Workshop on
Fun and Creative Problem Solving in Mathematics and Computer Science

On a Thursday afternoon, 40 students, 15 teachers, and 4 parents were having fun colouring circles on a piece of paper and thinking hard in Conference Room B.

What could they be up to?

Well, they were solving a *graph colouring problem* which was used to model the scheduling of tour routes in The Tourist Problem. The colouring activity was part of a workshop on "*Fun and Creative Problem Solving in Mathematics and Computer Science*" held on 28th January 2010 for MRP (mathematics research project) students. Fifteen teachers and four parents joined in the fun. The participants learned about *creative problem solving* through two interesting examples: the tourist problem and inverting a triangle of coins. The workshop also explained the various stages in a math research project and presented practical tips for both students and supervisors on achieving an excellent mathematics research project.

The workshop was a joint event by the PSG and the NUS School of Computing (SOC) and was conducted by Prof. Leong Hon Wai of the NUS SOC and also a member of the PSG.

The objectives of the workshop were (a) to give the students exposure to creative problem solving, (b) to mentally prepare students for their mathematics research project, and (c) to inspire them to love mathematics and computer science. The idea for organizing this workshop germinated last year while Prof. Leong was assisting teacher, Sharon Lee, with mentoring two teams of student doing mathematics research project.

Comments from Prof. Leong:

This workshop is one of the most challenging for me as there were students, teachers, and parents. It was a challenge to keep everyone engaged and not fall asleep. (When I learnt that many teachers were attending, I also added in some tips on project supervision.)

I hope most of the participants had fun, solving the problems in the hands-on sessions (like colouring the graph and moving the triangles of coins to maximize overlap). And most of all, that they were thinking hard and learned something along the way.

Finally, in looking back at it all after my workshop, I think the workshop is my "head-fake" (in the lingo of the late Randy Pausch) to get students to actually learn lessons in creative problem solving while they think that they were *simply doing something fun*.

More information on this workshop can be found at:
http://www.comp.nus.edu.sg/~leonghw/Outreach/2010-01-NYGH/

Comments from Participants:

"It was enriching & the speaker was interesting! the activities were engaging and they definitely got us thinking hard (smiley)."

…Liew Ting Ting, Sec 2/13 (commented via SMS)

"Through the talk given by Professor Leong, I have learnt a new method to do research questions, for example, the tourist question, or the NYGH one as Prof. Leong had modified it to be. Basically, I have learnt how to solve it in a "graphical" image form which involves colouring, something I enjoy. I would definitely recommend this to future students. Not only is it enriching, the few jokes Prof. Leong told were also really humourous, and the food was good!! :D"

…Koh Han Yi, Sec 2/13

"I thought it was enriching and I enjoyed the session. The professor was humourous, and it spiced up the session. Also, he was very detailed in explanation, deepening our understanding of math problems. I learnt the steps to solve a math problems, it has impacted me positively in my math. I would strongly recommend it to my juniors and I look forward to attending talks conducted by Professor Leong."

…Rachel Wu, Sec 2/13

"I chose to join the Math research programme because I wanted to broaden my knowledge in Mathematics which was not taught in the syllabus this year. Previously, I had enjoyed doing the Math enrichment the previous year so I decided to take it one step further, on a bigger scale to join this programme. However I was a little afraid of the little obstacles which could come my way such as: would I be able to think of a topic that would pique the interest of others? Would it have to be long and complicated? Would I myself even understand the Math concepts behind the topics which my group would research on?
However, after that talk, I learnt that seemingly simple problems were actually built on in-depth concept such as for instance the triangle problems which focused on triangular numbers, something I only realized after poring over the question for an hour. Thus this goes to show that the problems for the math research need not be too complicated; it was good so long it required thinking and problem-solving heuristics. To me, that was one dilemma solved. However, I also realized during the talk that Math research was not about blindly reading and memorizing concepts; it was about learning, understanding, asking questions and find them out myself! Thus, I also comprehended the fact that any Math concepts which I did not understand now or in the future must be solved by me and with the help of my group maters. It goes to show how understanding the method really was more important than the answer!
I hope that the Math research programme would be enriching, which is an apt word to describe the talk as well. I have learnt that we cannot be too rigid in Mathematics; learning to look at a problem at a different perspective was a skill that could and should be learnt along the way as well. Hopefully, after the programme is finished, this would be the desired result for all those who try to solve the problem which my group and I would eventually undertake.

…Foo Jie Min Jamie, Sec 2/13

Comments from Teachers:

"The workshop was very nicely crafted. The students, teachers as well as the parents present could understand what Prof Leong is presenting. Prof Leong is also an avid speaker, able to engage the audience with his sense of humor throughout the 2 hour workshop."

…Miss Elizabeth Liow (Teacher)

"1. The level of stuff discussed was pitched suitably; I thought most students, if not all, could follow the discussions comfortably. Citing a real life example such as planning tour routes was a good way to introduce simple ideas based on graph theory which would otherwise be too advanced for our students. Students had something solid to see and discuss, rather than dealing with something abstract straight away.
2. The parts on problem solving and on how to do a research project was useful.
3. I believe his body language helped to show his passion in math which might have a positive influence on our students. He also stressed on the importance of process and not so much the result."

…Mr Khoo Kok Thye (Teacher)

"Prof Leong is an engaging speaker. His logical and systematic approach to problem solving springs a good platform for students to engage in further research. With the introduction of a real-life problem, he made graph theory and vertex colouring accessible to the students. It was a fruitful session for the students."

…Miss Li Jia Wen:

Comments from Parents:

"Excellent workshop and thanks for your generosity in imparting your expertise. What I like: (a) you have demonstrated how a problem can be investigated and transform into a mathematical model, (b) how to handle the project (must enjoy the project, getting a team leader, breaking it into distributable tasks). …By attending this workshop, it refreshes and enhances my know-how in guiding my daughters. Thanks."

…Chong Chee Keong, parent of S3 girl

"Before attending the workshop, a bit worry that I may not understand the stuff, but turn out, it is fun, easy to understand and I learn new things."

…Sim Chay Eng, parent of S3 girl

"Very good workshop. Just the right level of seriousness and fun to get the message across to the students while keeping them engaged. You have shown the students how mathematical problems can be approached a from a different angle and how the solution thus derived can be mapped back mathematically. The second part on project participation (project members' attitude and responsibilities) is also something that all mentors should emphasize to all students ... it's a life skill that will benefit them in years to come. Last but not least, …can see that you have put in a lot effort preparing for this workshop! ... Wished that I had teachers like you (who can explain the concepts instead of just memorizing the formulas), when I was learning maths in school!"

…Quester Lim (NYGH-PSG alumni)

"Fun and Creative Problem Solving in Mathematics and Computer Science"

First, a Quote.

A great discovery solves a great problem,
but there is a grain of discovery
in the solution of any problem.

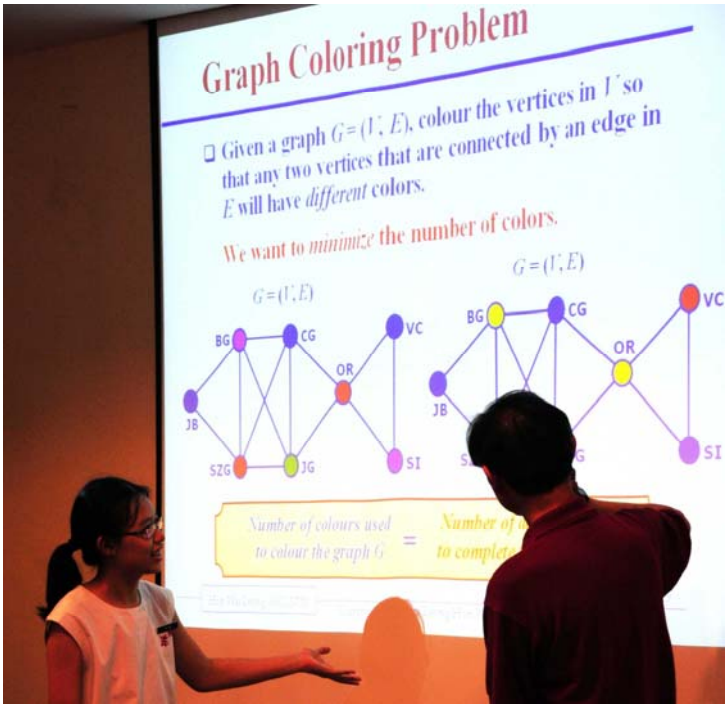
Your problem may be modest;
but if it challenges your curiosity and
bring into play your inventive faculties,
and if you solve it by your own means,
you may experience the tension and
enjoy the triumph of discovery.

The Aha! moment

G. Polya, 1945

A Quote on Problem Solving.

"Colouring circles in the handout. How many colours did you use?"



"Why can't we use fewer than four colours?"

"What's up? Inverting a Triangle of Coins."

"Parents and teachers. Let's hope they are not too bored."

"Bending a steel bar… without using brute force? Use *transformation*!"