

A TASK FOR A GRADE 4 CLASS: OUTFITS

The following is a kind of composite of the sort of experiences I and others have had with children at the elementary level. It illustrates that, while a lesson can be carefully prepared and its goals articulated, things may not always go according to plan. This can be an advantage, because very often things emerge that one might not be aware of or wish to introduce. A teacher should not be in the business of answering questions her students are not prepared to address, and the interactions in the classroom may well put on the table important issues that, because they emerge from the pupils themselves, may well engage them.

Suppose a grade 4 teacher gives the following question for her pupils to investigate. A man has four different shirts, three different pairs of trousers, and two different caps. How many different outfits with shirt, trousers and cap are there for him to wear? The teacher has a strategic decision as to how it should be presented. Do the children work independently, in small groups, or should it be a class discussion? Does she provide manipulatives, such as different coloured square, triangular and circular blocks? Does she suggest how the situation can be encoded, say by making a list of the possibilities as they emerge? Or does she leave it to the children to figure out how to record the information, and intervene when necessary?

However often the teacher may have given this particular lesson, she will still have to be prepared for different eventualities. Some pupils may not be participating either from lack of interest, not understanding the problem, or being at a loss as to how to proceed. There may be pupils who quickly get an answer which may be right or wrong, so, from their viewpoint, there is nothing more to be said or done.

Pupils who try to list the possibilities may pick choices willy-nilly, so that they miss some or count others twice. Some will be more systematic, looking at all the outfits with the red shirts first, for example, and successfully list all 24 possibilities in some kind of order. But some pupils will have a capacity for more abstract thinking. They may recognize the symmetry inherent in the situation and note, for example, that the number of outfits with red shirts is equal to the number with shirts of any other colour, so that the total number is four times the number with red shirts. These pupils understand situations in which multiplication is a legitimate operation, are ready for greater abstraction, and are in a position to understand a general combinatorial principle which may not appear in the syllabus until the later high school years.

This kind of diversity is not unusual in a school class, but it can be helpful to the teacher. Suppose a pupil immediately realizes that the answer is 24. If this is not apparent to everyone, can the student explain how he arrived at that answer? This may be difficult to do; pupils who “get” mathematics may not realize that others have a problem with it, so that task of the teacher here is to help the student find a voice.

However, a pupil may quickly get a wrong answer. One may suggest 9, being the sum of 4, 3 and 2. This presents a real challenge for the teacher, as well as the class. One can identify the answer as being wrong by, for example, displaying at least ten possible outfits. But this is not satisfying for the one who offered the answer. All he knows is that somehow he fumbled, so we have to go further. His reasoning may be that since there are four shirts, three pairs of trousers and two caps, then there are altogether nine outfits. What is the difficulty? Is it that he does not understand the situation (his answer is the number of garments)? Or is it rather that he does not understand the context in which a given mathematical operation, such as addition and multiplication, is appropriate?

The teacher may put the answer to the class; there may be other pupils who agree with it. This can be quite effective, especially if there are two competing answers and the members of the class can “take sides”. In this case, there are two sides who have to try to persuade the other. The important thing is that there be a spirit of open enquiry, where the aim is to get at the truth and to expose whatever misconceptions are present. There is a right answer, but at the end of the day, we hope that the pupils with the wrong answer understand where they went wrong and why the right answer is valid.