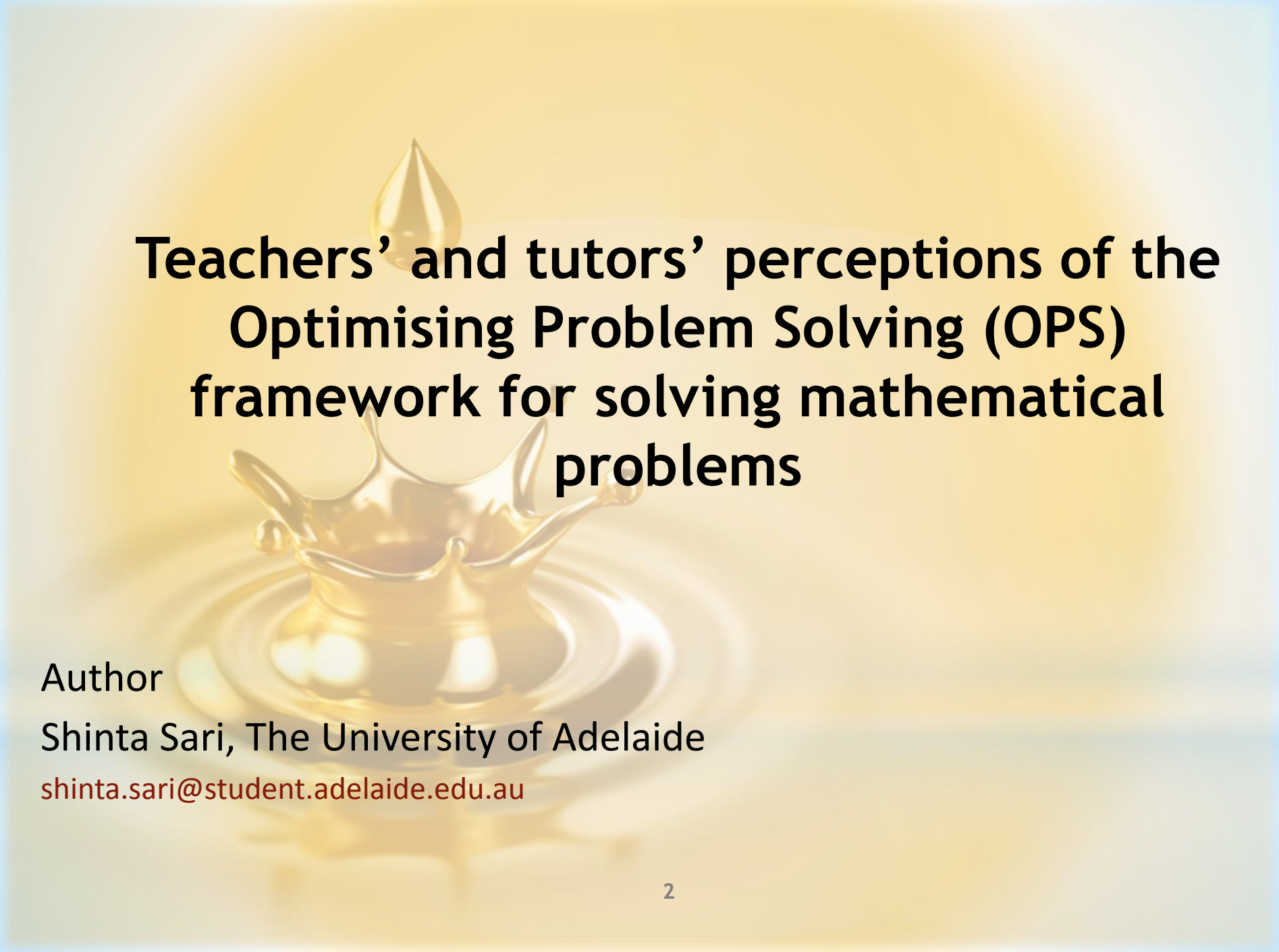




Shinta Sari

The University of Adelaide

Teachers' and Tutors' Perceptions of the Optimising
Problem Solving (OPS) Framework for Solving Math



Teachers' and tutors' perceptions of the Optimising Problem Solving (OPS) framework for solving mathematical problems

Author

Shinta Sari, The University of Adelaide

shinta.sari@student.adelaide.edu.au

Optimising Problem Solving (OPS) framework

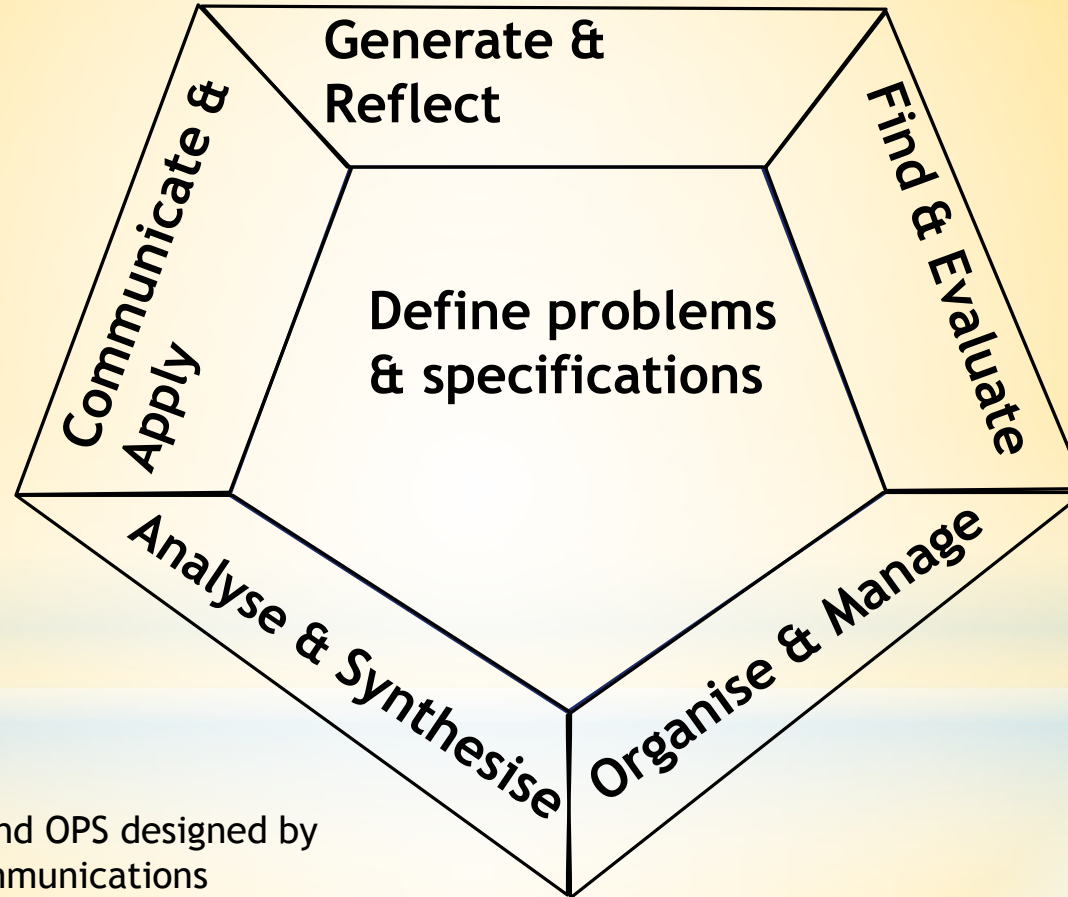
- Used by teachers or tutors to guide students in problem solving.
- OPS was created by engineering students and tutors in 2014 (Missingham et al., 2014).

Problem solving

- The capacity to respond to non-routine situations to gain a potential as constructive and reflective citizens (OECD, 2014).

Optimising Problem Solving pentagon

When in doubt, go to the centre...



Based on www.rsd.edu.au and OPS designed by
Mechanical Engineering Communications
Tutors, University of Adelaide, 2014
john.willison@adelaide.edu.au

Research Skill Development (RSD) facet descriptions	Optimising Problem Solving (OPS) pentagon facet descriptions
Embark & Clarify What is our purpose?	Define Problems and Specifications Examine the issues, in order to define problems & specify meaning, purpose and impacts
Find & Generate What do we need?	Find & Reflect Gather information, data & knowledge.
Evaluate & Reflect What do we trust?	Generate & Evaluate Consider alternative solutions, determine if relevant to work. Be unbiased in your approach.
Organise & Manage How do we arrange?	Organise & Manage Decide what information and which sources to use, plan the presentation of your work. Organise your work into graphs, tables, themes etc.
Analyse & Synthesise What does it mean?	Analyse & Synthesise Critically analyse your arguments & evidence. Create your own ideas, interpretations and conclusions.
Communicate & Apply How will we relate?	Communicate & Apply Effectively convey your proposals/ opinions/ options/ actions/ results/ recommendations etc. to others.

Background

1. Problem solving as a major skill in the 21th century
(Griffin & Care, 2012; OECD, 2014; Schoenfeld, 2009)
2. Students do not prioritise problem-solving in their mathematics learning
(NCTM, 2007; Mapolelo, 2009)
3. Teachers may find it beneficial to adopt some problem solving based frameworks in their teaching
(Fogarty, 1997; Willison et al., 2016)
4. The potential of the OPS framework in mathematics problem solving

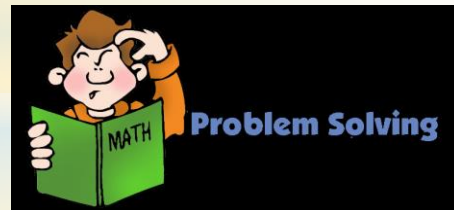
The potential of the OPS framework in mathematics problem solving:

- Developed for students by students
- Designed to scaffold students' problem-solving abilities
(Willison, et al., 2016).

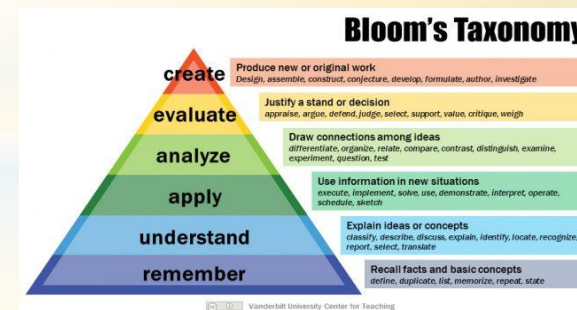


<https://i.pinimg.com/originals/90/5c/52/905c52838f556fe475f29b8eec64e87f.jpg>

- Connects mathematical problem solving to broader thinking
(Willison, 2015).



http://gonitsora.mathematics.website/wp-content/uploads/2017/06/banner_problemsolving.gif



<https://cft.vanderbilt.edu/wp-content/uploads/sites/59/Blooms-Taxonomy-650x366.jpg>

Gap

A lack of studies discussing and exploring the implementation of the OPS framework in a mathematical context

Research Question

What is the perceived usefulness, by teachers of international students, of the Optimising Problem Solving (OPS) framework for teaching mathematical problem solving?

Why teachers' perceptions?

The principle of readiness in organisational and management learning aspects for effective educational processes mentioned that the educators as a **'gatekeepers'** have to get ready in all aspect before teaching the students, such as in environment, facilities, and learning methods (Khine, 2015).

Methodology

Ethnographic study

Research Participants

1. Two tutors of Mathematics Drop-in-Centre in The University of Adelaide
2. Seven international and local students, themselves teachers, in the Master of Education

Data Gathering Method: Semi-structured interviews

Data Analysis Method: Thematic content analysis

Results & Discussion

1. Concept

- Higher order thinking skills should align in learning goals, learning process, and assessment (5/9).

“If you interpret and if you share this thing [OPS], it will be very helpful and it’s good for the improvement of the problem-solving skills and critical thinking. This framework will help the students to go to the higher level while solving problems.” (Participant C).

- The non-sequential facets including the motto ‘when in doubt, return to the centre’ (5/9).

“Having no sequence could be a strength. If there is no sequence, what might happen is some students may get the solution very quickly. Having no sequence might be good because the students might learn which ways give the solution quicker rather than having a sequence.”

(Participant H).

- Each facet title has a strong meaning to enhance students’ mathematical problem solving abilities

2. Structure

- The pentagon shape was more effective and efficient for students' learning (5/9).

“I love the gemstone. It's like pentagon and one in the centre and the other ones just come around the centre and it's just like balance between one and the other facets because if I can compare again with the Bloom's Taxonomy, it's like the hierarchical graph, but here this one is flexible and try to help each other.” (Participant G).

- Word format should be more readable and synchronise each other (4/9).
- The colour can enhance students' performance (3/9).
(Benbasat & Dexter, 1985; Gaines & Curry, 2011).

3. The Holistic Nature

The OPS framework could be potentially useful in the Mathematics context (9/9), yet requires:

- an appropriate pedagogical strategy (8/9)
- a suitable teaching context (3/9)
- a sufficient share of the OPS framework (9/9)

Conclusion:

The perceived usefulness of the OPS framework in teaching mathematics can be categorised based on three aspects:

1. Concept
2. Structure
3. The Holistic Nature

Teachers' perceptions may be a barrier to implementation of OPS pentagon in some cases, and an enabler in other cases.

Recommendation:

Further studies should use actual academic results as outcomes


Significance:

The OPS framework

1. Students' higher order thinking skills
2. Mathematics learning
3. Numeracy policy

References

- Griffin, P., McGaw, B., & Care, E. (2012). *Assessment and teaching of 21st-century skills* (p. 36). Dordrecht: Springer.
- Jones, I., Swan, M., & Pollitt, A. (2015). Assessing Mathematical Problem Solving Using Comparative Judgement. *International Journal of Science and Mathematics Education*, 13(1), 151–177.
- Khine, M. S. (2015). *Science Education in East Asia*. Switzerland: Springer.
- Nunokawa, K. (2005). Mathematical Problem Solving and Learning Mathematics: What We Expect Students to Obtain. *Journal of Mathematical Behavior*, 24(3), 16.
- OECD. (2014). *PISA 2012 Results: What Students Know and Can Do (Volume I, Revised edition, February 2014)*. Paris: Organisation for Economic Co-operation and Development. Retrieved from <http://www.oecdilibrary.org/content/book/9789264208780-en>
- Schoenfeld, A. (2009). Learning to think mathematically: Problem solving, metacognition, and sense-making in mathematics. *Colección Digital Eudoxus*, (7).
- The Learning of Mathematics: 69th NCTM Yearbook [2007 NCTM Yearbook (69th)]. (2007). National Council of Teachers of Mathematics. 1906 Association Drive; Reston, VA 20191-1502. Retrieved from <http://search.proquest.com.proxy.library.adelaide.edu.au/eric/docview/61946697/6C07C0FD1D44F9FPQ/2>
- Willison, J., & O'Regan, K. (2007). Commonly known, commonly not known, totally unknown: a framework for students becoming researchers. *Higher Education Research & Development*, 26(4), 393–409.
- Willison, J., Missingham, D., Cheong, M., Papa, T., Baksi, R., Shah, S. & Severino, G. (2016). Optimising Problem Solving: student and tutor perceptions of problem-solving within mechanical engineering. *AAEE 2016 Conference*.

A golden drop of liquid is shown falling from the top center of the frame. Below it, the drop has splashed into a pool of liquid, creating a crown-shaped splash with several smaller droplets rising from the center. Concentric ripples are visible on the surface of the liquid. The background is a soft, warm yellow gradient.

Questions & Answers