Appendices

Appendix One - Principles of Teaching Concepts and Rules in Secondary Schools.

* General Principles of Teaching
* Principles of Teaching Concepts in Secondary Schools
* Principles of Teaching Rules in Secondary Schools
* Source.

General Principles of Teaching

The preferred sequence of instructional activities is described below.

1. Orienting students : a) Use of advance organiser
   b) Informing objectives
   c) Attention-catching mechanisms
   d) Testing, explaining, and stimulating recall of prerequisites.

2. Presenting the content by providing appropriate activities for specific learning experiences
3. Testing the mastery of the content

Different principles for different types of content

4. Reviewing the content; providing suitable guidance for retention; relating the content with existing knowledge structure of students.

Principles of Teaching Concepts in Secondary Schools

Note: With respect to concrete concepts, developing the ability to differentiate examples from non-examples is the central element of learning. For defined concepts, understanding the definition is equally important with the ability to differentiate. So, concrete concepts and defined concepts require differential emphasis on the principles listed below.

1. Students should learn the proper definition of the concept. For this, teachers should either provide the defition or help students to derive the defintion. Teachers should
   a) explain the definition in relatively simple terms
   b) stress the essential attributes of the concept
   c) present a representative example along with the definition (especially in case of concrete concepts).
2. Concept learning involves proper generalisation. For this, teachers should provide divergent expository examples covering different difficulty levels.
3. Concept learning involves proper differentiation. For this, teachers should pair each example with a matching

non-example. Non-examples should be divergent. Most of the non-examples should be selected from co-ordinate concepts.

4. Students should develop a meaningful understanding of the concept. For this, teachers should stress on essential attributes while presenting examples and non-examples. Teachers should relate each example and non-example with the definition of the concept.
5. Students should learn a strategy to be followed for testing whether a given instance is an example or not. Teachers should provide such strategy information with suitable demonstrations.
6. For mastery of the concepts, enough practice problems are essential. This stresses the need for interrogatory presentation of positive and negative instances in a random order. Instances should be divergent. Proper feedback should be given. Teachers should be able to identify the specific learning difficulties faced by the students. Adequate corrective measures are essential. Rather than pointing out the wrongness, teachers should help the students to identify the wrongness. Repeated number of questions from the problem areas are needed.
7. For developing a proper cognitive structure, teachers should clarify the relationship of the concept in

question with other concepts in the taxonomy/hierarchy which are already learned by the students.

8. The following aspects should be covered while testing for mastery:

   a) understanding of the definition and essential attributes

   b) ability to differentiate examples from non-examples

   c) ability to explain why a given instance is a non-example

   d) ability to generate one's own examples.

Principles of Teaching Rules in Secondary Schools

1. Teachers should, wherever possible attempt the task of derivation or deduction of the rule depending upon the subject which they teach. For instance, in science, derivation is more important; in mathematics, deduction is more important.
2. Teachers should provide a clear rule-statement and explain it in simple terms. They should specify the conditions under which the rule can be applied.
3. Teachers should provide divergent demonstrations covering different difficulty levels. They should relate the demonstrations with the rule-statement.
4. Several practice problems are essential. Problems should be divergent. Teachers should offer help to needy students. Corrective feedback is very important. Whenever students make mistakes, they should be helped for identifying the mistakes. Repeated number of questions from problem areas is necessary.
5. Teachers should provide a variety of situations in which the rule in question can be used with other rules and concepts that are already studied by students, for solving the problems. High level of student participation is essential in this regard.

6. Teachers should explain the practical and theoretical applicability of the rule.

7. The following aspects should be considered while testing for mastery:

   a) understanding of the rule-statement

   b) understanding of the conditions under which the rule can be used

   c) ability to demonstrate the rule in a variety of direct situations

   d) ability to apply the rule along with other rules in solving new problems.

Source

Many of the principles are derived from empirical studies and theoretical models. Some are derived from logical analysis. The sources are many, but the major ones are the theory of Gagne (1985), and the experiments done by Tennyson and others. To list some of the important sources:

1. Tennyson and Cocchiarella, 1986.
2. Tennyson et al, 1983.
3. Tennyson et al, 1981.
4. Tennyson et al, 1980.
5. Tennyson, 1980
6. Tennyson and Rothen, 1977
7. Tennyson and Tennyson, 1975
8. Tennyson, 1975
9. Tennyson and Boutwell, 1974
10. Tennyson, 1973
11. Tennyson et al, 1972
12. Wooley and Tennyson, 1972
13. Clark, 1971
14. Bruner et al, 1956
15. Rosch, 1977
16. Klausmeier, 1976a.
17. Klausmeier, 1976b
18. Klausmeier and Feldman, 1975

19. Klausmeier et al, 1974

20. Klausmeier and Goodwin, 1971

21. Klausmeier and Harris, 1966

22. Richardson, 1986

23. Park, 1984

24. Cohen, 1983

25. Dunn, 1983

26. Mc Kinney et al, 1983

27. Shumway et al, 1983

28. Becker and Engelman, 1978

29. Mc Murray et al, 1977

30. Reid et al 1975.