

## **An Investigation into the Attainment of Rational Number Concepts By Elementary School Children**

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### **Introduction :**

The rapid technological advancements and innovations and shifting global trends of economic dominance and technological competence has elevated the status of mathematics education at all levels. In India also various commissions and committees appointed from time to time to upgrade the system of education emphasized the need to provide opportunities to the children in schools for the human resource development which would contribute to the development of the nation.

From experience and reports we find that rational number concepts are among those concepts that children in the elementary grades find complex and difficult to learn.

Researches conducted on the proportional reasoning of early adolescents e.g., (Karplus et al., 1979), Suarez (1977), Boelke (1980), Noelting (1980 a), and Rupley (1981) support that children use proportional reasoning while solving problems involving rational number concepts. Thus, children's level of proportional reasoning could perhaps influence their achievement on rational number concepts as well as their performance in respect of operations on rational numbers.

### **The Problem :**

**"An investigation into the attainment of rational number concepts by elementary school children".**

### **The Objectives :**

The objectives of the study were as follows :

To assess the achievement of rational number concepts of pupils of age thirteen plus studying in grade VIII.

To assess the performance in respect of operations on rational numbers of pupils of age thirteen plus studying in grade VIII.

To identify the pattern of proportional reasoning of pupils in the age group of thirteen plus studying in grade VIII.

To find out if there exists an association between the level of proportional reasoning of pupils of age thirteen plus studying in grade VIII and their achievement on rational number concepts.

To find out if there exists an association between the level of proportional reasoning of pupils of age thirteen plus studying in grade VIII and their performance in respect of operations on rational numbers.

### **The Hypotheses :**

The hypotheses formulated for the study were as follows :

H1 There exist different levels of proportional reasoning in children of age thirteen plus studying in grade VIII.

H2. There exists an association between proportional reasoning level of pupils in the age group of thirteen plus studying in grade VIII and their achievement on rational number concepts.

H3 There exists an association between proportional reasoning level of pupils in the age group of thirteen plus studying in grade VIII and their performance in respect of operations on rational numbers.

### **The Sample :**

Due to the fact that data for the study had to be collected through group as well as individual testing, the study was conducted on only 100 children of age 13+ years studying in grade VIII.

### **The Tools :**

The following tools were used in the study :

Concept Attainment Test of Rational Numbers.

Test of Operations on Rational Numbers, and

Proportional Reasoning Tasks.

Since the present investigator did not come across any standardized tests of rational number concepts as well as operations, these tests were constructed by the investigator. As far as measures to assess proportional reasoning were concerned, tasks standardized by Noelting et al; 1980 (a) were adapted for use in the present study.

### **Administration of Tools and Collection of Data :**

The data of the study was collected by administering concept attainment test of rational numbers, test of operations on rational numbers and proportional reasoning tasks to all

the 100 subjects of age 13+ years studying in grade VIII in Air force Senior Secondary School, Race Course, New Delhi. Concept attainment test and test of operations were administered in groups. Proportional reasoning tasks were administered individually. All these tests and tasks were administered in a sequence starting with concept attainment test followed by test of operations and finally proportional reasoning tasks were administered. Thereafter, the scoring was done and scores tabulated.

### **Analysis of Data**

Keeping the objectives of the study in mind data was analysed by using appropriate qualitative and quantitative techniques.

The present study being exploratory in nature, there was not much ground for making assumptions about the parameter or to use parametric methods. Therefore, non-parametric methods for the purposes of analysis and interpretation of data were used in the present investigation. For identifying the levels of proportional reasoning among pupils frequencies were used for categorizing pupils into groups, for finding associations between proportional reasoning level of the sample subjects and their achievement of rational number concepts as well as their performance in respect of operations on rational numbers with the levels of their proportional reasoning. The non-parametric technique of chi-square ( $\chi^2$ ) was used. The chi-square test represents a useful method of comparing experimentally obtained results with those to be expected theoretically on some hypothesis. Also, to study the degree of relationship between different attributes in numerical terms, contingency coefficient (C) was calculated.

### **Findings of the Study :**

The major findings of the study were as follows :

As far as first hypothesis  $H_1$  was concerned, the findings reveal that Pupils of age 13+ years studying in grade VIII were operating at different levels of proportional reasoning, and were identified at level I (pre-operational), level II (transitional) and level III (operational).

As far as first hypothesis  $H_2$  was concerned, the findings reveal that There was a significant ( $p < .01$ ) and high correlation (0.71) between the level of proportional reasoning of the sampled pupils of age 13+ years studying in grade VIII and their achievement in concept attainment.

As far as first hypothesis  $H_3$  was concerned, the findings reveal that There was significant ( $p < .01$ ) but moderate correlation (0.69) between the level of proportional reasoning of the sampled pupils of age 13+ years studying in grade VIII and their performance in respect of operations on rational numbers.

As far as the attainment of rational number concept is concerned, from these findings, it could be concluded that the association of proportional reasoning with achievement of rational number concepts as well as with performance in respect of operations on

rational numbers was positive and highly significant.

### **Educational Implications :**

The findings of the present study, reveal that the pupils of age 13+ years studying in grade VIII differ with regard to their levels of proportional reasoning i.e., there exist level I (pre-operational), level II (transitional) and level III (operational) of proportional reasoning in the same age and same grade. Since level I (pre-operational) and level II (transitional) are not fully operational as far as proportional reasoning levels are concerned, they are unable to internalize the rational number concepts and operations on rational numbers more meaningfully. It thus seems necessary to facilitate development of needed mental structures by providing students with opportunities for structuring tasks involving proportional relationships prior to teaching them rational number concepts.

Rational number concept attainment and proportional reasoning are significantly related to each other. Proportional reasoning is not given proper attention in the teaching aims of elementary level mathematics in India. The curriculum planners need to give more suitable place to this subject both as a topic for study and as a tool for the development of students capable of proportional reasoning.

Many science activities could be used in this way to present students with problems of proportionality and should be allowed to solve problems in a variety of ways and contexts. This provide students an opportunity to gradually abstract the principle from its concrete exemplar. It would seem that this would result in student competence with this aspect of formal reasoning.