosity and seeks beautiful and elegant connections between abstract concepts. These explorations typically involve some experimentation, but with ideas and symbols rather than physical things. There are usually lots of mistakes and dead ends. Great persistence is needed. If a new connection is believed to have been found, there is a unique intellectual thrill and maybe a sense of awe. But the game is not over. A proof – a complete, verifiable, logical justification – must be built. Constructing the proof can be difficult and often takes a lot longer than the initial discovery. It can also be tempting to move on to try to discover other connections, rather than work on the proofs to support the ones already found, but we must learn to persist until the proof is finished. This spirit however brings out the issue of realism vs instrumentalism (Slezak, n.d.). This spirit of mathematical research is the instrumentalism approach; being successful in explaining a discovery through theorizing. It has been a successful approach in the past. But now, we need not just proofs but we need to see this in the physical world through models, manipulate this models and see its practical applications; the realism approach. Nonetheless, the discipline and intricacies of doing mathematical research is what I appreciate most in the movie about this portrayal.

# Conclusion

Mr. Ramanujan went through a lot of hardships in his short lived life. Despite all of these things, he was able to pursue what he believed and earned a place amongst the greatest mathematicians in history. Being poor and having no degree, his persistence and ego has led him to find a job as a clerk. Excelling in mathematics, he then broke their tradition by cutting his hair and travelling overseas very eager to publish his ideas. In Cambridge Trinity College, amidst racial discrimination from some Fellows, he worked with Mr. Hardy and Mr. Littlewood who taught him the rigor of proofs which led to the publication of his formulae and his becoming a Fellow of the Royal Society and a Fellow of Trinity College.

Aside from his hardships and successes, the movie was also successful in bringing out the very essence of the nature of mathematics; mathematics as art and as a creative process of discovery. The movie showed that mathematical facts (theorems) are discovered rather than invented. Mr. Hardy described them as “notes of our observations”. They exist as fundamental truths independent of the activity of human beings, independent of time itself: their truth predates our recognition of them.

Overall, the film showed Mr. Hardy’s fearless mentoring of Mr. Ramanujan; in the process taming Mr. Ramanujan’s genius. Fearless in such a way that he insisted what he knew was right for Mr. Ramanujan; learning the rigor of writing proofs. This mentoring highlighted the importance of HPS in the teaching and learning of mathematics.

# Recommendations

The movie has made me appreciate pure mathematics. I have always evaded pure mathematics because of its abstract nature and the rigor of understanding and writing proofs. I appreciate most how the movie captured the discipline and intricacies of mathematical research. I have started reading books on mathematical proofs and I am planning to delve into pure mathematics; an effect the film has on me.

It has also made me realize and appreciate the importance of HPS in teaching and learning mathematics. The history and philosophy of mathematics that can be seen in the life story of Mr. Ramanujan and that of other mathematicians can spur appreciation and deeper understanding of mathematics. I would recommend my students and colleagues to watch the film. The film showed me how important proofs are to formulae, just as how critical thinking is important to science and HPS is important to science teaching.

Most important is that I admire Mr. Ramanujan’s persistence. A value that is worth emulating. This has thought me to be determined in what I believe and to what I want to accomplish; never giving up.

# Reference

Slezak, Peter. n.d. “Does Science Teaching Need History and Philosophy of Science?”