CHAPTER 11

TEACHING MATHEMATICS
TO SHOP-ASSISTANT APPRENTICES EXPLORING
CONTENT AND DIDACTICAL SITUATIONS

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Abstract. This article presents the results of a research study conducted with apprentices in order to examine the double hypothesis that vocational training incorporating work placement gives the opportunity to construct authentic situations out of the everyday practices of students and that these situations allow students to improve their understanding of mathematical problems. After analysis of workplace situations had shown that the only mathematical concept used by apprentices was that of proportionality applied to percentage calculations, we first analyzed the way in which students at several levels handled this idea of percentage. We then devised an experimental framework in order to help the apprentices to transfer their knowledge.

In the past years, many research studies explored out-of-school mathematical practices (see Adda, 1975, Cerquetti, 1981, Lave, 1988, Nunes et al, 1993). These studies showed the existence of informal mathematical procedures, most of the time without errors, sometimes complex but, in all cases, far removed from school procedures which seem difficult to transfer.

The results of the research studies lead us to wonder about the methods that could help students to make sense of mathematical content at school and make them capable of applying their knowledge out of school (Boaler, 1993, 1994). But is it really possible to bring the ‘real world’ into the mathematics classroom (Sierpinska, 1995)? And, if it is possible, will it really facilitate transfer?

This article presents the results of a research study conducted from 1993 to 1995 with jewel shop-assistant apprentices1 in order to answer these questions.

1. MATHEMATICS USED BY A JEWELRY SHOP ASSISTANT

The jewelry profession uses a very limited set of mathematical notions: In fact, proportionality is almost the only concept the apprentices must apply, in particular, for calculations of gold (Karats) and precious stones (carats). The most frequent application of proportionality is the percentage within the framework of ‘price

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Bessot & Ridgway (eds.), Education for Mathematics in the Workplace, 159—166.
calculations’. It implies the use of a very broad context which is quite embarrassing: Up to what point should we be teaching this context in the mathematics classroom?

Difficulties related to percentage calculations not sufficiently accounted for (Hahn, 1995) are amplified here by the differences in the discourses: Words can have different meanings, depending on the situation in which they are used.

A case in point is the word coefficient.

- In the mathematics classroom, it has the general meaning of a proportionality operator between two quantities linked by a percentage operation;
- In the management classroom a few ‘coefficients’ are identified by ‘formulas’;
- For shop owners, the ‘coefficients’ is the multiplicative operator between their purchase price (exclusive of tax) and their sales price (inclusive of tax).

Procedures are also very different: At school, fractional operators are preferred, while in the shop, symbolic procedures (‘- x%’ or, most of the time, the inaccurate procedure ‘± x%’) are mostly used.

For example, to calculate a pre-tax² at school, the apprentices are taught to perform
\[ \times 100 \div 118.6 \text{ or } \div 1.186 \] while shop owners prefer to perform ‘- 15.68%’, \[ \times 0.84327 \text{ or } \div 118.6\% \].

### 2. THE MATHEMATICS COURSE

The BEP³ curriculum contains a heavy mathematical content. The content tends to be an approximation of that which is taught in high school. Necessarily, it has very little in common with reality in the work place, because of the restricted corpus of mathematical knowledge used in the shop.

In the case of the jewelry shop-assistant apprentices, the mathematics classroom is not very different from the usual BEP mathematics classroom, except that it focuses on word problems the context of which is related to the professional background of the students.

If the apprentices prefer to solve problems relative to jewelry, it does not really help them to understand mathematics. Most of the time, mathematics teachers are unaware of their professional reality, there are very few contacts between them and the shop owners, even with the technical teachers: Teachers only present ‘classical’ problems embedded in a pseudo-professional context, and students who believe in their ‘reality’ are usually disappointed.

Here is an example of what can happen. A teacher had asked a student to calculate the discount given to a customer according to this scale:

<table>
<thead>
<tr>
<th>Quantity Purchased (FF)</th>
<th>Discount Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 2,000</td>
<td>0</td>
</tr>
<tr>
<td>2,000 to 4,000</td>
<td>2</td>
</tr>
<tr>
<td>4,000 to 8,000</td>
<td>3</td>
</tr>
</tbody>
</table>