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PSS 6: Teaching of mathematics

INTEGRATION OF MATHEMATICS WITH OTHER SUBJECTS

In the previous section, we stated that "Mathematics is the science of all sciences and art of all arts". Is this statement valid? Why do we make such a statements? Does Mathematics have any relation with science and art? Yes of course! The presence of Mathematics can be seen anywhere including the subjects like sciences, biology, engineering, agriculture, philosophy, psychology, history, geography, drawing, arts, languages and commerce. So, Mathematics has correlation with all other subjects. Today integrated teaching is advocated as it helps children for easy assimilation of subject knowledge. Thus, while organizing learning experiences, teacher should help children to integrate Mathematics and concepts of other subjects. Let us first briefly discuss the correlation of Mathematics with other subjects and then ways of integrating it with other subjects.

Mathematics and Physics: Mathematics is closely associated with physics. In physics, we find many mathematical equations and formulas. For example, $v=u+at$, makes use of the concept of mathematical equation (equal sign). Similarly, the laws of motion, laws of levers, laws of reflection and refraction, laws of electric current, etc. use Mathematics. Light rays, levers, steam engines, telephones and communication devices, electromagnetic rays, electronic and semiconductor devices, etc. have the application of Mathematics.

Mathematics and Chemistry: All chemical combinations are governed by mathematical laws. The formation of a chemical compound is not possible without Mathematics. The basic unit of any substance, atom and the sub particles, of which atom is made up, obey mathematical laws. Chemical equations are controlled by mathematical principles. The huge amount of energy created by an atom is calculated using Mathematics.

Mathematics and Biology: Mathematical principles and facts are applied in all studies concerning botany and zoology. The caloric and nutritional values are calculated using Mathematics. The growth of plants and animals is measured; the respiration and transpiration of water in living bodies etc also use Mathematics. The study of nutrition, growth, maturation, compounds, mixtures, laws of chemical combination, molecular and atomic structure, chemical names and formulas etc all are based on mathematical laws.

Mathematics and Engineering: Mathematics is considered as the foundation of engineering. Surveying, levelling, building construction, construction of electronic and other mechanical devices, dams, bridges etc., use laws and principles of Mathematics.

Mathematics and Agriculture: In agriculture, the money involved, expenditure and income generated are calculated. Similarly, the time to start cultivation of crops and vegetables is

analysed. Also, the measurement of plots for cultivation, production per unit area, cost of labour, seed price, etc are calculated using Mathematics.

Mathematics and Social Sciences: Economics employs mathematical principles and languages to interpret social phenomena. The share market operations, country's revenue statement, budget analysis, etc. use Mathematics.

In geography, the climatic changes, height of mountains, knowledge of rivers, population, moment of winds, area of earth, longitude and latitude, etc. are measured using Mathematics. In history, the historical developments are traced and analysed with Mathematics. Similarly, in philosophy, the basics of all subjects are formed with the help of Mathematics. In commerce, Mathematics is used in accounting and bank-related operations.

Mathematics and Psychology: All the psychological measurements related to human behaviour are collected using appropriate scale constructed using mathematical principles. Also, statistical methods use to organise, analyse and interpret psychological behaviour of any object/subject. Experimental psychology is based on mathematical computations.

Mathematics and Art and Drawing: The various branches of drawing like geometrical drawing, memory drawing, figure drawing, etc. employ Mathematics to produce beautiful colour combinations and pictures. A picture is attractive to eye when the proportion and ratio of colours are perfectly maintained. Even an artist, makes use of his/her mathematical knowledge before attempting to draw a picture on the canvas.

Mathematics and Language: It is language that helps Mathematics to express mathematical equations, laws and principles. Similarly, the medium of expression of any mathematical fact employs the use of language. The funny thing is that, language differs from place to place, but the mathematical idea remains constant irrespective of the language.

Having understood the relation between Mathematics and other subject areas, it is now the task of the teacher to integrate each subject with Mathematics in the teaching-learning process. How is it possible? Let us listen to a conversation. Here, Mr. Ramkishore is teaching the concept of 'arithmetic progression' to his tenth class students. Arithmetic progression (AP) is a list of numbers in which each term is obtained by adding a fixed number to the preceding term except the first term. The fixed number is called the common difference. How will a teacher introduce AP to his/her students? Normally, the teacher may say, "in the series of numbers 2, 4, 6,8,10, etc., each number is 2 more than the previous number. Such a list of numbers is called an AP". The teacher may give a few more examples. The children passively admit the concept and reproduce in the term tests. But, let us take note of the classroom interaction of Mr. Ramkishore.

Ramkishore : Hello children! how are you? Have you done yesterday's home assignment? Let me check it.

Students : Yes sir.

For a while, Ramkishore gets engaged in evaluating the home assignments. After checking the home assignments, he continued:

Ramkishore : Let me tell you an incident. The previous day, I went to a shop that sells pesticides. Do you know about pesticides?

Some students said 'yes' while a major group were unaware of pesticides. Then, teacher continued:

Ramkishore : I will tell you. Pesticides are substances which are used to destroy pests.

Aims and Objectives of Ramkishore continued to talk about pesticides. He explained different kinds of pesticides, where they are found, the techniques to use pesticides, and so on. Then, he started narrating the incident;

Ramkishore : So, where did I stop? Aah.. yes. yes. I went to the shop. Then for ten minutes I watched the people buying pesticides. Then what I found was that a man purchased 1 kg pesticides, then the other man purchased 2 kg (he may be having more cultivation), a third man 3kg, fourth man, 4kg and so on. Now, my question is can you tell, the quantity of pesticides purchased in order?

Students : It is very easy sir. 1 kg, 2kg, 3kg, 4 kg, 5kg.....

Ramkishore : let me repeat, 1,2,3,4, 5, isn't it?(he write the numbers on the board)

Students : Yes Sir.

Ramkishore : Now, my next question. Do you find any relation in the numbers given above?

The discussion prolonged till the conclusion, Mr. Ramkishore introduced the concept of AP. In this example, Mr. Ramkishore has tried to correlate Mathematics with the subject of agriculture. In the process, he discussed the different aspects of the concept 'pesticide', a topic of agriculture. In a similar way, Mathematics can be correlated with other subjects.