3.9 Technological impacts

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 ?*

Examples of specific questions:

- What implications does technology have for the range of applications and modelling problems that can be introduced?
- How is the culture of the classroom influenced by the presence of technological devices? Does technology compromise thinking and reflection or can these be enhanced by technology? In what ways?
- What evidence of successful or failed practice in teaching and learning applications and modelling has been documented as a direct consequence of the introduction of technology?
- With respect to non-affluent countries: can applications and modelling be successfully undertaken without the availability of technology?
- What are the implications of the availability of technology for the design of assessment items and practices?

4. Call for contributions to the Study

The Study Conference will be held in Dortmund (Germany) on February 13–17, 2004. Participation in the Study Conference is by invitation only, given on the basis of a submitted contribution, and is limited to approximately 75 people. The Study Volume, to be published in the ICMI Study Series, will contain selected contributions and reports prepared for the conference, as well as on the outcomes of the conference.

The International Programme Committee (IPC) for the Study invites submission of contributions on specific questions, problems or issues related to this Discussion Document. Contributions, in the form of synopses of research papers, discussion papers or shorter responses, may address questions raised above, or questions that arise in response, or further issues relating to the theme of the Study. Submissions should not exceed 6 pages in length and should reach the Programme Chair at the address below (preferably by e-mail) no later than June 15, 2003, but earlier if possible. All submissions must be in English, the language of the conference.

The members of the International Programme Committee for this Study are:

Werner Blum (University of Kassel, Germany), *Chair of the IPC*, Claudi Alsina (University of Technology, Barcelona, Spain), Maria Salett Biembengut (University of Blumenau, Brazil), Nicolas Bouleau (École Nationale des Ponts et Chaussées, Marne-la-Vallée, France), Jere Confrey (University of Texas-Austin, USA), Peter Galbraith (University of Queensland, Brisbane, Australia), Toshikazu Ikeda (Yokohama National University, Japan), Thomas Lingefjärd (Gothenburg University, Sweden), Eric Muller (Brock University, St. Catharines, Canada), Mogens Niss (Roskilde University, Denmark), Lieven Verschaffel (University of Leuven, Belgium), Shangzhi Wang (Capital Normal University, Beijing, China), Bernard R. Hodgson (Université Laval, Québec, Canada), *ex officio, representing the ICMI Executive Committee*, Hans-Wolfgang Henn (University of Dortmund, Germany), *Chair of the Local Organising Committee*.

For further information and submission of contributions, please contact the Chair of the IPC:

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