

M.C.Escher: Mathematics and Visual Arts

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(A more detailed version of this unit, containing supplementary ideas and activities, worksheets, evaluation instruments, a magazine article and a bibliography will be inserted in the mathematics curriculum guide for middle years which will be available in June 1996.)

Integration

Integration is a term that is appearing more and more frequently in the professional teaching literature. In its simplest form, integration means making connections or links.

Integrated teaching brings the following advantages:

- integration helps students to make connections since the links between various concepts, skills and attitudes are established;
- since students make connections, transferring what they've learned to new situations is more readily accomplished;
- integration fosters a deeper understanding of concepts, since linked ideas allow students to review, to test hypotheses and to assimilate concepts in a more efficient way;
- integration also allows students to gain an overview, since learning situations are placed in a larger context;
- students can then make connections between the learning situations and experiences in everyday life, and learning thus becomes more relevant and more motivating;
- since unnecessary overlaps are avoided, integration saves time (an important factor for classes that are multigrades and for designated schools);
- teachers who plan integrated units with colleagues receive the benefit of their expertise and knowledge, as well.

For teaching according to the new mathematics curriculum, several ways of integrating can be identified:

- simple integration, by which the teacher makes links between two or three topics in mathematics: the link between the decimal system and our system of currency, for example;
- integration of a mathematics topic with a life skill: an example is the link between problem solving in mathematics and working cooperatively;
- integration within the mathematics program: problem solving, data management, numbers and operations, geometry and measurement, ratio and proportion, and algebra are the six strands of the mathematics curriculum guide at the middle years level. The intent is to teach the six strands in an integrated fashion; that is, a lesson or a series of lessons would address the specific learning objectives of more than one strand at a time. For example, problem solving is integrated into all the other strands, and geometry can be used for learning concepts of area and volume as well;
- for another kind of integration, the teacher plans lessons in similar topics or objectives in several compulsory study areas and teaches them at the same time during the school year but in different class periods; in this way symmetry can be taught in mathematics as well as in art education, and measurement in mathematics as well as in natural sciences. The links between them are made explicit for the students;
- at a more complex level of integration, the class periods for mathematics and art education simply become one period during which symmetry is taught, the class periods for mathematics and natural sciences become one during which measurement is taught, and the class periods for mathematics and social studies become one period during which data management is taught;
- integration can also make links between all the compulsory study areas, through use of a theme. The teacher uses a conceptual diagram (also known as a spider web) to map out the links between the study areas in a visual form; the theme chosen should be easy to apply to all the study areas. This theme could be derived from one that has already been used in another study area. This is a form of