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### 3.2 APPLICATION PROBLEMS

There exists a plethora of applications and modelling problems and materials for use in mathematics classrooms at various educational levels. These materials range from mere 'dressed up' mathematical problems to authentic problem situations.

ISSUE 2. *What does research have to tell us about the significance of authenticity to students' acquisition and development of modelling competency?*

Examples of specific questions:

- What authentic applications and modelling materials are available worldwide?
- Taking account of teaching objectives and students' personal situations (experience, competence), how can teachers set up authentic applications and modelling tasks?
- How does the authenticity of problems and materials affect students' ability to transfer acquired knowledge and competencies to other contexts and situations?

### 3.3 MODELLING ABILITIES AND COMPETENCIES

With the teaching and learning of mathematical modelling and applications, many goals and expectations are combined.

ISSUE 3a. *How can modelling ability and modelling competency be characterised, and how can it be developed over time?*

Examples of specific questions:

- Can specific subskills and subcompetencies of 'modelling competency' be identified?
- How can modelling ability be distinguished from general problem solving abilities?
- Are there identifiable stages in the development of modelling ability?
- What are characteristic differences between expert modellers and novice modellers?
- What is the role of pure mathematics in developing modelling ability?

ISSUE 3b. *How can modelling in teacher pre-service and in-service education courses be promoted?*

Examples of specific questions:

- What is essential in a teacher education programme to enable prospective teachers to experience real, non-trivial modelling situations, and hence acquire modelling competencies for purposes of teaching applications and modelling in their professional future?
- Which training strategies can help teachers develop security in using applications and modelling in their teaching?

### 3.4 BELIEFS, ATTITUDES, AND EMOTIONS

Beliefs, attitudes and emotions play important roles in the development of critical and creative senses in mathematics.