Challenge Yourself and Enjoy Math — Tea Break with Richard Bamler

Yilin Hong and Yi Li

Biographical Sketch. Richard H. Bamler is the James H. Simons Chair in Mathematics and an Associate Professor in the Department of Mathematics at the University of California, Berkeley. His research interests include geometric analysis, differential geometry, and Ricci flow.

The interview took place at the ICBS in Beijing following Bamler's insightful presentation on his reward paper. After engaging in a brief discussion about the lecture, we proceeded to a coffee room to commence our conversation.

YH: *Hello Professor Bamler. It is a pleasure to meet you. And thank you for your stimulating lecture. We are undergraduate students from the Qiuzhen College* *at Tsinghua University. What advice would you offer those who have just started exploring the mathematical field?*

RB: I think you need to enjoy math, and you have to find problems that you like and try to form some imagination of the problems that you're working on.

I think that it's important to not only learn a kind of theory like what's written on the board but also draw some pictures and talk to other people about how they imagine certain concepts and so on. And then find the area where like this is kind of things you like to image, you know, to talk about.

YL: *Speaking of imagination and thinking about concepts, I think geometry is a very special subject in math because it somehow can be visualized. Therefore, I want to ask what your suggestion is for young students to develop their geometric intuition.*

RB: That's a hard question. I mean, some professors are very good at conveying geometric intuition. If you talk to other students and you try to have a conversation and maybe you try to draw something. Yeah, I think through conversation with other people, you develop some skills of conveying your intuition and also building your own intuition.

I think it's also important, maybe, to accept that as a student, you learn things in a very clean way, like when you learn a proof of the theorem.

And everything works out very well. That's because the theory you learn as a student has been deeper and has been improved over many decades, and you get the perfect version in the end. But that's not what math is about later in research. It's more dirty, and it's more like people may have some intuition about something, and they want to apply this intuition to something else.

They sometimes don't care about the exact theory, and they just want to know the intuition behind the theory or the proof. And these are the things you want to focus on when you study. And when you talk to other people, often you do not want the precise statement, but kind of the main idea behind it.

YL: *I read in a book that reading original papers of mathematicians is somehow more helpful than just reading textbooks, which are like a cleaner version, as you just said. What is your recommendation?*

RB: Yeah, reading a book is much easier than reading a paper because a paper is written by somebody who is in the middle of research. They're just the person who wrote the paper and are still in the process of understanding it themselves. So they sometimes do not present things in the best possible way.

So, I don't know, sometimes it's good, too. I think it's often more efficient to read the book if there's a book. If you see, I would read a paper if it is a new topic of research and a new type of problem that people care about, where there's no book available, then I would use this opportunity to read a paper and try to understand what's behind it.

YL: *How about more historical ones? For example, would it be beneficial to read the original papers of Riemann to study Riemannian geometry?*

RB: I don't know, I personally never did that, and I find it painful to read papers that are 100 years old because the notation is different, and the language is weird. And I don't know if it ever helped me. Yeah. I personally never did that. I know some colleagues who might sometimes read some very old paper, and then they notice something out of the ordinary in these papers, something that a mathematician 100 years ago discovered, but then it was kind of forgotten, but I think you're going to end up reading research papers soon enough.

So, I don't think you need to read the original ones. If you're interested historically, then you can go ahead. But I personally try to avoid reading older papers as much as possible because I have a very hard time reading them.

YH: *Will language be difficult when reading papers that are not in English?*

RB: I personally think that all papers should be written in English so that there is no problem with the language. I learned a little French so that I can read French, and I can sometimes make sense of things, but people from different countries, especially maybe from China, where you don't always learn French in high school. And there are some other languages that are important in Asia.

And so I think if we kind of agree on one single language, probably English, that could be a better option. Yeah, but I agree that reading a French paper is hard, or reading a paper in another language or even reading a paper that's very old when the language was different or people used to express things in a different way. I think it's hard. I don't think I like it when there is an old paper, and I don't think I've ever read a paper from the beginning to the end of an old paper because often I don't really know what they're talking about.

So I just try to skip and find the part that answers my question, and then maybe try to figure out certain things on my own, because I just don't know what they mean. They use some different notations, and sometimes the typesetting is strange, and so on.

YL: *It came across a time when I was trying to read the paper of Abel, the one on the solution of the 5th-degree polynomial with no radical solutions. I found a translated version, but it was hard to read and hard to understand. It just feels strange.*

RB: In the last century, I think we've developed a much better way of writing our proofs in a much more organized way, like writing down a formula and an argument.

Even if you look at, let's say, some older papers weren't the case, people would describe things in words, even though they could write down a formula, but they didn't have the mechanism, I agree.

YH: *So perhaps one more concluding question.*

YL: *When you are teaching a class, what is your feeling when young students come to you to ask questions?*

RB: It depends, yeah. There are many types of questions. For students who are really interested, and it was really fun to talk to them and try to find different ways of solving problems or a student asking like, how to imagine this, or why does this work like, what is an example for this or something like this? So sometimes, we get into a very nice conversation where I challenge myself, and I enjoy that.

But some students want to know how to solve the homework. You don't want to tell them the solution, but they basically just want to know the solution and be like, I don't know why don't you think about this. And then they're not satisfied with the partial answer. So I think it is a bit hard for me. I mean, it's part of learning, too, that you should learn that you are on your own sometimes, and you should try to push harder. And it's something that I may still have to learn to convey to students in a better way without offending the student. This is a process of learning, and sometimes, you cancel the problem for a day. But it's sometimes hard to convey to a student if they're not used to this process.

YL: *Professor Bamler, thank you very much for your time and your suggestions.*

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