

Working with High School Mathematics Competitions and Mentoring Students⁵

Those of you who had an opportunity to hear and/or read the recent NPR report about me⁶ might be misled by the title, expecting a list of criteria that might qualify one to become not just a mentor but a successful one too. Unfortunately, I can't give a complete list of the necessary requirements for such an accomplishment. Moreover, I will be the first to admit that my own successes were mostly accidental—being at the right place at the right time and doing the right things most of the time. Nevertheless, I want to recommend mentoring as a form of teaching, which became a form of public service in my case, since most of my mentoring was done in addition to my regular teaching duties. In fact, most of my mentoring was done to students at the high school level while I was teaching at the university level.

When a faculty member is considered for retention, tenure, promotion, and salary increases, usually three aspects of his or her performance are evaluated: teaching, research, and public service. Depending on the school, either teaching or research is given more emphasis, while public service is often limited to committee work within the school or the department. Of course, working on editorial boards, serving as a referee of papers, and writing reviews fall into the same category, as well as serving in various roles in professional societies. I want to advocate that working on programs for talented high school students should be considered just as important and credible.

It is a natural question: Why should a teacher at the college/university level work with high school students? The answers are complex and depend greatly on local conditions. On the one hand, one should note that the preparation of the American Mathematical Competitions (AMC) is done by several committees of one of the sister organizations of the AMS, the Mathematical Association of America (MAA). In fact, the AMS supports the competitions of the MAA; hence it is natural for its individual members to do the same. On the other hand, once we identify students with exceptional mathematical talent, it becomes our moral obligation to help them develop those talents.

More specifically, what can you do? For starters, you can familiarize yourself with the high schools in your part of town, pay a visit to them, and maybe meet some of the teachers of mathematics there. Unfortunately, you will be

on your own, since there are no bridges between the high schools and the universities any longer. You will want to learn whether they administer the AMCs, meaning the AMC 10 for students in grades 10 or below and the AMC 12 for students in grades 11 and 12. You should know that there is an AMC 8 also; it is relatively new, and it is designed for grades 8 and lower at the middle schools. You may want to pay a visit to the local middle schools too in order to learn whether they administer the AMC 8. If the schools in your area don't register for the AMC, you will want to encourage them to do so. Ideally, every school should be registered for the AMC, since one doesn't know where there might be a student of rare mathematical talent. To convince them, you will need to learn about the AMC via the website of the MAA.⁷ If they are already taking the AMC, you might want to learn about the results and seek the most outstanding contestants. They might need some guidance and mentoring in order to develop their talents to the fullest.

Alternately, you might want to organize a Mathematics Day for the high schools in your area and invite to it teams of four to six students, along with a mathematics teacher sponsoring them. That's what I did, organizing a full day of activities for them, including a mathematical competition for the students. We offered scholarships to the winners, and hence it was viewed as a tool for recruitment, and the various departments of engineering put up demonstrations to attract the students to their fields. We treated the students to lunch in the cafeteria and the teachers to lunch in the faculty dining room, while the mathematics faculty was busily grading the solutions submitted by the students. We made the award ceremony festive, giving trophies and book prizes to the winners, along with certificates to all participants. Some years I also organized a BUZZ competition, a Jeopardy-like rivalry, or a Rubik's cube contest to lighten the spirit, to gain some more time for the selection of the winners, and as a form of entertainment.

Over the years, I used various formats for the competitions but insisted on well-written, essay-type solutions for at least some of the problems. Their grading was definitely more demanding, but more rewarding too since the students often found unexpected ways to solve the problems, which were at times more elegant than the "official" solutions prepared by me. Which brings me to the creation and selection of the problems, which I always regarded as one of the most demanding and yet most enjoyable parts of my involvements.

A problem is distinguished from an exercise in that it requires a non-routine application of the tools of mathematics. To solve a problem, one must have at least one clever idea or even two if the problem is difficult. To create such problems requires an inquisitive mind and is akin to doing research in mathematics. Some problems may in fact be byproducts of one's research or easier versions

⁵George Berzsenyi, who wrote this article, is professor emeritus at Rose-Hulman Institute of Technology. His email address is gberzsenyi@gmail.com.

⁶<https://n.pr/2UEVMSM>

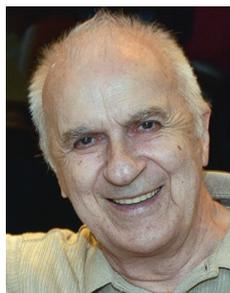
DOI: <https://dx.doi.org/10.1090/noti1927>

⁷<https://bit.ly/2wkzjuV>

of problems posed in mathematical journals. Prior to the competition you might want to challenge your colleagues to create and recommend some problems to you. It is important to have a pool of close to three times as many problems as you will need.

Selecting the most appropriate problems is an extremely important task, since you want to balance difficulty levels, vary topic areas, and make sure that the problems are exciting enough for the students. They should want to talk about them to one another after the contest the same way one hums and whistles the songs of an enjoyable musical after leaving the performance. They should all have some measure of success even if they can solve only two or three of the five problems posed. On the other hand, no one should manage to wiggle his way into the circle of the top winners simply on the basis of partial credit. The winners should be those who had bright ideas and knew how to apply them. They will be your candidates for mentoring.

Once you are good at problem posing, you might consider posing problems for the AMC. The MAA is always interested in strengthening its committees in charge of the competitions, which also include the American Invitational Mathematics Exam, which is of special interest to me. Once you get involved with various competitions, summer institutes, talent searches, mathematical circles, science fairs, and other worthy programs, you will find many more talented students surfacing and needing your help in the development of their talents to the fullest. Mentoring them is probably the highest level of public service possible. It is also the most satisfying.



George Berzsenyi

Credits

Author photo is courtesy of the author.



香港中文大學
The Chinese University of Hong Kong

Applications are invited for:-

Department of Mathematics
Assistant Professor
(Ref. 1900015R)

Founded in 1963, The Chinese University of Hong Kong (CUHK) is a forward-looking comprehensive research university with a global vision and a mission to combine tradition with modernity, and to bring together China and the West.

The Department of Mathematics in CUHK has developed a strong reputation in teaching and research. Many of the faculty members are internationally renowned and are recipients of prestigious awards and honours. The graduates are successful in both academia and industry. The Department is highly ranked internationally. According to the latest rankings, the Department is ranked 28th in the QS World University Rankings and 31st in the US News Rankings.

The Department is now inviting applications for a faculty post at Assistant Professor level. Applicants should have a relevant PhD degree and good potential for research and teaching. Those with outstanding research accomplishments and great enthusiasm for promoting fundamental mathematics, especially for Algebra and Algebra related fields, are encouraged to apply.

Appointment will normally be made on contract basis for up to three years initially commencing January 2020, which, subject to mutual agreement, may lead to longer-term appointment or substantiation later.

Applications will be considered on a continuing basis until the post is filled, but applicants are encouraged to apply by September 30, 2019.

Application Procedure
The University only accepts and considers applications submitted online for the post above. For more information and to apply online, please visit <http://career.cuhk.edu.hk>.