# Percentages as Part-whole Relationships

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| Project Title | Percentages as Part-whole Relationships |
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| Period | March 06 – October 06 |
| Funding Agency | SiMERR |
| Organisational Base | SiMERR ACT |

## Description

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The aim of the project was to test the applicability of teaching for abstraction to one of the many syllabus topics involving multiplicative structure (proportionality).

An experimental unit on Percentages was developed as an eight-lesson introduction to the topic for Year 6 students. The unit explored various situations familiar to students where it is or is not appropriate to use percentages, and led students to meaningfully link all the percentage situations. The unit gave special attention to part-whole relationships in contexts such as discounts and fair sharing. The unit used the four phases of the theoretical framework for Teaching for Abstraction:

- Familiarising: Students explored familiar contexts. Jelly beans were a feature of the introductory tasks;
- Recognising: Activities required students to compare and contrast the use of percentages in different contexts. Calculations were based on first calculating 10% and then multiplying by the appropriate factor;
- Reifying: Students were asked to make and explain generalisations based on the similarities found in the Recognising phase; and
- Application: Students created their own problems.

Five Year 6 teachers drawn from three schools in rural and regional areas of NSW in close proximity to the ACT taught this unit during Terms 2 and Term 3, 2006, in place of their normal teaching on percentages. These teachers met for a training day in Canberra before the unit was taught and attended a debriefing session afterwards. Members of the project team: Rhonda Faragher, Paul White and Sue Wilson visited each school twice. The experimental lessons were observed and analysed. In one case, one of the project team-taught the lesson. Before the teaching, five students from each class were given a pre-test by interview with a member of the research team. Work samples from these students were collected throughout the unit. On completion of the unit, the target students were given the same questions in a post-test interview. All students in the classes completed pre and post worksheets.

The data were analysed to consider understanding of percentage from the perspective of abstraction. The teachers and students found the contextual approach engaging, relevant and challenging. Pre-post analysis showed that student ability to use and apply percentages improved dramatically except in situations where fractions were involved.

## Participants

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Thirty students and teachers of five Year 6 classes in three regional primary schools.

## Findings

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After the teaching, the number of students who could both calculate with percentages like 10% and 20% and use these percentages appropriately in context doubled. This included explaining why they came to the answers they did, in particular identifying percentage as a relative comparison and the need to identify “percentage of what”. Of course, we would expect to see improvements after a teaching episode no matter what the approach was, especially when the same questions were used. But here the improvement in the students’ explanation is striking and transcends what could be expected from either memory of questions or just currency of the concepts following teaching. The move from inappropriate additive strategies highlighted in the literature is particularly encouraging.

The findings indicate that the approach taken has the potential to benefit student engagement, learning, and attitudes for both students and teachers, even though they found it challenging. The regional teachers indicated they did not normally have opportunities for such professional development and expressed a desire for more follow up support.

## Outcomes

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### Journal article

- White, P., & Wilson, S. (2008). A new approach to teaching percentages. Reflections, 33 (1), 15-18.

### Conference presentations

- White, P., Wilson, S., Faragher, R., & Mitchelmore, M. (2007, July). Percentages as Part Whole Relationships. In Watson, J., & Beswick, K. (Eds.) Mathematics: Essential Research, Essential Practice (Proceedings of the 30th annual conference of the Mathematics Education Research Group of Australasia, Hobart, pp. 805-814). Adelaide: MERGA.

  Note: This paper was presented in the common day for the combined conferences of the Mathematics Education Research Group of Australasia and the Australian Association of Mathematics Teachers.

- White, P., Wilson, S., Faragher, R., & Mitchelmore, M. (in press). Teaching for abstraction: Percentages. Accepted for short oral communication and inclusion in the proceedings of Proceedings of the 32nd Conference of the International Group for the Psychology of Mathematics Education: Morelia Mexico.

## Impact

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Professional learning and teaching practice in the five schools has been supported. The teaching approach has been disseminated to teachers in New South Wales and across Australia as the second two references were presented to teachers at the conferences of the Mathematics Association of NSW and the Australian Association of Mathematics Teachers respectively.

The teachers involved have asked for more professional learning in teaching for abstraction and follow up work is taking place in 2008.

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