

# Enhancing Engineering Students' Creativity and Generic Thinking Skills through Non-routine Mathematics Questions

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This talk reports on the results of three pilot studies on the impact of the regular use of non-routine mathematics questions, in particular puzzles, paradoxes and sophisms (PPS) as a pedagogical strategy on enhancing engineering students' creativity and generic thinking skills. By a *puzzle* we mean non-standard, non-routine, unstructured question presented in an entertaining way. Typically a puzzle appears deceptively simple. By a *paradox* we mean a surprising, unexpected, counter-intuitive statement that looks invalid but in fact is true. By a *sophism* we mean intentionally invalid reasoning that looks formally correct, but in fact contains a subtle mistake or flaw. The intention of using PPS is to engage students' emotions, creativity and curiosity and also enhance their problem-solving skills and lateral thinking "outside the box". Potential benefits for students from using PPS in teaching and learning are discussed in the talk. Students' attitudes towards this pedagogical strategy are evaluated via a short questionnaire given to university students taking a second year engineering mathematics course. The theoretical considerations of the study are based on the *Puzzle-Based Learning* concept developed by Michalewicz & Michalewicz (2008). Some examples of PPS from Klymchuk & Staples (2013) and students' responses to questionnaires are presented and discussed in the talk.

## References

Klymchuk, S., & Staples, S. (2013). *Paradoxes and Sophisms in Calculus*. USA: Mathematical Association of America.

Michalewicz, Z. & Michalewicz, M. (2008). *Puzzle-Based Learning: An introduction to critical thinking, mathematics, and problem solving*. Hybrid Publishers.

**About the speaker.** Sergiy is an Associate Professor of Mathematics in the School of Engineering, Computer and Mathematical Sciences and Director of the STEM Tertiary Education Centre at the Auckland University of Technology, New Zealand. He has 37 years' experience in teaching university mathematics in different countries. His PhD (1988) was in differential equations and his current research interests are in mathematics education. He authored or co-authored more than 200 publications. Sergiy is a Fellow of the Institute of Mathematics and its Applications (IMA) based in the UK, a member of the Royal Society of New Zealand and several international organisations on mathematics education.