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ADULT LITERACY RESEARCH

Learning numeracy on the job: A case study of chemical handling and spraying

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RESEARCH OVERVIEW

MANY TASKS IN INDUSTRY make significant demands on workers who have relatively little formal education or training. These demands can include the need to calculate, measure, estimate quantities, and to evaluate risks.

In industries where chemicals are stored, applied or distributed, miscalculation may harm production or the environment, or threaten the well-being of workers, clients and the surrounding neighbourhood.

The research

The research asked whether the skills required of workers in these industries are similar to those developed in school mathematics, or whether different practices in the workplace require different ways of learning. The project looked at chemical spraying and handling in horticulture, local government environmental management, rural production, outdoor recreation and chemical warehousing.

Past experience and historical data were analysed to determine what is reasonable and acceptable in such workplaces on both a social and cultural level. Important information was also obtained from key informants at both operating and supervisory levels, as well as from physical evidence of work practices: charts, tables, manuals, records of spraying and measuring devices.

The findings

Numeracy in the workplace differs from formal, rule-based abstract mathematics. It mixes technical understanding and the complex manipulation of variables with highly developed estimation skills and the ability to integrate knowledge with common sense and past experience.

In all workplace tasks, estimation is necessary and should be based on previous records and a sense of what is reasonable. Common sense is extremely important. At the same time, calculations are double-checked, and team and group work is encouraged in best-practice enterprises.

Although the most crucial learning is that which emerges from the culture and experience of the workplace, formal knowledge is still relevant. Many supervisors have relatively advanced formal qualifications and most operatives have entry-level qualifications (Australian Qualification Framework certificate I or II) normally provided by vocational educational and training (VET) organisations. In some jurisdictions, qualifications are mandated by government.

Implications for teaching practice

Numeracy in the workplace is not the same as school mathematics. A range of variables need to be considered in the context of each particular workplace in order to identify potential risks and to develop strategies to minimise them. Workplace numeracy involves practically applying rational numbers and the metric system to a specific context, usually with other workers, and often requires estimation. It may involve key competencies of planning, organising, cooperating and communicating effectively.

Trainers need to offer:

- carefully chosen practical activities which enhance understanding of rational numbers (fractions, decimals)
- opportunities to use real workplace tools like graphs, chemical labels, tables, calibration charts, calculators, calculation templates and records

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- problem-solving activities using case studies from workplaces
- realistic group work exercises with open-ended solutions and shared responsibilities
- simulations, video learning and workplace visits
- log books of strategies developed by trainees
- computerised systems with authentic data.

Implications for employers

Workplace supervisors often assume their workers have a stronger foundation in school mathematics than is warranted to perform their job. However, the ability to transfer this knowledge to practical environments is also important. Specialised guidance may be necessary for workers to develop or reinforce mathematical skills relevant to chemical handling and spraying.

Findings from this study indicate that, although most workers have undertaken formal training in chemical use, each workplace is different, and mentoring and support on the application of numeracy processes in the individual workplace are still required.

Implications for policy

Because not all enterprise-specific numeracy skills can be covered in formal training, the importance of metacognitive skills (learning to learn, critical thinking, planning, problem-solving) need to be recognised and consciously developed. Training packages do not always provide sufficient opportunity for this. The assessment focus of training packages can limit the development of the 'required knowledge' within units of competency. Package developers need to identify numeracy demands and incorporate this information within units of competency.

Questions arise as to how competently teachers or trainers with little or no background in mathematics education can teach workers. Consideration should be given to mandatory specialised preparation or continuing professional development for teachers and trainers involved in adult numeracy, even if this is not their principal role.

The full report of *Learning numeracy on the job: A case study of chemical handling and spraying*, by Gail FitzSimons and Susan Mlcek, wil be available from the NCVER website at <http://www.ncver.edu.au>.

RESEARCH OVERVIEW

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This publication is one of a set of eight research overviews produced in 2005. It adds to a set of seven overviews produced previously in 2004. For more information about the project and to obtain copies of all the research overviews, please go to the NCVER website at <http://www.ncver.edu.au/publications/1485.html>.