

## **CHALLENGING TASKS: REAL-WORLD, DIGITAL TECHNOLOGIES, AFFORDANCES – OPPORTUNITIES FOR LEARNING**

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Challenging tasks are critical learning activities at all levels of schooling. Without mathematically challenging tasks being a normal part of the teaching and learning environment, opportunities to learn are limited. Real-world tasks are by their very nature challenging. By real-world tasks I refer to task solvers solving real problems. This includes making sense of the real-world context, making decisions about what is relevant and important, mathematising the problem – that is bringing the problem into the mathematical world so that it can be solved. Once solved, the mathematical solution must be interpreted in terms of the real world to ascertain what the real-world solution is and if this is acceptable. Typically, in mathematical modelling, the initial real-world solution would be explored further, perhaps by relaxing some of the simplifying assumptions, accounting for additional factors, considering alternative estimates for important factors, to seek an improved real-world solution. At the very least, students should reflect on their solution and consider varied assumptions or estimated or approaches.

Access to digital technologies can also change the complexity of tasks student explore. More complex or larger and hence more realistic data sets can be explored. Calculations beyond one's by-hand capabilities are accessible. Graphing calculator or equivalent computer-based technologies allow for the making and testing of conjectures, and exploring ideas, that would not otherwise be possible. CAS-enabled technologies provide upper secondary students the capabilities to apply calculus related ideas to any functions. Digital technology use provides opportunities for students to deepen and expand their mathematical knowledge.

Teachers play a critical role in not only providing students with challenging tasks, but also in ensuring the cognitive demand remains high during task implementation. A challenge for many teachers is to maximise the mathematical thinking done by the students, rather than themselves during the lesson. A technology-rich teaching and learning environment also poses a challenge for teachers. Affordances of such an environment (e.g., Brown and Stillman, 2014; Gibson, 1979) must be both perceived and enacted by students during task solving. Prior to this occurring, teachers must provide opportunities for students to experience such affordances and consider their applicability or usefulness in different mathematical situations. This paper presents a selection of my research.

### **References**

- Brown, J. P., & Stillman, G. (2014). Affordances: Ten years on. In J. Anderson, M. Cavanagh, & A. Prescott (Eds.), *Curriculum in focus: Research guided practice* (pp. 111-118). Adelaide: MERGA.
- Gibson, J. J. (1979). *An ecological approach to visual perception*. Boston, MA: Houghton Mifflin.