Chapter 16: Senior Secondary School Practices

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ABSTRACT

This chapter deals with senior secondary school practices, which for most systems means the teaching of students aged between 15 and 18 years. This sector of mathematics education has come under increased scrutiny as more students are staying on after their junior secondary school time and as access to higher education has developed dramatically over the past decade. Rather than attempting to survey world-wide practices, an impossible task in itself, the authors have chosen to focus on four topics with which to analyse the trends, developments, and issues.

In the first 'problem-solving', they describe the growing arguments in favour of including more problem-solving activities at this level of schooling, and strategies for organising such activities in the class. They also describe a French interpretation of mathematics teaching known as 'situations-problèmes' and discuss its organisation and practice by examples. In the second part, 'the evolution of mathematics teaching objectives and practices' the authors discuss the trend towards greater 'realism' in the mathematics curricula, and new teaching approaches such as group-work.

The third section analyses the profound influence of 'new tools for calculating and representing functions'. It is certainly arguable that graphic and scientific calculators, and computers are having their greatest effect at this level of schooling. In the fourth section the authors discuss 'the contribution of epistemology and the history of mathematics'. They present several examples of a historical approach to mathematics teaching through using ancient, classic, problems, and through using history as a source of ideas for justifying topics in the curriculum. They also point to the use of historical situations to enable the teacher to understand better the reasons for their student's difficulties in learning certain topics.

1. INTRODUCTION

Providing a summary of teaching practices in secondary school mathematics would be a far too ambitious objective for a chapter of thirty pages. Translating official curricula into effective class activities, the analysis of texts, approaches to classwork, classroom management, teaching notions, the evaluation of students' skills and knowledge and so on are each aspects which would require a very detailed study. When we try to go beyond the boundaries
of a particular region or country, we can well imagine the complexity of the task and the impossibility of achieving an exhaustive examination of the issues.

It is therefore necessary to make choices and to content ourselves with describing some of the current trends affecting the teaching of mathematics at the secondary level. Therefore this chapter will limit the discussion to four main issues:

1) problem solving
2) the evolution of mathematics teaching objectives and practices
3) new tools for calculating and representing functions
4) the contribution of the epistemology and the history of mathematics.

2. PROBLEM SOLVING

Problem solving is the mathematician’s prime activity. But have secondary schools forgotten this? One could well believe this if one observes the manner in which maths lessons traditionally take place: the presentation of material by the teacher or in the text, followed by exercises and applications of the rules. Underpinning this method of teaching, there is a conception of the transmission of knowledge from the teacher (who possesses the knowledge) to the student (who must absorb it). Uncertainty, side-tracking, errors, adjustments and reformulations are all strictly discouraged. A neatly tied packet of knowledge is thus presented to the students whose sole task is to reproduce or apply it.

Problem solving takes an opposing approach to this view of the student as a receiver and instead, places the student in the role of actor in the construction of his/her own knowledge.

We can thus define a problem as a new activity which is meaningful to the students and which must be sufficiently close to their current knowledge to be assimilated and yet must be sufficiently different in order to force them to transform their methods of thinking and working. The problem can be likened to the work of the mathematician who constructs and produces mathematics.

It is therefore a question of organising the activities of the students in such a way as to allow them the responsibility for the different phases of the problem solving process: understanding of the problem, hypotheses, trials, verifications, justifications, etc.

We will now describe some possible strategies for the organisation of problem solving activities and their different phases in two approaches; firstly, that of ‘problem solving’ (following current trends which reaffirm the value of problem solving activities), and secondly, that of ‘problem situations’ (situations-problèmes, according to the current French interpretation of mathematics teaching).