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### 3.8 ASSESSMENT AND EVALUATION

The teaching and learning of mathematics at all levels is closely related to assessment of student achievement. There seem to be many indications that the assessment modes traditionally used in mathematics education are not fully appropriate to assess students' modelling competency.

ISSUE 8a. *What alternative assessment modes are available to teachers, institutions and educational systems that can capture the essential components of modelling competency, and what are the obstacles to their implementation?*

Examples of specific questions:

- In assessing mathematical modelling as a process (instead of a product) what can be learnt from assessment in the arts, music, etc.?
- When mathematical modelling is introduced into traditional courses at school or university, how should assessment procedures be adapted?
- When state or national centralised testing of students is implemented, how do we ensure that mathematical modelling is assessed validly?
- How does one reliably assess individual contributions and achievement within group activities and projects?

There is a need to develop specific means of evaluating programmes with an applications and modelling content.

ISSUE 8b. *What evaluation modes are available that can capture the essential features of applications and modelling, especially of integrated courses, programmes and curricula, and what are the obstacles to their implementation?*

Examples of specific questions:

- In what way do usual evaluation procedures for mathematical programmes carry over to programmes that combine mathematics with applications and modelling?
- What counts as success when evaluating outcomes from a modelling programme? For example, what do biologists, economists, industrial and financial planners, medical practitioners, etc., look for in a student's mathematical modelling abilities? How does one establish whether a student has achieved these capabilities?

### 3.9 TECHNOLOGICAL IMPACTS

Many technological devices are available today and many of them are highly relevant for applications and modelling. In a broad sense these technologies include calculators, computers, the Internet and computational or graphical software, as well as various kinds of instruments for measuring, experimenting, etc. These devices provide not only increased computational power, but broaden the range of possibilities for approaches to teaching, learning and assessment.

ISSUE 9. *How should technology be used at different educational levels to effectively develop students' modelling abilities and to enrich the students' experience and capability with open-ended mathematical situations in applications and modelling?*