ACHIEVEMENT TEST

Meaning:

An achievement test is a test of developed skill or knowledge. The most common type of achievement test is a standardized test developed to measure skills and knowledge learned in a given grade level, usually through planned instruction, such as training or classroom instruction.

USES OF ACHIEVEMENT TEST

- Achievement test scores are often used in an educational system to determine what level of instruction for which a student is prepared.
- High achievement scores usually indicate a mastery of grade-level material, and the readiness for advanced instruction.
- Low achievement scores can indicate the need for remediation or repeating a course grade.

Characteristics of a good test

- Test preparation activities which promote quality, long-term learning are appropriate, even essential. Good test-taking skills and appropriate content learning can reduce the likelihood that extraneous factors will influence students' test scores. The various characteristics of a good test are:
- It can be tried out and selected on the basis of its difficulty level and discriminating power.
- Directly related to the educational objectives.
- It should possess description of measure behaviour in realistic and practical terms.
- Contains a sufficient number of test items for each measured behaviour; concerned with important and useful matter; comprehensive, brief, precise and clear.

- It should be divided into different knowledge and skills according to behaviour to be measured.
- Standardized the items and made instructions clear so that different users can utilize it.
- Rules and norms have to be developed so that various age groups can use at various levels.
- It provides equivalent and comparable forms of the test.
- A test manual has to be prepared, which can act as a guide for administering and scoring.

BLUE PRINT

A blueprint is a guide for making something — it's a design or pattern that can be followed. Want to build the best tree house ever? Draw up a blueprint and follow the design carefully.

The literal meaning of a blueprint is a paper — which is blue — with plans for a building printed on it.

Maths
Achievement Test

TABLE-1: SHOWING THE WEIGHTAGE ALOTTED TO THE OBJECTIVES

OBJECTIVES	MARKS ALLOTED	PERCENTAGE
Knowledge	05	12.5%
Understanding	17	42.5%
Application	16	40%
Skills	02	5%
TOTAL	**40**	**100%**

TABLE-2: WEIGHTAGE GIVEN TO THE TOPIC

S.NO	TOPICS	MARKS ALLOTED	PERCENTAGE
1.	Fraction	13	32.5%
2.	Playing with numbers	14	35%
3.	mensuration	13	32.5%
	TOTAL	**40**	**100%**

TABLE-3: WEIGHTAGE GIVEN TO DIFFERENT FORMS OF QUESTIONS

S.NO	FORMS OF QUESTIONS	MARKS ALLOTED	PERCENTAGE
1.	Very short answers(VSA)	7	17.5%
2.	Short answers(SA)	8	45%
3.	Long/ essay type answers	15	37.5%
	TOTAL	**40**	**100%**

Class: VI
Subject: Mathematics

BLUEPRINT

Time: 80 min
M.M: 40

FORMS OF QUES / TOPIC	KNOWLEDGE LEVEL			UNDERSTANDING LEVEL			APPLICATION LEVEL			SKILLS	TOTAL
	V.S.A	S.A	L.A	V.S.A	S.A	L.A	V.S.A	S.A	L.A		
INTEGERS		3(1)				5(1)		3(1)		2(2)	13(5)
FRACTIONS	1(1)			1(1)	3(1)		1(1)	3(1)	5(1)		14(6)
AREA AND PERIMETER	1(1)				3(1)	5(1)	1(1)	3(1)			13(5)
TOTAL	5(3)			17(5)			16(6)			2(2)	40(16)

VSA: Very Short Answers Questions
SA: Short Answer Questions
LA: Long Answer Questions

Number in bracket shows number of questions.
Number outside the bracket shows marks given to each questions.

Subject- Mathematics

Class-VI

Time: 80 minutes **M.M: 40**

General Instructions

Section ‘A’ contains 5 very short answer questions,1 marks each

Section ‘B’ contains 5 short answer questions, 2 marks each

Section ‘C’ contains 4 long answer questions, 3 marks each

Section-A

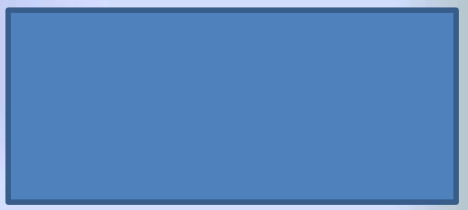
Q1. Write the next 3 natural numbers after 10999.

Q2. Find the perimeter of a square with a side of 25 cm.

Q3. Identify the successor of 2440701

Q4. Find the sum by suitable rearrangement of 837+208+363

Q5. Measure the length and the breadth of rectangle



Q6. Write 3 equivalent fraction of 3/5

Q7. Find the fraction having denominator 16 equivalent to 3/8

Section-B

Q8. Find the product using suitable properties

a) 738 X 103 b) 854 X 102 c) 258 X 1008

Q9. Justify through examples. If the product of two whole number is 1 , can we say that one of both of them will be 1?

Q10. Find the perimeter of the table top measures 2m 25 cm by 1m 50cm.

Q11. Illustrate, A piece of string is 30 cm long. What will be the length of each side if the string is used to form.

a) A square b) an equilateral triangle c) a regular hexagon

Q12. Find the equivalent fraction of 3/5 having:-

a) Denominator 20 b) numerator 9 c) denominator 30

Q13. Replace the following fraction to simplest form :-

a) 48/60 b) 150/60 c) 84/98

Section-C

Q14. Ila read 25 pages of a book containing 100 pages, lalita read 2/5 of the same book. Illustrate who read less.

Q15. Find the common factors of :-

a) 20 & 28 b) 15 & 25 c) 35 & 50 d) 56& 120 e) 5 & 15

Q16. Explain the number of tiles whose length and breadth are 12cm and 5cm resp. will be needed to fit in a rectangular region whose length and breadth are resp:-
a) 100cm & 144cm b) 70cm & 36cm

MARKING SCHEME

S.No	ANSWERS	MARKS
1	11000,11001,11002	1
2	4X25=100cm	1
3	2440702	1
4	1408	1
5	Length=4cm,breadth=2cm	1
6	6/10, 9/15, 12/20	1
7	1x10 + 4x1/100 + 9x1/1000	1
8	a) 76014 b) 87108 c) 260064	3
9	1x1=1 1x6=6	3
10	Perimeter=7.5m	3

S.No	ANSWERS	MARKS
11	a) side= 7.5cm b) Side=10cm c) Side=5cm	3
12	a) 12 b) 15 c) 18	3
13	a) 4/5 b) 5/2 c) 6/7	3
14	Ila has read less number of pages	5
15	a) 1,2,4 b) 1,5 c) 1,5 d) 1,2,4,8 e) 1,5	5
16	a) 240 b) 42	5

SCORE SHEET

Q. No.	No. OF students attempted	No. of students attempted question correct	No. of students attempted question incorrect
1	40	38	2
2	40	33	7
3	40	36	4
4	40	33	7
5	40	31	9
6	40	29	11
7	38	28	12
8	36	28	12
9	40	30	10
10	40	37	3
11	40	35	5
12	35	28	12
13	40	33	7
14	40	32	8
15	40	27	13
16	40	36	4

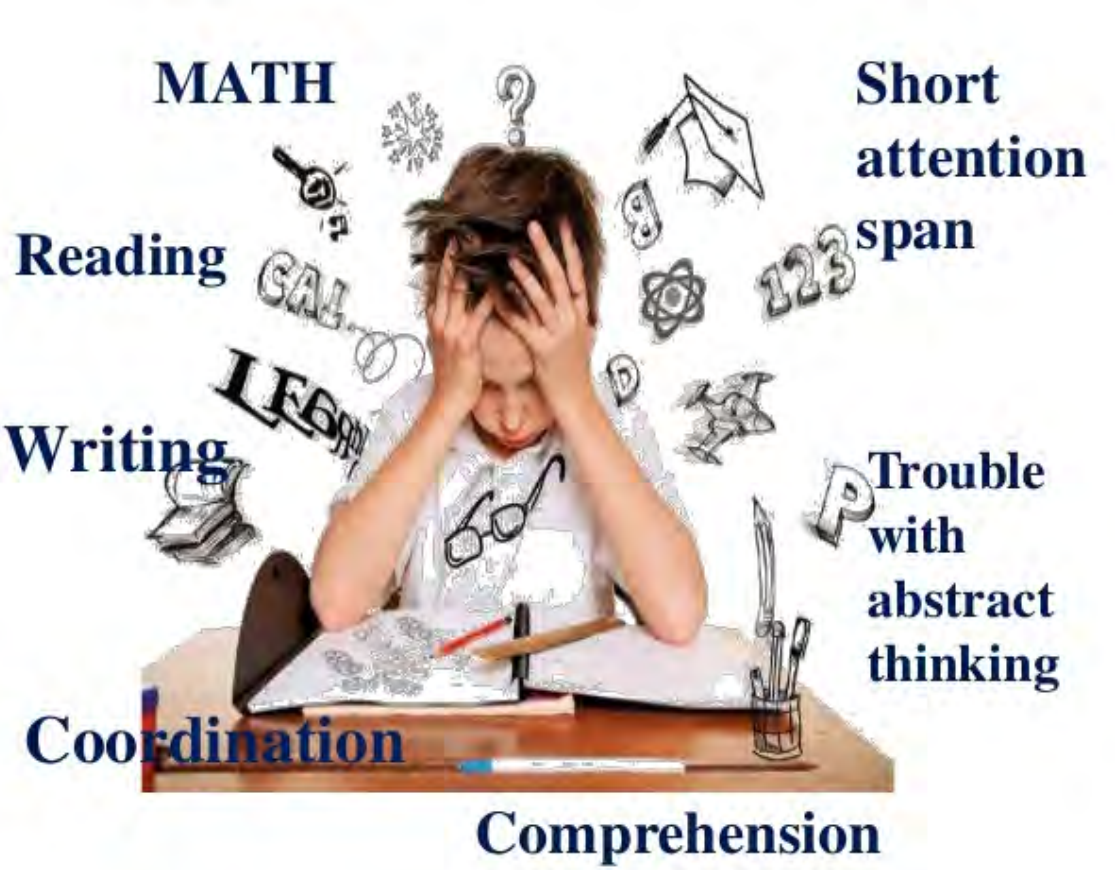
INTERPRETATION

- Students find section A easier
- Question related to the topic Fractions are not clear to the some students
- Area and perimeter topic is clear to most of the students it means teacher hs taught accurately in the class

SUGGESTIONS

- Uncleared topics should be revised in the class in free period
- Some remedial classes should be given to some students
- Students scoring good marks above average should be appreciated.

BACKWARD STUDENTS (Slow Learners) : CAUSES AND REMEDIES



<u>BACKWARD STUDENTS</u>

There may be two types of backwardness:

1. General backwardness, and
2. Particular backwardness.

GENERAL BACKWARDNESS

This means all-round backwardness. It is almost inherited and is due to a low I.Q. which may be between 50-70. We can at the most raise it by 7 or 8 points. The removal of this backwardness is a joint responsibility of all the teachers in the school. Of course, the mathematics teacher will be required to pay special attention in the case of his subject. If the case of the child is a hopeless one, it should be guided sympathetically to take to some manual type of vocation.

PARTICULAR BACKWARDNESS

This is the case, which is backward in mathematics but fairly intelligent in other subjects. The child is otherwise intelligent, but is weak in mathematics. Removal of particular backwardness is easier than removal of general backwardness, because the former is a hopeful case. His being intelligent in other subjects, is a hopeful sign. His achievement in other subjects is a source of confidence and inspiration for him. This backwardness is the sole concern of the mathematics teacher. Acute cases may have to be treated in separate classes, whereas border cases may be tackled in the classroom itself.

Before adopting any means to remove the backwardness, the teacher must be clear about its causes which may be many.

CAUSES AND REMEDIES

1. **Physical causes:** There may be some physical cause, such as poor eye-sight, defect in the hearing organ, stomach trouble, headache or any other physical ailment, which does not allow the child to concentrate on his studies. Mathematics needs special concentration. The remedy of almost all these causes lies with the doctor or physician, but some sort of physical exercise may also help the child. The teacher has to refer the child to the school doctor, some other medical expert or the school PTI according to the nature of the case. He has to try to make available all the possible remedies. If it is a case of serious physical deficiency, the teacher should try to persuade the parents to get their ward admitted to a special institution for the physically handicapped children of that type.
2. **Mental causes:** The backwardness may be due to some mental causes. These causes may be inborn and/or environmental. The child may have low I.Q., some mental ailment, mental dissatisfaction, domestic problem, mental conflict, sense of insecurity, inferiority complex, lack of interest in mathematics or a dominant interest in something else. A case of simple mental problem can be tackled with some chances of success by the teacher. But complicated cases will have to be passed on to a psychologist or a psychoanalyst for thorough diagnosis and treatment. An attitude of love and sympathy and preparedness to help the children on the part of the teacher will always be helpful in the treatment of such cases.
3. **Distaste for the subject:** A distaste for the subject may be another cause. This distaste may either be natural or acquired. If it is inborn, the teacher's efforts may go waste. But if it is an acquired one, it may be

mostly the teacher's fault. If he fails to develop a feeling of attachment between the child and himself, the only outcome is the child's distaste for the subject. Heaviness of the syllabus, toughness of the subject and difficulty of its problems tend to produce this distaste. A genuine taste for the subject will be developed through the teacher's patience and persistence. He should never be in a hurry to pronounce case as hopeless and backward. He should never allow the idea 'once backward always backward' to enter his mind.

4. **Doubts about fundamentals:** Sometimes the child develops some doubts about the fundamentals of the subject, and these doubts hinder his progress throughout. The teacher should be very careful while teaching these fundamentals. He should not hesitate to explain them over and over again if required. Only a clear understanding of these fundamentals can build a sound foundation for mathematical learning.
5. **Wrong influence of home:** Influence of the home may also create distaste and backwardness. Some parents unintentionally provide negative suggestions to their children. Some of them are in the habit of saying that they never liked mathematics or they never wanted to study it, or were never able to pass in it or that failure in mathematics has been a tradition of their family. Even the educated parents commit such mistakes. These pronouncements are likely to have an adverse effect on the child's attainment in the subject. Parents must be made conscious if this adverse effect and their duty in this manner.
6. **Teacher's behavior:** The teacher's unbalanced behavior may also be one of the causes. If he is very lenient, some of the clever and mischievous students may get undue advantage of it and may become backward due to continuous inattention and non-seriousness. If he is very strict and gives heavy punishment unsparingly, some of the feeble-minded students may get disheartened and discouraged. They may start disliking the teacher and consequently the subject. The teacher should never forget that his behavior is very important.
7. **Mid session changes:** The change of school or even the change of teacher may not suit some of the students. Whenever the change of school is unavoidable, the parents and the teachers have to remain on guard till the child's complete adjustment with the change. Changing the teacher in the middle of a session should be avoided as far as possible.
8. **Teacher's reputation:** The subject teacher's bad reputation in the school and neighbourhood may also affect some of the students adversely. The teacher must earn respect and reputation. He should be a source of inspiration for his students in every respect. He should carefully maintain his scholarship and character.

9. **Apathy towards method:** A part of the students' apathy towards the teacher's most favourite method of teaching may result in their backwardness. The teacher should not always stick to the same method. Students like 'newness and novelty'. The teacher should always be prepared to adjust his method to the learner's likes. He may have to devote extra time and attention to the student who is lagging behind. Slow learner deserves the teacher's individual attention and help. The teacher should so conduct himself that the slow learners never feel that they are being disowned or being left behind.
10. **Lack of practice:** Of these students, some may need more practice and drill than others. The teacher should not overlook their need. The intelligent one may pick up an idea after solving only one problem, whereas the slow learner may need solving two or three problems to grasp it. The teacher has to adopt a via-media.
11. **Neglect of home work:** When the child does not get sufficient time at his home for home work, he is likely to lag behind. Regularity in home work should be ensured. The parents should give full cooperation to the teacher in this regard.
12. **Irregular attendance:** If the child remains unavoidably irregular or absent for a long time, there are chances of his falling a prey to backwardness. The facility of extra-coaching for sometime should be provided to such students so that they can fill up their gaps and catch up with other class-fellows. Such temporarily backward students should not be left to themselves. The provision of extra-classes made in most of the schools near the examination, enables many backward students to get through.
13. **Defective handwriting:** Defective hand at writing and geometrical constructions may be the cause of unsatisfactory performance in certain cases. Their weakness does not therefore pertain to mathematics. The cooperation of language teacher may be sought in their case. The teacher should make it a point to insist on neatness of hand and construction in such cases.
14. **Examination system:** Faulty examination system may also cause non-seriousness and backwardness among some students. If passing in mathematics is not compulsory at the time of passing the final examination, some students may ignore this subject. Therefore it should be treated as a compulsory in this respect.

Chapter 1

Continuous and Comprehensive Evaluation

Education aims at making children capable of becoming responsible, productive and useful members of society. Knowledge skills and attitudes are built through learning experiences and opportunities created for learners in school. It is in the classroom that learners can analyse and evaluate their experiences, learn to doubt, to question to investigate and to think independently.

Globalisation in every sphere of society have important implications for education. We are witnessing the increasing commercialisation of education. We need to be vigilant about the pressures to commodify schools and the application of market-related concepts to schools and school quality. The increasingly competitive environment into which schools are being drawn and the aspirations of parents place a tremendous burden of stress and anxiety on children, including the very young to the detriment of their personal growth and development, and thus hamper the joy of learning.

The aims of education simultaneously reflect the current needs and aspirations of a society as well as its lasting values and the immediate concerns of a community as well as broad human ideals. At any given time and place they can be called the contemporary and contextual articulations of broad and lasting human aspirations and values.

An understanding of learners, educational aims, the nature of knowledge, and the nature of the school as a social space can help us arrive at principles to guide classroom practices. Conceptual development is thus a continuous process of deepening and enriching connections and acquiring new layers of meaning. Alongside is the development of theories that children have about the natural and social worlds, including themselves in relation to others, which provide them with explanations for why things are the way they are, the relationships between causes and effects, and the bases for decisions and acting. Attitudes, emotions and values are thus an integral part of cognitive development, and are linked to the development of language, mental representations, concepts and reasoning.

As children's metacognitive capabilities develop, they become more aware of their own beliefs and capable of regulating their own learning.

'We're drowning in information and starving for knowledge'

-Rutherford D. Rogers

Characteristics of learning:

- All children are naturally motivated to learn and are capable of learning.
- Making meaning and developing the capacity for abstract thinking, reflection and work are the most important aspects of learning.
- Children learn in a variety of ways-through experience, making and doing things, experimentation, reading, discussion, asking, listening, thinking and reflecting, and expressing oneself in speech, movement or writing-both individually and with others. They require opportunities of all these kinds in the course of their development.
- Teaching something before the child is cognitively ready takes away from real learning. Children may *'remember'* many facts but they may not understand them or be able to relate them to the world around them.
- Learning takes place both within school and outside school. Learning is enriched if the two arenas interact with each other. Art and work provide opportunities for holistic learning that is rich in tacit and aesthetic components. Such experiences are essential to be learnt through direct experience, and integrated into life.
- Learning must be paced so that it allows learners to engage with concepts and deepen understanding, rather than remembering only to forget after examinations. At the same time learning must provide variety and challenge, and be interesting and engaging. Boredom is a sign that the task may have become mechanically repetitive for the child and of little cognitive value.
- Learning can take place with or without mediation. In the case of the latter, the social context and interactions, especially with those who are capable, provide avenues for learners to work at cognitive levels above their own.

Examinations are an indispensable part of the educational process as some form of assessment is necessary to determine the effectiveness of teaching learning processes and their internalization by learners. Various Commissions and Committees have felt the need for examination reforms. The *Hunter Commission (1882), Calcutta University Commission or Sadler Commission (1917-1919), Hartog Committee Report (1929), the Report of Central Advisory Board / Sargeant Plan (1944), Secondary Education Commission / Mudaliar Commission (1952-53)* have all made recommendations regarding reducing emphasis on external examination and encouraging internal assessment through Continuous and Comprehensive Evaluation.

This aspect has been strongly taken care of in the National Policy on Education- 1986 which states that *"Continuous and Comprehensive Evaluation that incorporates both scholastic and non-scholastic aspects of evaluation, spread over the total span of instructional time"* {8.24 (iii)}.

Report on the Committee for Review of NPE-1986-recommendation brought out by Government of India in 1991 lays down norms for *"continuous comprehensive internal evaluation and suggests safeguards against abuse of this evaluation system"*{268(iv)}.

Report on the *CABE Committee on Policy* brought out by MHRD, Govt. of India in January, 1992 has also referred to the provisions of NPE with regard to evaluation process and examination reforms and also suggested *'continuous and comprehensive internal evaluation of the scholastic and non-scholastic achievement of the students'*(16.8).

The need for Continuous and Comprehensive School-based Evaluation has been reiterated over the last few decades. The *Kothari Commission report (1966)* observed, *'On the completion of the course, at the end of the lower or higher secondary stage, the student should receive a certificate from the school also giving the record of his internal assessment as contained in his cumulative record. This certificate may be attached to that given by the Board in connection with the external examination...' (9.81)*. It further adds, *'This internal assessment or evaluation conducted by the schools is of greater significance and should be given increasing importance. It should be comprehensive, evaluating all those aspects of students' growth that are measured by the external examination and also those personality traits, interests and attitudes which cannot be assessed by it.'* (9.84).

The Report of the Task Force on the Role and status of the Board of Secondary Education (1997) observed: *In our scheme of things, it is the School Boards which are expected to play the central role in the academic renovation of the school system. In other words, leadership has to come from the Board*. Once the Boards get committed to this vital and supplementary system of evaluation and push it vigorously, this innovation will come to be accepted by more and more schools.

Remodelling of School Education Boards – a report on the Task Force on the role and the status of *Boards of Secondary Education (1997)* has explained the philosophy of CCE (4.39). It further states that *'no agency other than the Boards should promote CCE and that is why it is sought to be emphasized that the Boards have to play a pioneering role in this regard'*(4.40).

"Learning without Burden"- a Report of the National Advisory Committee appointed by the Ministry of Human Resource Development, Department of Education, Govt. of India has stated that:

" Board examination, taken at the end of Class X and XII, have remained rigid, bureaucratic, and essentially uneducative..."

Accordingly, National Curriculum Framework - 2005 (NCF-05) proposing Examination Reforms stated - *"Indeed, boards should consider, as a long-term measure, making the Class X examination optional, thus permitting students continuing in the same school (and who do not need a board certificate) to take an internal school examination instead".*

As a sequel to above, the Position Paper on *`Examination Reforms' by NCERT 2006, says,*

"Indeed, it is our view that the tenth grade exam be made optional forthwith. Tenth-graders who intend continuing in the eleventh grade at the same school and do not need the Board certificate for any immediate purpose, should be free to take a school-conducted exam instead of the Board exam."

Evaluation is goal directed, and educational outcomes are judged in terms of goal attainment. Every educational programme should aim for the all round development of the personality of the child. Therefore, the learning experiences provided in the school should contribute toward the achievement of the desired goals. A teacher, while deciding about the related learning experience should see both scholastic and co-scholastic outcomes as desirable behavioural outcomes of that programme.

The scope of evaluation in schools extends to almost all the areas of learners' personality development. It should include both scholastic and co-scholastic areas, i.e. it should be *comprehensive* in nature. This is in line with the goals of education. Evaluation is continuous and reveals the strengths and weaknesses of learners more frequently, so that the learners have better opportunity to understand and improve themselves. It also provides feedback to the teachers for modifying their teaching strategies.

Obviously, the efforts of CBSE to provide a leadership and pioneering role in implementing CCE is a major breakthrough which attempts to elevate the status of the schools as equal partners of the Board in assessing the attainment levels of the learner for public consumption through a separate independent certificate issued by the schools under the directive of the Board.

Place of Evaluation in the Curriculum

A curriculum is what constitutes a total teaching-learning program composed of overall aims, syllabus, materials, methods and assessment. In short it provides a framework of knowledge and capabilities, seen as appropriate to a particular level. The syllabus provides a statement of purpose, means and standards against which one can check the effectiveness of the program and the progress made by the learners. Evaluation not only measures the progress and achievement of the learners but also the effectiveness of the teaching materials and methods used for transaction. Hence evaluation should be viewed as a component of curriculum with the twin purpose of effective delivery and further improvement in the teaching learning process.

Understood properly, evaluation or assessment will not be perceived as something administered by the teachers and taken by the learners on the conclusion of a period of learning. When evaluation is seen as an end of the learning exercise, both the teachers and the learners will tend to keep it outside the teaching-learning process, rendering assessment broadly irrelevant and alien to the curriculum. Further such a perception associates anxiety and stress with evaluation for learners. On the contrary, *if evaluation is seen as an integral part built into the teaching learning process; it will become continuous like both teaching and learning.* When evaluation is subsumed into teaching learning, learners will not perceive tests and examination with fear. CCE will lead to diagnosis, remediation and enhancement of learning.

Evaluation results: Fundamental to effective teaching and learning

Success in education is determined by the extent to which the learning objectives are realized. The progress towards attainment of objectives has to be assessed and evaluated for otherwise, we will not know where we are going.

One of the main purposes of evaluation at the school stage is to help the learner's improve their achievement in scholastic areas and to develop Life Skills and attitudes with reference to the larger context and canvas of life.

Further, in NPE (1986) it has been emphasized that at the school level the evaluation should be formative or developmental in nature because at this stage child is in the formative stage of learning and thus the emphasis should be on improvement of learning.

What is `Continuous' and `Comprehensive' Evaluation ?

Continuous and Comprehensive Evaluation (CCE) refers to a system of school-based evaluation of students that covers all aspects of students development.

It is a developmental process of assessment which emphasizes on two fold objectives. These objectives are continuity in evaluation and assessment of broad based learning and behaviourial outcomes on the other.

In this scheme the term *`continuous'* is meant to emphasise that evaluation of identified aspects of students *`growth and development'* is a continuous process rather than an event, built into the total teaching-learning process and spread over the entire span of academic session. It means *regularity of assessment, frequency of unit testing, diagnosis of learning gaps, use of corrective measures, retesting* and *feedback of evidence to teachers and students* for their self evaluation.

The second term *`comprehensive'* means that the scheme attempts to cover both the scholastic and the co-scholastic aspects of students' growth and development. *Since abilities, attitudes and aptitudes can manifest themselves in forms other then the written word, the term refers to application of variety of tools and techniques (both testing and non-testing) and aims at assessing a learner's development in areas of learning like :*

- Knowledge
- Understanding/Comprehension
- Applying
- Analyzing
- Evaluating
- Creating

The scheme is thus a curricular initiative, attempting to shift emphasis from testing to holistic learning. It aims at creating good citizens possessing sound health, appropriate skills and desirable qualities besides academic excellence. It is hoped that this will equip the learners to meet the challenges of life with confidence and success.

The objectives of the Scheme are :

- To help develop cognitive, psychomotor and affective skills.
- To lay emphasis on thought process and de-emphasise memorization
- To make evaluation an integral part of teaching-learning process
- To use evaluation for improvement of students achievement and teaching – learning strategies on the basis of regular diagnosis followed by remedial instruction
- To use evaluation as a quality control devise to maintain desired standard of performance
- To determine social utility, desirability or effectiveness of a programme and take appropriate decisions about the learner, the process of learning and the learning environment
- To make the process of teaching and learning a learner-centered activity.

What should be assessed?

Since education is concerned with the total all-round development of the child, *(physical, socio-emotional, intellectual etc)* all aspects of the child's development need to be assessed. At the moment we do not assess the whole child, but only his or her academic achievement in specific areas. We assess learner's basically on examination results, we do not assess effort, performance, attitudes to learning, ability to practically apply what is learned in every day situations, nor do we assess them on how creatively they use techniques or critically evaluate different theories.

To make the process more comprehensive in nature, it is important that assessment of the child's learning be done in a whole range of situations and environments both in and out of the classroom. The assessment process also needs to be part of the way of providing information and feedback on the extent to which the school and teachers have been successful in realizing the expected outcomes of education.

In view of getting a complete picture of the child's learning, assessment should focus on the learner's ability to –

- learn and acquire desired skills related to different subject areas.
- acquire a level of achievement in different subject areas in the requisite measure
- develop child's individual skills, interests, attitudes and motivation
- understand and lead a healthy and a productive life.
- monitor the changes taking place in child's learning, behaviour and progress over time.
- respond to different situations and opportunities both in and out of school.

- apply what is learned in a variety of environments, circumstances and situations
- work independently, collaboratively and harmoniously.
- analyze and evaluate.
- be aware of social and environmental issues
- participate in social and environmental projects and causes.
- retain what is learned over a period of time.

Schools of the future will need to develop in their learners the ability to take risks, to be adaptable, to be flexible, to cope with constant change and become lifelong learners. In this context, learners become dynamic leaders with teachers as enablers.

Before looking at how assessment is to be undertaken teachers need to determine objectives for achievement at secondary level. They need to look at what Secondary Education should develop in children not only in cognitive domain but also psychomotor and affective domains. Along with those attributes mentioned above they need to incorporate different age related indices and behaviours into the assessment criteria and practices. They also need to determine what their expectations are from the learner at the end of the secondary stage, and what kind of profile report is required in relation to different aspects and learning areas, that reflect the child's rapidly changing, personal development.

Thus assessment is a useful, desirable and an enabling process. To realize this one needs to keep the following parameters in mind -

The need to:

- assess the learner.
- use a variety of ways to collect information about the learner's learning and progress in subjects and cross curricular boundaries.
- collect information continuously and record the same.
- give importance to each learner's way of responding and learning and time it takes to do so.
- report on an ongoing continuous basis and be sensitive to every learner's responses.
- provide feedback that will lead to positive action and help the learner to do better

In the assessment process, one should be careful NOT to:

- label learners as slow, poor, intelligent etc.
- make comparisons between them.
- make negative statements.

UNIT 9 DIAGNOSTIC TESTING AND REMEDIAL TEACHING IN MATHEMATICS

Structure

9.1 Introduction

9.2 Objectives

9.3 Diagnostic Testing : Its Meaning and Importance

9.4 Nature and Purpose of Diagnostic Testing

9.5 Steps and Stages in Diagnostic Testing

9.6 Remedial Teaching

9.7 Let Us Sum Up

9.8 Unit-end Exercises

9.9 Answers to Check Your Progress

9.1 INTRODUCTION

Your main role as a teacher is to promote quality learning among the students. This is possible only when you act as a guide and the students actively participate in the process of learning. During the teaching-learning process, you have to locate and identify the areas where the learner commits mistakes. It is the crucial stage of the teaching-learning process where you have to DIAGNOSE and prepare instructional material for REMEDIAL TEACHING to ensure the desired quality of learning.

At this stage the role of a teacher is just like a doctor's. The doctor takes all the steps necessary to diagnose the disease by performing different tests and then prescribes medicines for the particular disease.

In the case of education the process of Diagnostic Testing is the STEP and REMEDIAL TEACHING is the PRESCRIPTION. Hence diagnostic testing and remedial teaching are very essential for ensuring effective learning and in improving the quality of education.

In this unit an attempt is being made to discuss the orgnization of Diagnosic Tests in Mathematics and undertaking appropriate remedial measures.

9.2 OBJECTIVES

After going through this unit, you should be able to:

- understand the meaning and importance of Diagnostic Testing;
- understand the nature and purpose of Diagnostic Testing;
- follow the steps and stages of Diagnostic Testing in the classroom teaching-learning process; and
- conduct remedial teaching in mathematics in classroom situations.

9.3 DIAGNOSTIC TESTING : ITS MEANING AND IMPORTANCE

In general, after completing a particular unit/topic you conduct a test to assess the achievements of learners. After evaluation you draw some conclusions and you find that some of the students have fared very well and a particular group of students have achieved below your expectations. Now you will have to find out the causes for this low achievement or slow learning. There would be certain reasons for this low achievement. Now it is very essential to find out the particular area where the difficulty lies or the particular concept where the learner commits errors. To *locate* and *identify* the areas of learning difficulties leads to Diagnostic Testing.

After identifying the areas where the error lies, you have to find out the reasons due to which the particular child/group of students have not responded well. At this stage you have to play the role of a doctor. If a patient visits the doctor's clinic he suggests different tests relevant to the symptoms observed by him. After getting reports he is in a position to identify and diagnose the disease and then prescribe the medicine for it.

Likewise, as a teacher, you have to first identify and locate the area where the error lies. The process adopted for this purpose in educational situations is known as Diagnostic Testing. We may say that Diagnostic Testing implies a detailed study of learning difficulties.

In diagnostic testing the following points must be kept in mind:

i) Who are the pupils who need help?

ii) Where are the errors located ?

iii) Why did the error occur ?

Let us take the following examples to make this point more clear.

Example 1

Suppose you have taught the simple method of subtraction of two-digit numbers without borrowing and then conducted a test which indicates the solutions as follows :

Student's name — Mr. 'X'

98	77	85	81	97
– 62	– 52	– 35	– 40	– 67
36	25	5(5)	41	3(7)
38	68	96	54	75
– 26	– 61	– 26	– 24	– 25
12	(6)7	7(6)	3(4)	5(5)

After conducting test you are in a position to assess the whole group. This assessment is followed by an analysis i.e., you have to find out about each individual the area of difficulty or the concept where the learner commits errors. For example, Student 'X' has solved all the questions of subtraction of two-digit numbers without borrowing correctly except for the subtraction of one digit from another one-digit number. You find that his answers are 5 – 5 = 5, 7 – 7 = 7, 6 – 6 = 6, 4 – 4 = 4 etc. You are in a position to diagnose the particular concept which Mr. 'X' could not understand. This is known as Diagnostic Testing.

While performing a Diagnostic Test you have the specific aim to analyze the exact nature of the progress made by the learner in a particular topic/unit and to know the particular area of weakness/error which requires a series of carefully graded tests. The main aim of Diagnostic Testing is to analyze not to assess. It will be more clear in the following example.

Example 2

Student's name – Mr. John

370	590	860	870	
– 210	– 230	– 330	– 353	
160	360	530	520	
67	39	28	75	88
– 43	– 20	– 15	– 40	– 45
24	10	13	30	43
347	182	883	578	
– 101	– 90	– 570	– 200	
206	90	310	370	
513	654	845		
– 206	– 352	– 203		
307	202	602		

Careless slip

260	280	370
– 109	– 140	– 143
100	240	230

Skill analysis of subtraction performance

You have conducted a test in the classroom to assess subraction skill. After this assessment you have to find out how many students have not acquired this skill and who they are. For that particular group you will have to prepare a list to find the concept which is not clear to the learner or the particular step where the learner makes mistakes. For instance, in John's case you have found that he makes a mistake when the question involves subtraction of zero from a number or of a number from zero through borrowing from the next digit. John knows how to subtract zero from zero. You can conclude from this analysis that John makes a mistake only when the concepts of zero and a number come together in subtraction. This is identification of the area of learning difficulties, and the process involved in identifying and testing the problem is called Diagnostic Testing.

Check Your Progress

Notes: a) Write your answers in the space given below.

b) Compare your answers with the one given at the end of this unit.

1. Fill in the blanks using the words: 1) detailed, 2) errors, 3) assess, 4) located, 5) identify, 6) analysis.

   i) The aim of class test is to .....the performance of pupils.

   ii) Diagnostic Test implies .....study of learning difficulties.

iii) In the Diagnostic Testing process the problem is.....through due .....

iv) Diagnostic Testing means to .....the problem areas.

v) In Diagnostic Testing we try to find the area where ..... occur.

9.4 NATURE AND PURPOSE OF DIAGNOSTIC TESTING

If we consider arithmetical attainments from both a qualitative and quantitative standpoints, we can distinguish four main points (i) accuracy (ii) speed of writing (iii) methods of work and (iv) extent of the arithmetic process mastered.

It is obvious that you will try to find the feedback through the medium of class work or through weekly or monthly tests which indicate pupils' ability in each of the four aforesaid directions. But it is not enough for teaching purposes particularly with those pupils/learners who are slow learners. With this group of learners you are required to have a more analytical estimate of their achievements. Let us take the following example :

Example 3

After teaching basic operations (addition, subtraction, multiplication and division) to a group of students, you conduct a test of say 10 items and the results are summarized as below :

Items	Errors
1	2
2	1
3	3
4	2
5	3
6	10
7	8
8	9
9	32
10	32

From the above data it is possible to analyze the test items. It is clear that items 9 and 10 have been missed by most of the students. At this stage you have to rethink to make some modifications in items 9 and 10. This is the stage where you have identified and located the problem and hence diagnosed the area of error committed by the learners. Similarly, for items 6, 7 and 8, you will rethink and evolve instructional material to improve the quality of learning.

The above example suggests that Diagnostic Testing is analytical in nature where the teacher has to look at the performance of pupils in order to examine why they have not learned or mastered the particular concept or competency. For each pupil individually one has to pinpoint the specific kind of mistake he makes. This analysis is based on the date of performacne rather than the general opinion of the teacher. It may be interpreted in terms of each students, a group of students, each concept/competency and for each of the questions.

Why should the teacher undertake this kind of probe into the performance of pupils? The obvious response is that he/she wants to ensure the quality of learning (at the level of mastery) and is curious to know what specific action should be taken to obtain the desired results. Thus the main purpose of Diagnostic Testing is to spot the learning difficulties of pupils with a view to developing corrective measures, termed as remedial teaching.

9.5 STEPS AND STAGES IN DIAGNOSTIC TESTING

The essential steps in educational diagnosis are:

i) Identifying the students who are having trouble or need help.

ii) Locating the errors or learning difficulties.

iii) Discovering the causal factors of slow learning.

i) Identifying the students who are having trouble or need help

First, one must know the learners who require help. For this you can administer a general achievement test based on the topics already taught. After evaluation you will be in a position to make lists of students who are below average, average or above average. Next, one has to locate the area where the error occurs in order to have a deeper insight into the pupils' difficulties.

ii) Locating the errors or learning difficulties

After identifying the students who need help and visualising the necessity of additional instructional material to improve the quality of learning, your main role is to find out the area where the learner commits mistakes or which is the area where learning difficulties lie. For example we examine the pupils' responses as follows:

i) $\frac{3}{4}+\frac{5}{4}=\frac{8}{4}$

ii) $\frac{2}{3}+\frac{5}{3}=\frac{7}{3}$

iii) $\frac{7}{12}+\frac{4}{12}=\frac{11}{12}$

iv) $\frac{4}{13}+\frac{5}{13}=\frac{9}{13}$

v) $\frac{3}{4}+\frac{5}{4}=\frac{⑧}{4}$

vi) $1+\frac{3}{4}=\frac{④}{4}$

vii) $3+\frac{5}{7}=\frac{8}{7}$

viii) $5+\frac{1}{7}=\frac{⑥}{7}$

ix) $\frac{1}{2}+\frac{1}{3}=\frac{②}{⑤}$

x) $\frac{3}{7}+\frac{4}{5}=\frac{⑦}{⑫}$

From the above example you would realize that the learner has the knowledge of adding fractions having the same denominator but the concept of addition of fractions having different demoninators is not clear to him even through it was taught in the classroom. Thus you have located the area where the learning difficulty lies.

iii) Discovering the causal factors of slow learning

In some cases of learning difficulties, the causal factors are relatively simple. A student may be inattentive during teaching-learning or may be committing errors due to insufficient practice or irregular attendance.

Sometimes the cause is ill-health or faulty work habits etc. It has also been observed sometimes that the basic cause of low achievement is a feeling of helplessness or the complexity of the subject-matter which perhaps is much above the level of their comprehension.

Sequential presentation in Fig. 9.1 shows how diagnosis leads to improved quality of learning.

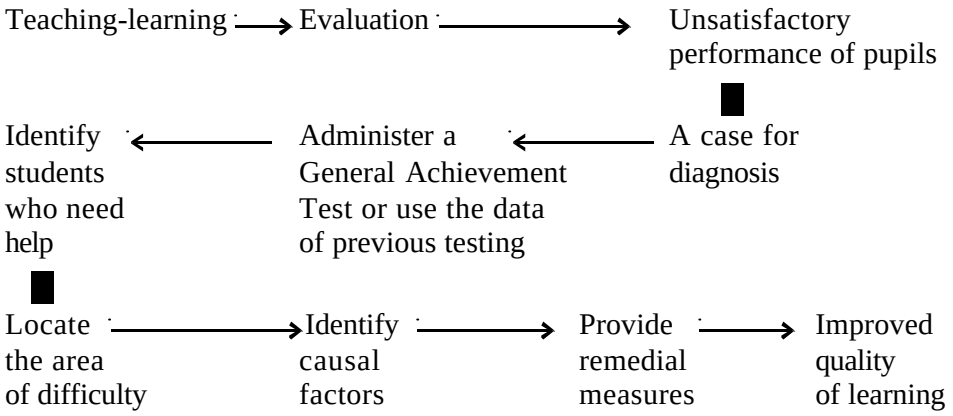


Fig. 9.1

This is how quality can be improved through diagnosis.

9.6 REMEDIAL TEACHING

While diagnosis is the process of investigating the learners' difficulties and the reasons for this, its follow up leads to actions that may help children make up their deficiencies. This step is generally termed Remedial Teaching. So you have to be skilled in preparing or arranging for such materials which may be used to undertake corrective instruction and thus enhancing the quality of learning.

Selection of Materials

The following points should be kept in mind while selecting appropriate instructional material:

i) The corrective material should be designed to correct the students' individual difficulties.

ii) You have to analyze the work of slow learners by means of observation, interview and Diagnostic Testing. A careful consideration of the three may help decide what kind of corrective material is to be designed and whether material will be adequate to correct the specific difficulties of learners.

iii) The corrective material should be graded, self-directive and should permit students to work independently. Written directions, which accompany the material, should be easily readable and comprehensible by the students.

iv) The corrective material must permit individuals to progress according to their pace.

v) The material should encourage systematic recording of evidence of pupils' progress.

Some examples

The following examples will illustrate the points discussed above.

Example 1

For preparing the material for remedial teaching, let us explain the example discussed in 9.5 above. In this you had diagnosed that the learners had not understood the concept of adding fractions of the following type:

$$1+\frac{3}{4},\ 2+\frac{5}{7},\ 3+\frac{6}{7},\ \text{etc.}$$

On the other hand, they had attained mastery over adding fractions of the type

$$\frac{1}{2}+\frac{3}{2};\ \frac{3}{2}+\frac{5}{2};\ \frac{3}{4}+\frac{5}{4};\ \frac{4}{5}+\frac{7}{5};\ \text{etc.}$$

Accordingly now you will have to prepare material where the learner should have plenty of opportunity to exercise on equalization of denominators in the given fractions.

i) $1+\frac{3}{4}=\frac{1}{1}+\frac{3}{4}=\frac{1\times 4}{1\times 4}+\frac{3}{4}=\frac{4}{4}+\frac{3}{4}=\frac{4+3}{4}=\frac{7}{4}$

ii) $2+\frac{5}{7}=\frac{2}{1}+\frac{5}{7}=\frac{2\times 7}{1\times 7}+\frac{5}{7}=\frac{14}{7}+\frac{5}{7}=\frac{14+5}{7}=\frac{19}{7}$

iii) $3+\frac{6}{7}=\frac{3}{1}+\frac{6}{7}=\frac{3\times 7}{1\times 7}+\frac{6}{7}=\frac{21}{7}+\frac{6}{7}=\frac{21+6}{7}=\frac{27}{7}$

iv) $\frac{1}{2}+\frac{1}{3}=\frac{1\times 3}{2\times 3}+\frac{1\times 2}{3\times 2}=\frac{3}{6}+\frac{2}{6}=\frac{3+2}{6}=\frac{5}{6}$

v) $\frac{3}{7}+\frac{4}{5}=\frac{3\times 5}{7\times 5}+\frac{4\times 7}{5\times 7}=\frac{15}{35}+\frac{28}{35}=\frac{15+28}{35}=\frac{43}{35}$

Enough practice should be provided to pupils on similar questions until they attain mastery. While selecting and implementing the instructional material the most important thing is the individual need of the student in a particular area. You have to give differential treatment. Different methodologies have to be adopted for different kinds of students. Other modes of interaction such as learner-learner interaction and learner-material interaction may also be utilized, besides the traditional teacher-learner interaction, using appropriate instructional material.

Example 2

The following are graded exercises to diagnose the difficulty in addition.

1st step

1 4	1 5	1 2	2	(10 to 18 in one line, 1 to 9
+ 3	+ 4	+ 6	+ 1 7	in the other; no carrying)
———	———	———	———	
———	———	———	———	

2nd Step

1 0	1 3	1 2	1 1	(10 to 19 in both lines,
+ 1 5	+ 1 6	+ 1 4	+ 1 0	zero introduced; no carrying)
———	———	———	———	
———	———	———	———	

3rd Step

3 1	6 5	2 3	2 8	(10 to 89 in both lines;
+ 6 6	+ 2 2	+ 7 3	+ 3 0	no carrying)
———	———	———	———	
———	———	———	———	

4th Step

123	346	482	543	(Hundreds and tens in both
+ 145	+ 212	+ 305	+ 126	lines; no carrying)

5th Step

9	15	6	9	(1 to 9 in one line, 10 to 19 in the other;
+ 19	+ 6	+ 17	+ 17	with carrying)

6th Step

57	58	6	8	(1 to 9 in one line, 10 to 89 in the other;
+ 7	+ 6	+ 89	+ 68	with carrying)

7th Step

87	96	84	50	(Tens in both the lines; carrying in
+ 31	+ 63	+ 94	+ 81	tens place)

8th Step

23	39	14	37	(Tens in both the lines; carrying in
+ 17	+ 48	+ 79	+ 59	units place)

9th Step

401	209	874	635	(Numbers over 100 in one or both lines.
+ 607	+ 39	+ 83	+ 944	carrying in units or tens or hundreds
				place)

10th Step

56	38	57	54	(Tens in both the lines; carrying in both
+ 69	+ 86	+ 59	+ 97	units and tens place)

11th Step

74	38	46	86	(Column addition 3 lines
+ 56	+ 78	+ 37	+ 48	number under 100; with carrying)
43	94	96	39	

12th Step

897	953	765	925	(Hundreds, tens and units in both lines;
+ 497	+ 818	+ 488	+ 469	carrying in 2 or 3 places)

13th Step

77	94	277	126	(Column addition 4 lines of 2-digit
+ 48	+ 83	+ 183	+ 848	numbers and 3 lines of 3-digit
32	76	149	976	numbers; with carrying)
65	59			

14th Step

28	608	3	951	(Variation in column addition; introducing
+ 103	+ 705	+ 81	+ 382	difficult number combinations)
784	33	19	467	
9	219	827	539	
		94	196	

After conducting the above test you will be able to locate all the possible errors which students could commit while performing the addition. For example one child, say Neeta, has not learnt to carry. She worked the first sixteen sums correctly but after that all her efforts were like this:

9	15	6	9
+ 19	+ 6	+ 17	+ 17
1 18	1 11	1 13	1 16

57	58	6	7
+ 7	+ 6	+ 89	+ 68
5 14	5 14	8 15	6 15

In the case of a second student, Lata, you find evidence of a persistent error in a certain combination, e.g.,

96	635	56
+ 63	+ 944	+ 69
129	1279	122

You may notice that this child finds it difficult to add 9 with 6 or *vice-versa*. You have to prepare different remedial teaching material for these two students, namely Neeta and Lata. In the case of Neeta questions based on carrying will be set in exercises. In Lata's case questions based on adding the two numerals 6 and 9 will be set to remove the errors.

The following example takes into account graded subtraction with a view to diagnosing pupils' difficulties in subtraction.

Example 3

1st Step

98	57	84	38	(Tens and units in minuend:
– 3	– 4	– 1	– 8	units in subtrahend; no borrowing)

2nd Step

55	99	78	97	(Tens and units in minuend and
– 23	– 54	– 21	– 81	subtrahend; no borrowing)

3rd Step

346	987	378	496	(Hundreds, tens and units in minuend and
– 215	– 832	– 122	– 261	subtrahend; no borrowing)

4th Step

18	19	16	17	(Numbers less than 20. Unit digit in
– 14	– 18	– 10	– 15	subtrahend less than the unit digit in
____	____	____	____	minuend; tens digit unity in both)
____	____	____	____	

5th Step

71	62	46	84	(Tens in minuend; unity in subtrahend;
– 2	– 4	– 7	– 6	borrowing in units)
____	____	____	____	
____	____	____	____	

6th Step

54	22	58	46	(Tens and units in minuend and
– 39	– 17	– 19	– 27	subtrahend; borrowing in units)
____	____	____	____	
____	____	____	____	

7th Step

331	543	283	786	(Hundreds, tens and units in minuend,
– 18	– 25	– 29	– 58	tens and units in subtrahend;
____	____	____	____	borrowing in units)
____	____	____	____	

8th Step

316	564	68	387	(Borrowing in units and tens or borrowing
– 27	– 59	– 59	– 279	in units, and '0' result in tens)
____	____	____	____	
____	____	____	____	

9th Step

980	160	80	430	(Introduction of '0' difficulty in units or
– 930	– 68	– 57	– 416	tens)
____	____	____	____	
____	____	____	____	

10th Step

180	250	160	890	(Introduction of examples having zero as
– 71	– 49	– 31	– 889	units in minuend and 1 to 9 as units in subtrahend)
____	____	____	____	
____	____	____	____	

11th Step

346	629	756	387	(Borrowing in tens place;
– 284	– 473	– 382	– 196	numbers over 100)
____	____	____	____	
____	____	____	____	

12th Step

364	831	8354	8112	(Borrowing in hundreds, tens and
– 295	– 276	– 5676	– 6798	units places)
____	____	____	____	
____	____	____	____	

13th Step

800	607	700	906	(Advanced '0' difficulty and borrowing)
– 695	– 298	– 192	– 109	
———	———	———	———	
———	———	———	———	

14th Step

891	904	705	60 67	(Advanced '0' difficulty and borrowing)
– 207	– 206	– 109	– 59 70	
———	———	———	———	
———	———	———	———	

After conducting this test you would be able to know the nature of errors committed by individual students in subtraction. For example: In the case of Student 'X', the following pattern of errors and learning difficulties were observed:

In 1st Step; One error

38
– 8
———
3⑧

2nd and 3rd Steps, No errors.

4th Step : Four errors

18	19	16	17
– 14	– 18	– 10	– 15
———	———	———	———
①4	①1	①6	①2

5th, 6th, 7th & 8th Steps; No errors

9th Step; Two errors

80	430
– 57	– 416
———	———
3⑦	④2⑥

10th Step; Four errors

180	250	160	890
– 71	– 49	– 31	– 889
———	———	———	———
11①	21⑨	13①	⑧1⑨

11th & 12th Steps; No errors

13th Step; Four errors

800	607	700	906
–695	– 298	– 192	– 199
———	———	———	———
2⑨⑤	4⑨9	6⑨②	8⑨7

14th Step; Three errors

904	705	69 67
– 206	– 109	– 59 70
———	———	———
7⓪8	6⓪6	1⑨①⑦

You have come to know the types of errors committed by 'X' in different steps. Now you will think to prepare material for remedial teaching for different learning difficulties faced by 'X'. The diagnosis made on the basis of a graded test provides a definite direction to remedial teaching. The teaching-learning strategy should of course, put emphasis on exercises in the relevant area of difficulty until mastery is achieved. Further testing would be desirable to examine the impact of remedial teaching.

9.7 LET US SUM UP

In this unit you have learnt about Diagnostic Testing which is the most important part of the teaching-learning process. It implies a detailed study of learning difficulties. Its aim is to analyze, not to assess. The nature and purpose of Diagnostic Testing is to identify the areas of difficulties where the learner commits errors. The stages of diagnostic testing are:

i) Identifying the students who need help.

ii) Locating the error/learning difficulties.

iii) Discovering the causal factors.

After locating the area where the difficulty lies, as a teacher you will devise some strategy to remove problems in learning and the causes due to which the learner has faced the difficulties. The strategy used by you to remove the weakness of the learner is known as remedial teaching. Diagnostic Testing leads to remedial teaching in which you have to prepare instructional material for quality learning, adopting different methodologies as per needs of the individual or a particular group.

9.8 UNIT-END EXERCISES

1. Define Diagnostic Testing.
2. Distinguish between Test and Diagnostic Testing.
3. Explain the nature and purpose of Diagnostic Testing.
4. Prepare a graded test for diagnosing problems in multiplication.
5. What is remedial teaching?
6. Prepare remedial teaching material for enhancing the learning of multiplication technique.

9.9 ANSWERS TO CHECK YOUR PROGRESS

1. i) assess
   ii) detailed
   iii) located, analysis
   iv) identify
   v) errors

Diagnostic Test: Concept, Construction and Barriers

After reading this, you will learn about:- 1. Concept of Diagnostic Test 2. Dimensions of Diagnostic Test 3. Steps 4. Construction 5. Materials Used 6. Elements 7. Barriers.

Concept of Diagnostic Testing:

The term diagnosis has been borrowed from the medical profession. It means identification of disease by means of patient's symptoms. For example, when a patient comes to a doctor, the doctor initially puts some questions to the patient to gather some basic information's about the disease and then uses other techniques to get more related information to identify the disease and its probable cause(s).

After careful analysis of these data, he prescribes the medicines as remedial treatment. Similarly, in the field of education, diagnosis has many such implications. Difficulties in learning occur frequently at all levels and among pupils of both high and low mental ability.

In order to handle such cases, the teacher also uses similar techniques like a doctor to diagnose the relative strengths and weaknesses of pupil in the specific area of study, analyse the causes for the same and then provides remedial measures as per necessity.

Since tools and techniques used in mental measurements are not that exact, objective and precise like the tools and techniques used in sciences, the teachers are cautioned to use the diagnostic data with great care for designing remedial programmes.

But it is used in education to determine the learning difficulties or deficiencies of the learner. Diagnostic test is a test used to diagnose strength and weakness of the learning in certain areas of study whereas diagnostic evaluation is centered on schooling process such as the curriculum programme, administration and so on.

When learning difficulties that are left unresolved by the standard corrective prescriptions of formative evaluation and a pupil continues to experience failure despite the use of prescribed alternative methods of instruction, then a more detailed diagnosis is indicated.

To use a medical analogy, formative testing provides first aid treatment for simple learning problems and diagnostic testing searches for the underlying causes of those problems that do not respond to first aid treatment.

Thus it is much more comprehensive and detailed and the difference lies in the types of question each of them is addressing.

The following are the salient features of Diagnostic Testing:

(i) The diagnostic test takes up where the formative test leaves off.

(ii) A diagnostic test is a means by which an individual profile is examined and compared against certain norms or criteria.

(iii) Diagnostic test focuses on individual's educational weakness or learning deficiency and identify the gaps in pupils.

(iv) Diagnostic test is more intensive and act as a tool for analysis of Learning Difficulties.

(v) Diagnostic test is more often limited to low ability students.

(vi) Diagnostic test is corrective in nature.

(vii) Diagnostic test pinpoint the specific types of error each pupil is making and searches for underlying causes of the problem.

(viii) Diagnostic test is much more comprehensive.

(ix) Diagnostic test helps us to identify the trouble spots and discovered those areas of students weakness that are unresolved by formative test.

Dimensions of Diagnostic Test:

(i) Who can conduct → Teacher/Researcher

(ii) Where → School/Home/Work places

(iii) On whom → Learners

(iv) Purpose → Specific strength and weakness of the learner in a particular area.

(v) Length of time → Flexible in nature

(vi) Techniques of → Test/observation/interview etc. Assessment

(vii) Sequence → Logical and step by step

(vii) Method of → Negotiable/Therapeutic Remediation

(ix) Support to → Learner/Parents/Teacher

Steps of Educational Diagnostic Test:

(i) Identification and classification of pupils having Learning Difficulties:

(a) Constant observation of the pupils.

(b) Analysis of performance: Avoiding assignments & copying from others.

(c) Informal classroom Unit/Achievement test.

(d) Tendency of with-drawl and gap in expected and actual achievement.

(ii) Determining the specific nature of the Learning Difficulty or errors:

(a) Observation.

(b) Analysis of oral responses.

(c) Written class work.

(d) Analysis of student's assignments and test performance.

(e) Analysis of cumulative and anecdotal records.

(iii) Determining the Factors/Reasons or Causes Causing the learning Difficulty (Data Collection):

(a) Retardation in basic skills.

(b) Inadequate work study skills.

(c) Scholastic aptitude factors.

(d) Physical Mental and Emotional (Personal) Factors).

(e) Indifferent attitude and environment.

(f) Improper teaching methods, unsuitable curriculum, complex course materials.

(iv) Remedial measures/treatment to rectify the difficulties:

(a) Providing face to face interaction.

(b) Providing as may simple examples.

(c) Giving concrete experiences, use of teaching aids.

(d) Promoting active involvement of the students.

(e) Consultation of Doctors/Psychologists/Counselors.

(f) Developing strong motivation.

(v) Prevention of Recurrence of the Difficulties:

(a) Planning for non-recurrence of the errors in the process of learning.

Construction of Diagnostic Test:

The following are the broad steps involved in the construction of a diagnostic test. Diagnostic Test may be Standardized or Teacher made and more or less followed the principles of test construction i.e., preparation, planning, writing items, assembling the test, preparing the scoring key and marking scheme and reviewing the test.

The Unit on which a Diagnostic Test is based should be broken into learning points without omitting any of the item and various types of items of test is to be prepared in a proper sequence:

1. Analysis of the context minutely i.e., major and minor one.

2. Forming questions on each minor concept (recall and recognition type) in order of difficulty.

3. Review the test items by the experts/experienced teacher to modify or delete test items if necessary.

4. Administering the test.

5. Scoring the test and analysis of the results.

6. Identification of weakness

7. Identify the causes of weakness (such as defective hearing or vision, poor home conditions, unsatisfactory relations with classmates or teacher, lack of ability) by the help of interview, questionnaires, peer information, family, class teacher, doctor or past records.

8. Suggest remedial programme (No set pattern).

Motivation, re-teaching, token economy, giving reinforcement, correct emotion, changing section, giving living examples, moral preaching's.

Materials Used in Diagnostic Test:

Classroom teachers, principals, supervisors and qualified diagnosticians use the following resources and materials in making educational diagnoses more vibrant:

1. Test records (Standardized and Teacher made).

2. Pupils' written work (themes, compositions, home assignments and test papers).

3. Pupils' oral work (discussion, speeches and oral reading).

4. Pupils' work habits (in class activities, participation, peer relationship, independent work, interest, effort etc.).

5. Physical and health records (school and family records about vision, hearing, dental, general).

6. Guidance and cumulative record data (family) background, anecdotal references, school activities).

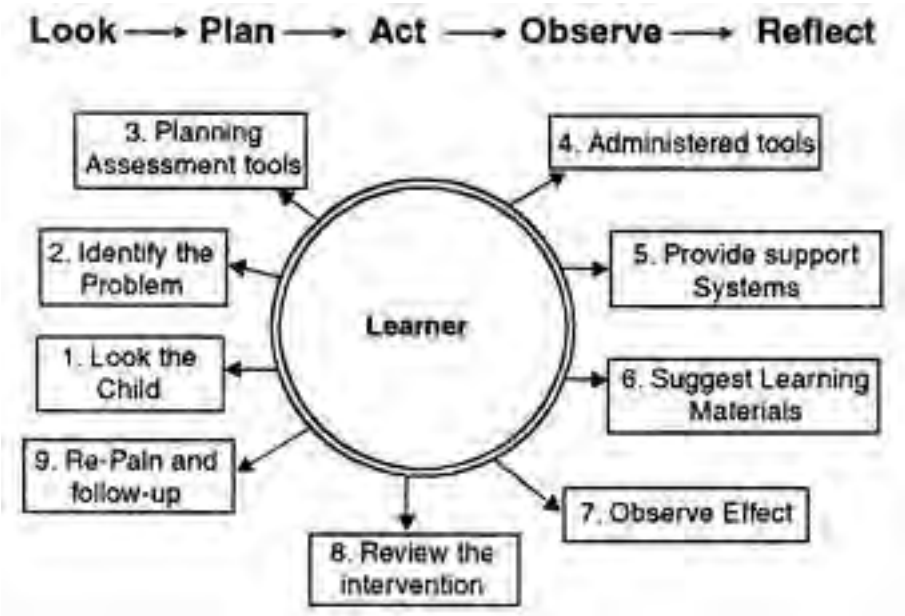
7. Interview with pupil (problem or trouble and elimination of misconceptions).

8. Parent conference (pupil problems at home, parent interpretation).

9. Self-guidance (completing assignments, independent work and seeking teacher help).

10. Clinic or laboratory aids (vision tester, audio-meter eye photographs, tape recorder etc.).

Elements of Diagnostic Tests:



Barriers in Diagnostic Tests:

(i) Attitudinal change.

(ii) Will Power and patience of the teacher.

(iii) Time Scheduling .

(iv) Sequencing of Study.

(v) Faulty method of data collection and test.

(vi) Maintaining records impartially.

(vii) Costs.

C H A P T E R V

ENRICHMENT PROGRAMME FOR THE GIFTED

CHAPTER V

ENRICHMENT PROGRAMME FOR THE GIFTED

5:01 INTRODUCTION

Gifted students typically find their regular classroom experiences dull and less than challenging. Although some rare teachers detect the gifted child's spark and do everything they can to fan it to flame, the majority of gifted students sit in schools for twelve years experiencing precious little challenge and motivation. This therefore, implies that the typical classroom diet is inadequate for the academically talented child. Gifted children should, therefore, be provided with learning activities that challenge them and expand and deepen their understanding (Greenlaw and McIntosh, 1988).

5:02 MEANING

The specific defining attributes of the concept of enrichment in planning educational programmes have varied across the years and across the programmes which have been labelled 'enrichment'. Generally, however, the term has been used to designate the process of providing activities and/or content areas which are outside the range of the regular curriculum offered in the school. Enrichment denotes those programmes in which the student remains at grade level but spends part of the day or week engaged in activities which are supplemental to those offered in his or her classroom. The assumption is made that these activities have been especially structured to meet the particular needs of gifted children(Kauffman and Hallahan, 1981).

5:03 HORIZONTAL AND VERTICAL ENRICHMENT

Newland (1976) further divided the concept of enrichment into the categories of horizontal and vertical enrichment.Horizontal enrichment is used to designate those activities which involve content areas

which may not be part of the regular curriculum (or exploration of those areas in more depth) but in which the level of sophistication used in the study and discussion of those topics remains at about the same grade level. The assumption underlying horizontal enrichment is the need for gifted children to become acquainted with a broad spectrum of content areas.

If however, the level of thinking skills required in carrying out the enrichment activities is more sophisticated, then the enrichment activity is considered vertical enrichment. It is based on the need for gifted children to develop more complex cognitive processing skills such as analysis, evaluation, discrimination and creativity.

Although the horizontal - vertical distinction is theoretically possible and is sometimes incorporated into models for enrichment, it has not served a useful purpose in the study of enrichment programmes. Programmes and models which have been labelled enrichment have generally been based on a combination of both vertical and horizontal enrichment with their components and their effects being indistinguishable. Even a programme which has stated explicitly that its objective is to develop higher level thinking skills will usually rely on content materials outside the regular curriculum in order to achieve these goals.

5:04 ACADEMIC CURRICULUM FOR THE GIFTED

While it is true that gifted students do need to know the same content as other children and youth and that most will be able to

master the skills and content easily and well, it is not true that these skills and this content should be covered in the same way for the gifted as for other learners. By definition gifted youths require a differentiated curriculum to adequately meet their learning needs. According to Greenlaw and McIntosh(1988) curriculum differentiated for the gifted is purposely made, unlike or different from the regular curriculum, observers can perceive and implementers can express differences between it and the regular curriculum. In other words differentiated curriculum for the gifted has characteristics that distinguish it from regular curriculum for non-gifted students.

Curriculum for the gifted cannot just be differentiated, it must be qualitatively differentiated(Maker,1982). Based on her own work and that of other experts in the field of gifted education, Maker(1982) makes several recommendations concerning how basic curriculum can be made more appropriate for gifted children and youth. She says modifications should be made in the areas of content, process, product and learning environment.

At least sixty curriculum models exist for the gifted. However, only three models will be mentioned for the purpose of this study. These models emphasize three components that are vital in planning and developing curriculum for gifted students.

These are:

1. Bloom's Cognitive Taxonomy, which emphasizes higher level thinking.
2. William's Teaching Strategies for Thinking and Feeling which emphasize creativity.

3. Renzulli's Enrichment Triad, which emphasizes product.(Greenlaw and McIntosh, 1988).

BLOOM'S COGNITIVE TAXONOMY

Bloom's Cognitive Taxonomy is one of the better known and more widely used models for creating curriculum for the gifted because of its emphasis on developing higher level thinking. It is also relatively simple in design and is easily applicable by teachers with a minimum of training in its use (Greenlaw and McIntosh, 1988).

As a taxonomy, Bloom's is hierarchical in nature, i.e achievement at higher levels in dependent on success at lower levels. The following six levels comprise Bloom's Cognitive Taxonomy.

1. Knowledge: which is the lowest level, consists of remembering what has been read, seen or heard, with no transformation of the information received.

2. Comprehension: involves the lowest level of understanding and requires that a student be able to restate what has been read, seen, or heard in his or her own words and make use of the information, although not relating the information to any other ideas already possessed or presented.

3. Application: involves putting the new information to use in a different situation, without being told how to do so.

4. Analysis: entails deconstructing the whole into its component parts so that the relationship between the parts can be seen.

5. Synthesis: entails constructing a whole from constituent parts - although the new whole or pattern or structure is not the one from which the parts were taken.

6. Evaluation: is the highest level in the taxonomy, and it involves making judgements about the value of something, for a particular purpose. Students must either develop their own criteria or be able to apply the criteria of others and use various types of evidence in order to make these critical, evaluative judgement.

WILLIAM'S TEACHING STRATEGIES FOR THINKING AND FEELING

William outlines eighteen teaching strategies that lead to creative thinking.

1. Paradox: A seemingly contradictory statement that may nonetheless be true.

2. Attribute: A quality or characteristic belonging to a person or thing, a distinctive feature.

3. Analogy: A form of logical inference, based on a correspondence in some respect between people or things otherwise dissimilar.

4. Discrepancy: A divergence or disagreement, as between facts or claims; in-consistency.

5. Provocative Question: Questions intended to excite and stimulate students' thinking and exploration of new ideas.

6. Example of change: A demonstration of how dynamic the world is or can be. Making provision for activities that employ modifications or substitutions.

7. Example of habit: Habits are a constant, often unconscious inclination to perform some act, acquired through frequent repetition, Activities for this strategy seek to provide examples that encourage students to avoid habit - bound thinking.

8. Organised Random Search: Developing a structure to lead randomly to another structure.

9. Skills of Search: The development of methods to search for information. This might include trial and error, historical skills or experimental skills.

10. Tolerance for ambiguity:

Ambiguous situations are open to multiple interpretation. Activities for this strategy seek to present open-ended situations for discussion.

11. Intuitive Expression: Intuition is the act of knowing without the use of rational process. Activities for this strategy seek to present open-ended situation for discussion.

12. Adjustment to development: This strategy seeks to enable students to develop or change rather than merely adjust to situations.

13. Study of Creative people and Processes: Activities for this strategy encourage students to look at people who are creative and explore the processes they utilise.

14. Evaluation of Situations: Activities for this strategy encourage students to engage in prediction from the delineation of actions and ideas and to form conclusions based on careful consideration of consequences and inferences.

15. Creative Reading Skill: Using text as a stimulus for the creation of an idea or a product.

16. Creative listening Skill: Encouraging students to respond to oral text in various ways that will allow them to develop ideas and respond to questions.

17. Creative Writing Skill: Encouraging students to express their feelings and emotions in clearly written passages.

18. Visualization Skill: Activities for this strategy encourage students to form a mental image that includes an unusual or unique prespective (Greenlaw and McIntosh, 1988).

RENZULLI'S ENRICHMENT TRIAD MODEL

The Enrichment Triad Model is one of the very few teaching learning models developed specifically for use with gifted children. He developed the model after extensive experience working with, and evaluating programmes for gifted children and youth. According to Greenlaw and McIntosh(1988, p. 227), Renzulli,"sought to design a model that could be used as a guide in developing defensible programmes for the gifted - programmes that are qualitatively different" . His model ties in closely with his conclusion about what constitutes giftedness. In his three ring conception, giftedness resides at the intersection of three clusters of traits (1) Above-Average General Ability, (2) Task Commitment, and (3) Creativity. Renzulli believes that the interaction of these three clusters is necessary for creative productive accomplishment.

Accordingly, Renzulli's triad model includes three types of enrichment:

1. Type 1 - General Exploratory Activities:

The three main purposes of Type I enrichment, general exploratory activities are (1) exposing students to topics that are not a normal part of the school's curriculum, (2) making general enrichment activities available to all interested students, and (3) inviting highly motivated students to find and pursue a later Type III. Independent

Project. Gifted students should understand that they are to explore these interest areas purposefully, with a view toward identifying ideas for further study. Some students already will have long standing interests or hobbies which are well suited for type III projects (photography, drama, calligraphy and so on). In these cases, Type I activities serve mainly to expose students to new topic areas.

Resource centres should be well stocked with books, magazines, and other media dealing with a large number of topics.

Another good exploratory activity is field experiences in which gifted and talented students meet dynamic people involved in creative and problem - solving endeavour - artists, actors, engineers, museum and art gallery curators, T.V show directors, business leaders and so on. This type of field trip goes beyond just visiting an art gallery or planetarium. The purpose is not to "look at" but to become involved with professionals and their activities.

The design of Type I exploratory activities will require effort and ingeniuty by participating teachers. (Davis and Rimm, 1989).

Type II Enrichment-Group Training Activities:

The purpose of Type II Enrichment-Group Training Activities is to promote the development of a broad range of thinking and feeling processes(Renzulli and Reis, 1985).

The following are the general and specific skills especially recommended by Renzulli and Reis.

1. Creative thinking, problem solving, critical thinking, decision making and affective processes such as appreciating and valuing.

2. Learning how - to - learn skills, such as listening, observing, perceiving, note taking, out lining, interviewing, surveying,analysing and organising data and other research skills.

3. Using advanced - level reference materials including a variety of print and non-print references, information retrieval systems and other procedures for gaining access to advanced resources.

4. Writing, oral and visual communication skills that will be directed toward maximising the impact of student products upon appropriate audiences. (Davis and Rimm, 1989).

The objective of type II Enrichment is "to develop in the learner the processes or operations (the powers of the mind) that enable him/her to deal more effectively with content". Renzulli(1977, pp.24-25).

TYPE III ENRICHMENT - INDIVIDUAL AND SMALL GROUP INVESTIGATION OF REAL PROBLEMS:

With Type III enrichment activities, the gifted young person becomes an actual researcher investigating a real problem. Renzulli emphasises that students should act as producers of knowledge, not merely consumers of information. They should not simply be asked to consult more encyclopeadias, text books or other already summarized sources and then

write a report. They should use raw data as their main information source, from which they draw their own conclusions.

The student should play an active role or part in formulating the problem, designing the research methods and planning the final product. The teacher, as the "guide on the side", helps with clarifying the problem, designing the research, and locating materials and equipment, and recommends information sources or community experts (Davis and Rimm, 1989).

It is important for students to have audiences for their Type III products. Grown-up artists, scientists, and other professionals do not keep their work to themselves. Indeed a good part of their motivation and satisfaction derives from at least a limited amount of publicity and public awareness of their accomplishments (Renzulli, Reis, and Smith, 1981).Gifted students also are product-oriented; they wish to hold up their accomplishments and to inform and perhaps influence a particular audience.

5:05 PERCEPTIONS OF THE GIFTED WITH REGARD TO EXISTING SCHOOL PROGRAMME

As mentioned in Chapter III, Section 3:04(vi) an Interview Schedule based on the school curriculum - subjects and activities offered in the school, areas of interest, kinds of activities which the gifted children would like to get involved with, methods of teaching etc. was conducted on the Very Superior and Superior children. Since the number of gifted children in the Very Superior group was small (9 in number), the Interview Schedule was conducted on all of them. In the case of the Superior group with a total of 84 students, the interview

was conducted only on 75 p.c of the total number.

The analysis of responses to some of the items in the Interview Schedule in percentage terms is shown in the following table.

TABLE 5:05

TABLE SHOWING PERCENTAGE OF RESPONSES OF THE GIFTED CHILDREN WITH REGARD TO EXISTING SCHOOL PROGRAMMES:

	Items	Very Superior N=9		Superior = 63	
1.	Attitude Towards School Curriculum	Highly Satisfied Moderately " Not Satisfied	= 11.11% = 11.11% = 77.78%	Highly Satisfied Moderately " Not Satisfied	= 22.22% = 14.29% = 63.49%
2.	Working on Groups and Projects	88.89%		87.30%	
3.	Interest in Academic Subjects	Arts - nil Commerce - Nil Maths. Science	 = 22.22% = 77.78%	Arts Commerce - Nil Maths. Science	= 7.94% = 30.16% = 61.90%
4.	Interest in Science Subjects	Biology Chemistry Maths. Physics	 = 11.11% = 22.22% = 66.67%	Biology Chemistry Maths. Physics	= 4.76% = 19.04% = 30.16% = 46.04%

The above table shows the following: Most of the interviewees (77% in the Very Superior Group and 63% in the Superior Group) are not satisfied with certain areas of the school curriculum. They would be happy if studies in certain subjects could be expounded, so as to create opportunities for them to express their understanding, thinking and reasoning etc.

When asked if they would be interested to work in groups on Projects, majority of them, i.e 88% in the Very Superior Group and 87% in the Superior Group showed their interest to do so if the school provided the necessary facilities.

Regarding their interest in academic subjects, a good majority of both groups, (77% and 61% respectively) expressed preference for science subjects. Within the Science Subjects as many as 66% of Very Superior Group children and 46% of Superior group children indicated preference for Physics.

The other questions covered in the Interview Schedule pertained to facilities available in their schools - libraries, laboratories etc. Most of them expressed that their schools were not adequately equipped.

It was also expressed that attending classes which are easily managed without the help of a teacher proves to be dull and monotonous and therefore, a waste of time. To them, this could be utilized in furthering extra programmes and projects.

When asked the essential need for the presence of the teacher, most of them expressed the need especially in guiding and assisting them, while they work on projects.

5:06 ENRICHMENT PROGRAMME

Basing on the findings of the Interview Schedule, the researcher has tried to develop Enrichment Programmes in Physics (depending on their choice of interest). The Enrichment Programmes have been

developed by drawing ideas contained in the three Models - Bloom's Cognitive Taxonomy, William's Teaching strategies for Thinking and Feeling and Renzulli's Enrichment Triad Model. The first Enrichment Programme relates with the topic "Heat", and the second one with "Renewable Sourcesof Energy"

5:06 A. ENRICHMENT PROGRAMME ON HEAT

Step I - Knowledge:

The first step in the Enrichment programme relates with knowledge. A good text book (such as Physics by E.White, Physics - George Gammow) is given to the students and they are asked to read on the chapter of "heat". The teacher than explains to the students certain terms like:

(i)_ Temperature (ii) Heat (iii) Differences between Heat and Temperature (iv) Units of Heat (v) Thermal capacity (vi) Water equivalent (vii) Specific Heat (viii) Thermal expansion (ix) Co-efficient of expansion.

Step II Comprehension:

This step deals with testing student's comprehension. It could be done in the following ways:-

(i) Giving them calculations using specific heat and co-efficient of linear expansion.

(ii) Asking the students to explain the terms in their own words.

Step III - General Exploratory Activities:

(1) Present to the students some aspects of Heat such as:

(i) Loss of heat of a substance under different situation.

(ii) Study on Evaporation

(iii) Study on heat as Electro-magnetic Wave

(iv) Heat and Light

(v) Heat as a form of energy

(vi) Expansion of substance under temperature

(2) Give them time and opportunity to explore a wide variety of content - with the one they are interested in, so as to find a topic for further indepth study.

(In between the teacher should ask provocative questions so as to excite and stimulate students' thinking and exploration of new ideas).

Step IV - Group Training Activities:

In this step the teacher should make use of instructional methods and techniques to help the learner to deal more effectively with content and which would also help to develop the higher levels of thinking, William's Teaching Strategies, such as Critical reading skill and Creative reading skill should be taught to the gifted children.

(Critical Reading Skill requires the reader to evaluate the material for truth, authority and value and also to be able to lead to conclusions upon which one can act. Creative Reading Skill on the other hand involves an even higher level of reading and thinking. It is a thinking process in which new ideas are originated, evaluated and applied. Creative Reading involves using the printed page as a spring board to thinking and action) (Greenlaw and McIntosh, 1988).

To be able to accomplish the above, the reading curriculum should have a wide variety of resources where the gifted learners will be exposed to different kinds of reference books -Encyclopeadias, Dictionaries, Periodicals, Popular Science Series, Supplementary Text Books, Journals like Science Reporter, Science Age (2000 AD) etc.

Step V - Individual/Small Group Investigations

In this step the student becomes an actual investigator of a real problem or topic by using appropriate methods of inquiry.

For example: If students take up "Loss of Heat of a Substance under different situation", the steps involved would be:

(i) Students should first of all study the history of development of thermometer and thermoflask.

(ii) They should then design an experiment to compare the conductivity of heat of locally available substance such as dry cloth,

dry cotton, dry paper, dry bamboo, dry wood, pine - leaves, betel nut, peel fibres etc.

(iii) Check the validity of the designed experiment - allow them to exercise their original model of experiment as far as possible even at the cost of some amount of anticipation of unreliable findings.

(iv) Ask them to collect the data very carefully and prepare a chart of conductivity of material locally available.

(v) The next step is to design an experiment to measure the heat loss of substances in containers of different materials such as copper, aluminium, glass - first without the outer layer to cover them - Secondly, by taking different materials for the outer layer to cover them (bamboo, cloth etc.)

(vi) Collect data of temperature versus time with different room temperature and graphically represent it.

(vii) Ask them to design a low cost thermometer. Set guess list of performance of the designed thermometer basing on the above finding. (For example, water of $60^{o}C$ will remain not less than $50^{o}C$ for a period of ten hours).

(viii) Perform the experiment with the designed thermoflask to see how far the guessed performance is true, (quality test).

Step VI - Outlets for Creation:

Present the findings in a newspaper or in a seminar or in children's magazines which routinely publish children's writings and research summaries. If possible Children's Art Shows and Science Fair could be arranged to be as outlets for the children's or adolescents's products.

5:06 B. ENRICHMENT PROGRAMME ON ENERGY

Sub-Topic : Renewable Sources of Energy

Step-I Knowledge:

In the first step knowledge or general awareness of energy should be given to the students. This should be based on the concept that, "Energy is the capacity of doing work". It could be done in the following manner:

(i) The teacher should inform students about energy with regard to:

(a) Common usage of the term, energy.

(b) Examples such as - we need energy for our daily life to carry out different types of works: to walk, to run, to lift an object etc. Further, an athelete needs more energy than a common man, a car needs less energy than a truck to cover same distance.

Conclude the information given to the students that MORE THE ENERGY, MORE THE CAPACITY TO WORK, LESS THE ENERGY LESS THE CAPACITY TO DO WORK.

(ii) Allow students to consult books to find out.

(a) The relation between energy, mass and velocity.

(b) The potential energy(mgh) and Kinetic energy ($\frac{1}{2}$ mv^2)

(c) The different types of energy, their transformation from one form to another.

(d) Unit of energy: Calorie, Watt, Joules,

(e) Different sources of energy: coal, petroleum, charcoal, electricity etc.

Step II - Comprehension

Before the pupils proceed further, comprehension is to be tested. The test will not be on how much they can memorize but it will be how far their general/qualitative understanding of energy as they learn in step I (i) agree with the qualitative mathematical formulae (in step i(ii).

Some sample/model questions to test pupil's comprehension should be as follows:

(a) Why do we say that K.E=$\frac{1}{2}$ mv^2 ? Why not mv^2 or mv^3 /

(b) Instead of mgh, if someone says that m^2gh = P.E., do you think that the definition of energy as capacity of doing work remains the same ?

(c) Do you think that there is a system in the world where once it starts functioning, it keeps on working forever?

(d) Can a machine be 100% efficient? If Yes/No. Why?

(e) What advantages are there to measure energy in terms of calorie?

If a pupil's answer is not in agreement with the existing formulae or definition, the word "wrong" is not to be used. For example, if a pupil says that K.E.= 1/3 mv^2 (which in the book is said to be 1/2 mv^2 , the pupil should not be discouraged, but should be allowed to carry on and find it for himself). (Of course, care is to be taken that the pupil does not draw conclusions from incomplete/discontinuous premises).

Step III - General Exploratory Activities

Present to the students some aspects on energy such as:

(a) Utilisation of energy or energy consumption

(b) Misutilisation of energy

(c) Variation of wind speed

(d) Radiant energy from the sun(solar heat)

(e) Method of waste disposal/toilet system and estimation of energy which is to be obtained from the biomass conversion of the human excreta .

Give them time and opportunity to explore a wide variety of content with the one they are interested in, so as to find a topic for further indepth study.

Step IV - Group Training Activities

In this step the teacher should make use of instructional methods and techniques to help the learner to deal more effectively with content and which would also help to develop the high levels of thinking. Some of the teaching strategies suggested by William should be made use. These are:

(a) Provocative questions

(b) Skills of search

(c) Tolerance for ambiguity

(d) Intuitive expression

(e) Adjustment to development

(f) Evaluation of situation

(g) Creative Reading Skill

(h) Creative Writing Skill

(i) Visualization Skill

Step V - Individual/Small Group Investigations

Characteristics:

(a) It must be voluntary

(b) Groups/individual must be coordinated

(c) Based on the particular activities, extra knowledge is to be provided by the teacher concerned (if necessary).

(d) In case of survey, necessary permission and legal formalities are to be completed prior to the commencement of the projects.

Some Suggested Activities

Utilisation of Energy:

1. Statistical data available easily like Petrol consumption in India from 1960 to 1980 per year (b) Daily energy consumption of a person.

2. Data should be analysed and represented graphically showing calender years versus energy consumption of the nation, persons versus energy consumption.

3. Make them aware of different levels of energy utilisation in different types of machine(degree of efficiency).

e.g Machine	Consumptions
(a) HERO HONDA 100 cc Bike	80 Km/1 litre
(b) Scooter Bajaj Super 150 cc	35 Km/1 litre

B. Survey on energy consumption

1. Select 3 houses of affluent class
   3 houses of upper middle class in urban set-up
   3 houses of lower middle class

2. Collect electricity bill, water bill, shopping bills for 3 months. Make a survey of types of fuels used.

3. Prepare a report on energy consumption level, types of fuel, population level - suggest some remedial measures.

4. Do the same activities in rural set up.

Prepare a comparative study report on it.

C. Survey of Electrical Energy Consumption in a Particular Locality

1. Select a particular area

2. Contact State Electricity Board Billing Section to collect data of billing for last 10 years.

3. Draw graph of Bill vs months of the years - Bill versus years.

4. Choose 3 establishments with very high, medium, low billing.

5. With due permission, make a survey on how they utilise the energy.

6. Suggest ways and means to minimise the consumption with alternative sources of energy such as solar water heater, wind mill water pump, fanless-well ventilated room, zero level dim light etc.

7. Prepare a report to be submitted.

D. Survey on Misutilisation of Energy:

1. List out all the misutilisation/inefficient way of utilising energy e.g. A lot of smoke/unburned carbon in exhaust pipes of vehicles, not using pressure cooker, tube light etc.

(b) Estimate the total loss of energy

(c) List out its harmful environmental effect.

(d) Suggest Remedies

(e) Prepare a report

E. Non-Conventional Sources of Energy:

(a) The teacher concerned or an official from Non-conventional Energy Department, or an expert from University could be invited for a lecture on "Present trend in Non-conventional Sources of Energy"

(b) Students are given access to the current research findings and latest development of design of non-conventional energy sources in their choosen area.

(c) In consultation with the students involved some projects are listed e.g. windmill, solar cooker, biomass etc.

(d) Any innovative idea towards the saving of energy by improving/renovating/reforming the already existed system or machines to be encouraged.

F. Modelling:

(If student/students choose a project e.g. Windmill).

Tools to be provided: wooden saw, file, blade, scissor,knife, hammer, cellotape, gum, card paper etc.

Teacher's Role: A teacher must act as an assistant, not as a supervisor, he must suggest and not overrule/dictate except when it is for safety.

Steps involved:

(a) The student should first make a static model of a windmill.

(b) Based on this static/semi-working/working (mini) model, provisions should be made for the student to interact with experts in the field to help the child sharpen his abilities.(Any kind of

disagreements should not end in arguments but the child should be helped to complete the model with design,calculation and verification).

(c) All necessary knowledge (higher level) to be involved in the process of making the pilot project is to be taught to the pupils.

(d) With necessary arrangement of financial assistance, the student should be instructed to make a working model.

Step VI - Outlets for creation:

(a) Present the findings in a seminar

(b) Present findings in Children's Magazines which routinely publish children's writings and research summaries. If possible, arrange for Children's Art Shows or Science Fair to be as outlet for the Children's or Adolescent's products.

(c) Based on the interest of the student, it is the duty of the teacher to decide whether a life-size pilot project of the same should be made.

LESSON PLAN STEPS (HERBARTIAN APPROACH)

LESSON PLAN

Introduction

A lesson plan is the systematic preparation done in a scientific manner. Effective and successful teaching mainly depends on perfect lesson planning. A lesson plan represents a single teaching unit meant for a class period. Generally a lesson plan is teacher's mental and emotional visualization of classroom activities.

Definition

"Lesson plan is the title given to a statement of the achievement to be realized and the specific means by which these are to be attained as a result of the activities engaged in during the period".

Bossing

"Daily lesson planning involves defining the objectives, selecting and arranging the subject matter and determining the method and procedure".

Binging and Binging

Stands – A lesson is "A plan of action"

Needs of Lesson Planning

The lesson plan does not allow the teacher to deviate and its keep him on the way. In the process of teaching, lesson plan is needed due to the following reasons.

i. Through lesson plan, the teacher regularly achieves the teaching objectives and process in the form of complex objectives and processes.

ii. A lesson plan develops the possibilities of adjustment in the classroom situation which makes the teaching effective.

iii. A lesson plan helps in calling every step of curriculum unit.

iv. A lesson plan helps in planning the process of teaching on the basis of class control, motivation and individual differences.

IMPORTANCE OF LESSON PLAN

Planning is essential for every aspect of human activities, but for a planned teaching more planning is required.

1. Suitable Environment

In a lesson plan objectives are fixed and the teaching strategies, techniques and material aid etc. are decided beforehand. When a proper teaching environment is created, the teaching task goes in a much planned way.

2. Based on previous knowledge

In preparing lesson plans, the teacher presents new knowledge as the basis of previous knowledge of the pupils. This enables the pupils to gain the knowledge very conveniently on one side, the teacher succeeds in acquiring his objective on the other side.

3. Psychological teaching

The teacher uses proper teaching strategies, techniques and instruments keeping in mind the interests, aptitudes, needs, capacities and abilities of the pupils for teaching them when the lesson plans are prepared. This makes the teaching more psychological.

4. Limitation of subject matter

In a lesson plan, the subject matter becomes limited. This enables the teacher to give up irrelevant things. He only remembers definite and limited matter and its presentation before the pupils become easy. The pupils also receive the knowledge in a systematic and organized way.

5. Determination of activities

In a lesson plan, the teachers and pupils activities are pre-decided according to the class level. This makes the teaching activities meaningful and purposeful.

6. Preparation of material aids

At the time of preparing a lesson plan, the teacher decides what facts are to be clarified by what strategies, techniques and instruments and what aid is to be used at what time. This prepares the necessary and effective aids before starting the teaching task.

7. Developing of teaching skill

The lesson plan acts as an important means for developing teaching skills in the pupil-teacher.

8. Use of Theoretical knowledge

Whatever the pupil-teachers get theoretical knowledge during their training period, that knowledge.

9. Teaching with confidence

The preparation of a lesson plan makes the subject and other allied subjects more clearly to the teachers. This arouses self confidence among them. When a teacher gets developed the feeling of self-confidence, then he presents the new knowledge to the pupils with more enthusiasm and pleasure.

10. Discipline in class

By preparing lesson plan, the teacher becomes aware of what, when and how much is to be done in the class. This absorbs all the pupils in their respective tasks. Hence, it results in appreciable classroom discipline.

11. Time sense

Lesson plan is prepared allotting to the duration of the periods.

12. Teaching from memory level to reflective level

In an ideal lesson plan, development and thought provoking questions should be asked. Also there should be an effort to stretch the teaching from memory level to reflective level.

CHARACTERISTICS OF GOOD LESSON PLAN

1. Objective based

The lesson plan must be based on one or the other objective. While writing this, objectives should be written and defined clearly because its main objective is to achieve some goal.

2. Decision about appropriate material aids

The material aid an important means of the teacher. Hence correct decision regarding the charts, graphs, pictures, diagrams and maps should be taken while preparing ideal lesson plan and these should be marked at proper places which a teacher is to use them while teaching.

3. Based previous knowledge

An ideal lesson plan should be based on the previous knowledge of the pupils. This will avoid difficulty in acquiring new knowledge by the pupils.

4. Division of lesson plan in units

Lessons are of three types (a) knowledge lesson (b) skill lesson (c) appreciation lesson. In an ideal lesson plan all the relevant steps of these three types of lesson plan should be

determined. Each lesson should be divided into suitable units so that the pupils may understand the lesson gradually.

5. Simplicity of activities

In an ideal lesson plan, the simplicity of the lesson plan and clarity of thoughts should be according to the mental level of the pupils.

6. Determination of activities

In an ideal lesson plan, the activities of a teacher and the pupils should be determined before-hand.

7. Home work

There should a provision of home work in an ideal lesson plan. This will enable the pupils to learn the appreciation of the acquired knowledge.

8. Self-evaluation

A good lesson plan must have a suitable plan for self-criticism. The teacher should put some questions to him and find out the answer and there by judge the effectiveness of the lesson writing.

9. Use of illustration

Examples should be used which have relevance with the daily life of the peoples.

10. Use of blackboard

The blackboard summary of each and every unit should be written on the blackboard.

This approach generally known as Herbartian five steps approach in the procedure of the Herbartian School of propagated by ***J.F.Herbart*** (1776-1841) and his followers.
The formal steps involved in the approach as below

i. Introduction / Motivation
ii. Presentation
iii. Comparison and association
iv. Generalization
v. Application
vi. Recapitulation

Introduction / Motivation

This step is concerned with the task of preparing the students for receiving new knowledge. In preparation, nothing new is taught to students. Relevant to the topic in hand he teacher should make himself sure of what the pupils already know, by putting a few questions, based on the pupils previous knowledge. In general, with the help of this step, the teacher can check the students entering behavior before he starts teaching the lesson. Thus, testing previous knowledge, developing interest in the minds of students and maintaining curiosity of the students can be achieved with the help of this step.
The following activities involved in this step

· The assumption about the previous knowledge of the students in relevance to the lesson
· The testing of the previous knowledge
· Utilizing the previous knowledge for introducing the lesson
· Motivating the students for studying the present lesson

Presentation

It is the key step and only through which the actual process of teaching is going to take place. Here the aims of the lesson should be stated clearly and the heading should be written on the blackboard. We have to provide situation for both the teacher and the students to participate in the process of teaching and learning. Our ultimate aim of the presentation is to make the concepts understandable to the students. Therefore simple language is used. Appropriate and specific examples and illustrations of the concepts will make the understanding better. The interest of the students on the subject matter should be maintained continuously by the way of asking questions from time to time in this stage. The teacher should carefully and skillfully arrange his material so that his pupils may clearly and readily grasp it. The teacher should make proper use of questions, charts, graphs, pictures, models and other illustrative for demonstration and explanation.

At the end of each section a few questions concerning that section only should be asked to whether the pupils are now ready for the acquisition of new knowledge.

Comparison of Association

More importance should be given in this stage to compare the facts observed by the students with another concept by way of giving examples. By making use of this comparison, the students can derive definitions or theories. The students are encouraged to give new suitable examples for the concept instead of the examples given in the book to make them think in an innovative manner.

Generalization

This step is concerned with arriving at some general ideas or drawing out the necessary conclusions by the students on the basis of the different comparisons, contracts and associated observed in the learning material present by the teacher. As far as possible the task of formulation should be left to students. The teacher at this stage should try to remain in the background for providing only necessary guidance and correction.

Application

In this stage, the teacher makes the students to use the understood knowledge in an unfamiliar situation. Unless the knowledge of science is applied in new situations or in our day-to-day life, the study of science will become meaningless. This application of scientific principles will strengthen learning and will make the learning permanent.

Recapitulation

This stage is meant for the teachers to know whether students have grasped by reviewing a lesson or by giving assignments to the students. Only through this step achieving closure (in teaching) is possible.

INSTRUCTIONAL OBJECTIVES

Instructional objectives represent the desired change in the pupil who undergoes instruction in a lesson. There are two types of instructional objectives. They are

1) General Instructional Objectives
2) Specific Instructional Objectives

When a teacher plans a lesson, he should ask himself, “Why should I teach this lesson?” The answer to this question constitutes Instructional objectives. All instruction will result in learning which in turn bring about changes in the behavior of the learners. So the instructional objectives it means the anticipated behavior change, which is what is what the teachers expect as a result of their teaching.

1) General Instructional Objective (GIO’s)

If the objectives are stated in general and vague manner, then they are called general objectives. They contain non-behavioral verb i.e. they contain non-action verb.
For example;

i. The learner acquires knowledge of the various branches of science.
ii. The learner develops skill in manipulating apparatus.

Here the verbs 'acquires' and 'develops' are non-action verbs which are cannot measure or observe directly, because they are in the form of inner development or passive aspect of mental activity.

Example;

The pupil,

i. Acquires knowledge of friction
ii. Understands various types of friction
iii. Applies knowledge of friction in relevant unfamiliar situation
iv. Develops skill in doing experiments
v. Develops interest in experimenting

2) Specific Instructional Objectives (SIO's)

If the objectives are stated in specific, then they are called specific objectives. They contain behavioral verb i.e. they contain 'action' verb. The observable and measurable behavioral changes as a result of realizing an objective is termed as specific instructional objectives or specification.

For example

The learner defines friction
Here defines is the active verb
The statement of specification should contain two parts

i. Modification Part (MP)
ii. Content Part (CP)

Example;

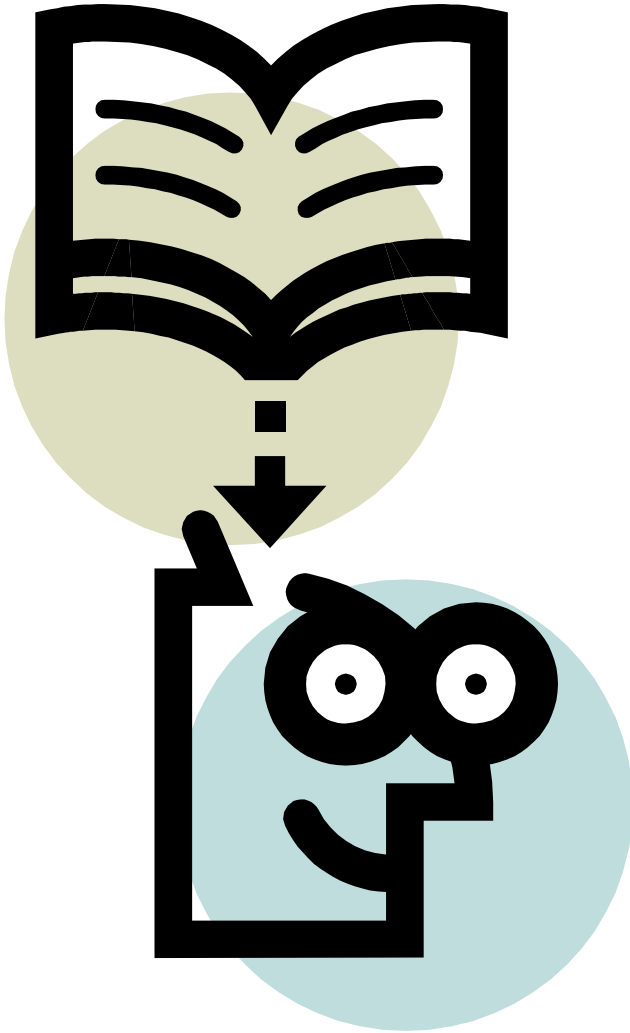
The learner <u>definesfriction</u>
MP CP

The table showing illustrative examples of specifications with specified behavioral part and content part from physical science.

LEVEL	**SPECIFIC OBJECTIVE / SPECIFICATIONS**	
	THE BEHAVIORAL PART	**THE CONTENT PART**
KNOWLEDGE	Recalls Recognizes	The branches of science
	Distinguishes Identifies Selects Compares Classifies	between metals and non-metals the physical properties of metals colored salts from the salts velocity and acceleration primary, secondary and tertiary alcohol

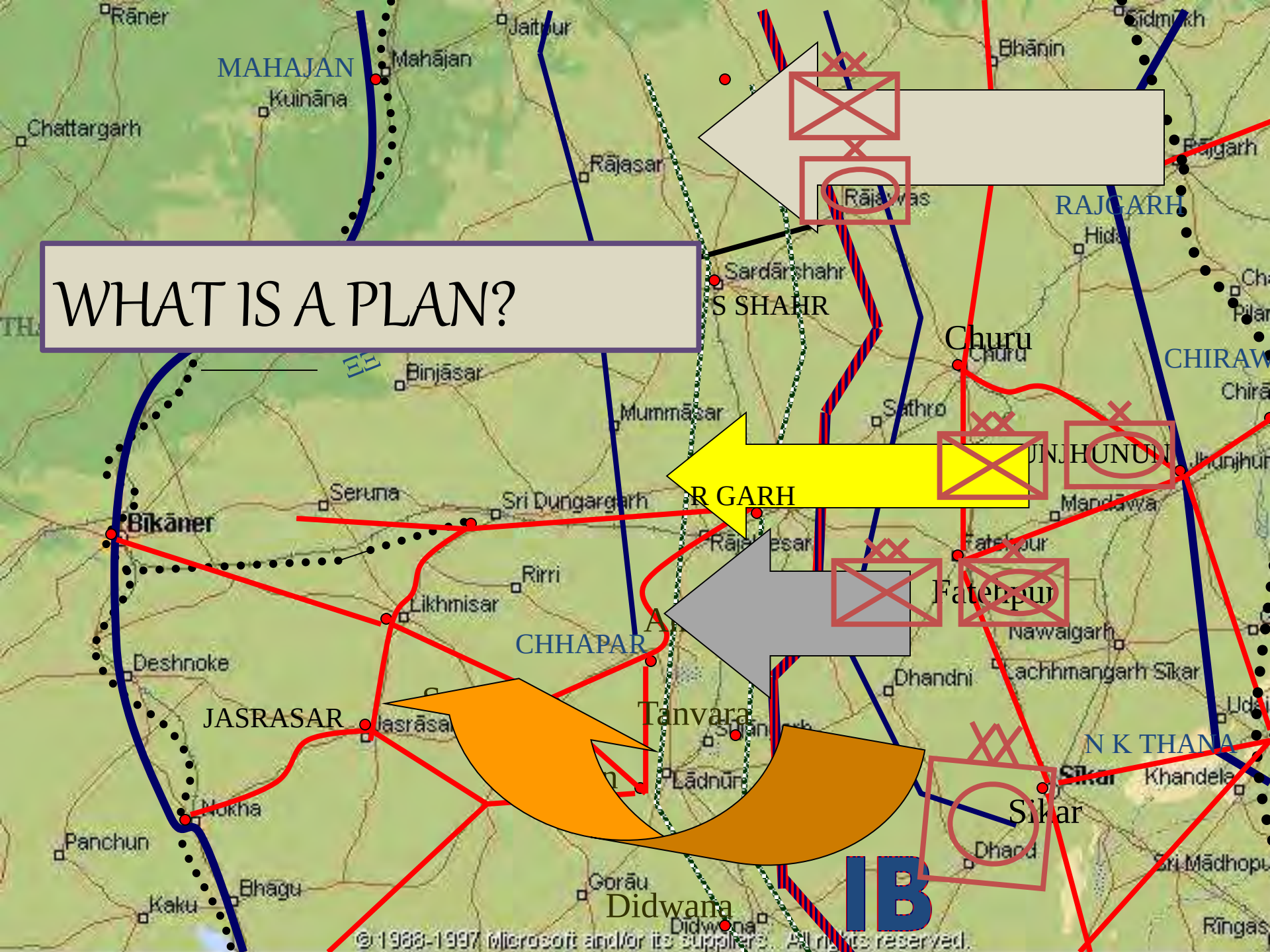
UNDERSTANDING	Identifies relationships Give examples Describes Explains Generalizes	between rest and motion for first order lever the preparation of Iron the function of generator the ideas of input devices
APPLICATION	Gives reason Infers Computes Analyses Establishes relationships Suggests Selects Detects Give new illustrations	Why sky appears blue? The result obtained in the experiment The normality of the liquid Analyses situations Establishes relationship between metals and non-metals Improvisation to apparatus Apparatus with purpose Detects errors For friction
SKILL	Draws Labels Doing experiments Participates	The diagram of screw gauge The part of a generator Of simple pendulum In a science quiz
INTEREST	Collects Prepares Writes Organizes	Picture of scientists, some machines etc. Posters on water pollution An article on 'Globalization' for school magazine Organizes science exhibition on ICT in Science Education

LESSON PLAN



What is a Lesson?

- A lesson is a learning experience for an indl or a gp and is acquired either through a structured interaction or by accident


WHAT IS A PLAN?
MAHAJAN
RAJGARH
CHHAPAR
JASRASAR
N K THANA
IB
Churu
Sikar
Didwana
Tanvara
Fatehpur
Bīkāner
Jhunjhunu
Rāner
Mahājan
Kuināna
Chattargarh
Rājasar
Sardārshahr
Binjāsar
Mummāsar
Sathro
Seruna
Sri Dungargarh
Rirri
Likhmisar
Deshnoke
Nokha
Panchun
Bhagu
Kaku
Gorāu
Bhānin
Rājaswas
Nawalgarh
Dhandni
Lachhmangarh Sikar
Khandela
Dhand
Lādnūn
Jaitpur

A detailed proposal for doing or achieving something - *Oxford*

A series of actions that you think about carefully to help you to achieve something - *Macmillan*

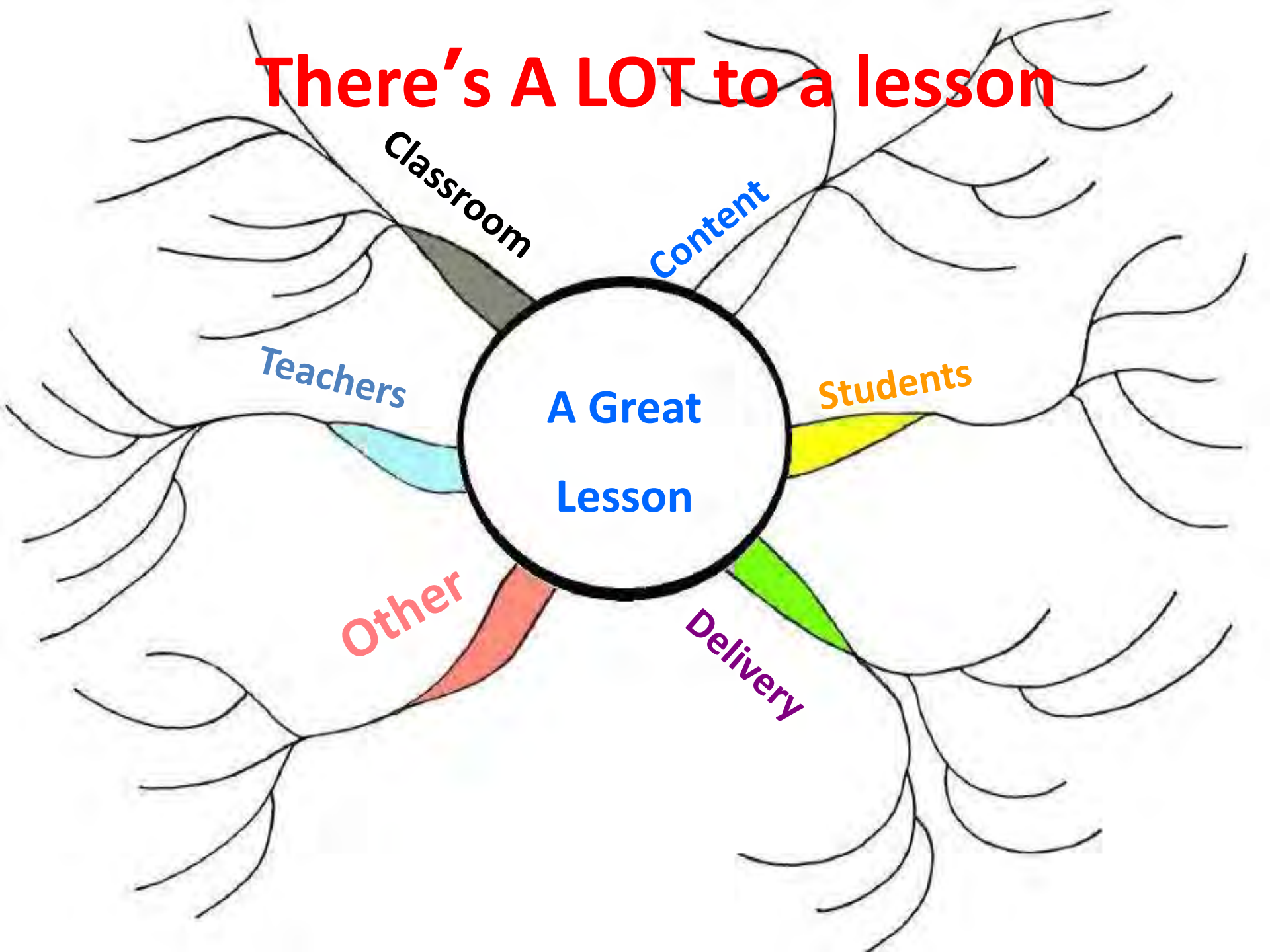
A written account of intended future course of action (scheme) aimed at achieving specific goals or objs within a specific timeframe, with resources avl

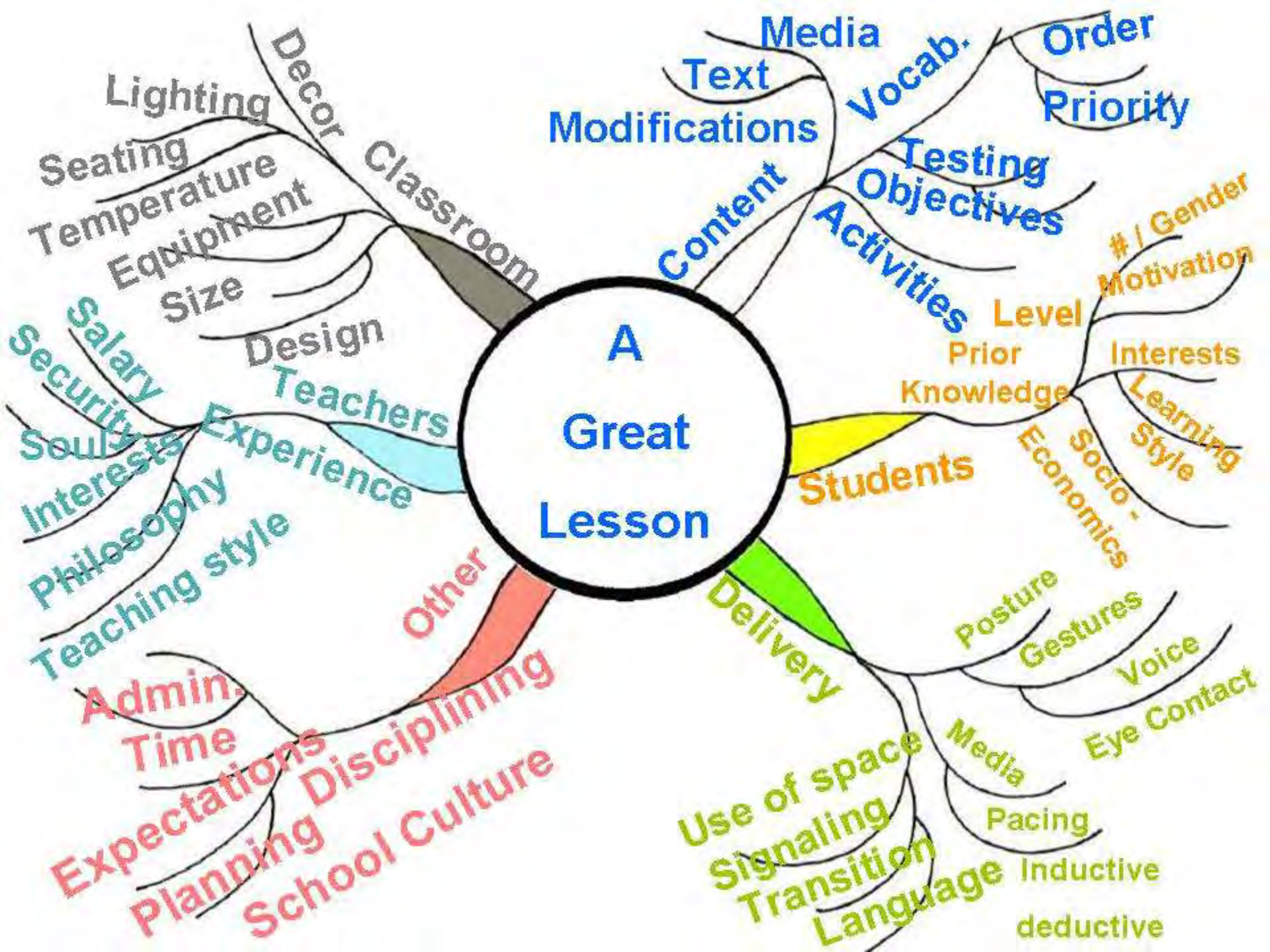
It explains what needs to be done, when, how and by whom

Why is lesson planning important?

Lesson plg means making decisions in adv about what to teach, how to teach and the time assignment of every teaching procedure

- Teaching plan is **necessary for both novice and experienced teachers**
- Prep does not guarantee successful lessons, **walking into a classroom unprepared is often the beginning of a disastrous lesson**
- Although the main teaching **contents may be the same, the students, the time and the mood are all different.**


There's A LOT to a lesson
Classroom
Content
Teachers
A Great
Lesson
Students
Other
Delivery


A
Great
Lesson
Classroom
Decor
Lighting
Seating
Temperature
Equipment
Size
Design
Teachers
Salary
Security
Souls
Interests
Philosophy
Teaching style
Experience
Other
Admin.
Time
Expectations
Planning
Disciplining
School Culture
Content
Media
Text
Modifications
Vocab.
Order
Priority
Testing
Objectives
Activities
Students
Level
Prior
Knowledge
/ Gender
Motivation
Interests
Learning
Style
Socio -
Economics
Delivery
Posture
Gestures
Voice
Eye Contact
Media
Pacing
Use of space
Signaling
Transition
Language
Inductive
deductive

PLAN TO

- Wk out what you want to do
- Wk out if you can achieve what you want
- Think about how you want to achieve what you want
- Wk out any extra sp you might need
- Iden areas to focus upon & have more cont
- Think about what you want to do if something doesn't wk out
- Think about changes
- Plan to make changes successful

A GOOD PLAN SHOULD

- Be about what you want
- Incl all resources / sp needed
- Have only things that you agree with
- Help you to do what you want
- Incl big picture (goals/Objs)
- Incl things that will make your plan happen
- List resp
- Incl time frames
- Be flexible to adopt to changes
- Be easy for you and every one to understand
- Should be a written docu

Planning

- Designs the learning experience

Principles for Good Lesson Planning

- **Aim: Should be simple & clear. The teacher has to set & achieve the realistic goals of the lesson**
- **Variety: Incl various activities and materials to ensure high motivation and interest**
- **Flexibility: Adopt more teaching methods & techniques - do not restrict to just reading / disseminating the lesson / its contents**

Principles for Good Lesson Planning

- **Learnability:** **the planned contents & tasks should be within learning capability of students.**
  - **doing things that are beyond or below the students' coping ability will diminish their motivation (Schumann, 1999)**
  - **Contents should be slightly higher than the present proficiency of the students**
- **Linkage:** **the teaching steps should be linked with each other. That is, there should be coherence.**

Macro Planning vs. Micro Planning

- **Macro planning - planning over a longer period of time.** Planning for the entire subject / course
- **Macro planning is not writing lesson plans for specific lessons but rather helping teachers get an overall felling or idea about the course** and also get familiarized with the context in which teaching will takes place

Macro planning involves

- ***Knowing about the profession:***

  Get to know **what should be taught / practised in the course**, what **materials and teaching aids** are available, and what **methods and techniques** can be used.

- ***Knowing about the institution:***

  The teacher should get to know the institution's **arrangements regarding time, length, frequency of lessons, physical conditions of classrooms, and exam requirements.**

- ***Knowing about the learners:***

  Acquire information about the **students' age, service bracket, motivation, attitudes, interests, learning needs & other factors**

- ***Knowing about the curriculum/syllabus:***

  The teacher should be clear about the **purposes, requirements and targets specified in the syllabus**.

- ***Knowing about the textbook:***

Know the textbook well in terms of **methods of teaching, organization of learning contents, major topics, recommend teaching methodology, unit components and ways of assessment.**

- ***Knowing about the objectives:***

Know **what learners are expected to achieve and able to do after the course**

- *Macro planning provides a general guidance for teachers, but it is not enough for good teaching. Teachers need to plan each lesson in detail in order to teach effectively and confidently in the classroom.*

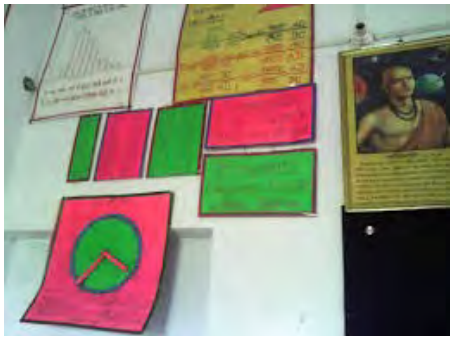
Common mistakes in Lesson Plans

- **Lesson Plans not made**
- **Learning Objs either not enunciated / poorly written**
- **Timelines not allotted based on content**
- **No time planned for interaction**
- **Trg aids not planned**
- **Lesson assessment not connected with behavior indicated in the obj**
- **No activities planned to promote interaction**

MATHEMATICS LABORATORY

Mathematics Laboratory is a place where students can learn and explore mathematical concepts and verify mathematical facts and theorems through a variety of activities using different materials.These activities may be carried out by the teacher or the student to explore, to learn, to stimulate interest and develop favourable attitude towards mathematics.

Laboratory in Mathematics is the brain child of Mr.Sreedhara Chandra Sekhara Sastry, a creative mathematician. The Maths Lab consists of more than 200 models in various branchers of maths like Algebra, Geometry, Arithmetics,etc. which are of great help to students from K.G to 12th.The models are so designed to catter to the needs of all segments of teachers and learners in verifying formulae results and applications etc., irrespective of curriculum.



It is true that the Mathematics laboratory bar has not yet received the same general acceptance as a Science laboratory. This is probably because the mathematics teachers themselves have no recognized the significance of mathematics laboratory as the Science teachers have. Actually most mathematical teachers have been very passive as to this respect.

Need & Significance of Mathematics Laboratory

Recently, Laboratory works in Mathematics in receiving in creating attention. The underlying idea of a Mathematical Lab is that people will develop new concepts and understanding particularly well through experimental activities dealing with concrete situation. They can be learned better through observation of the concrete situations and experiments and manipulation

of concrete objects. Activities such as measuring and drawing, counting ,weighing, averaging & estimating ,taking the readings from instruments, recording comparing ,analyzing ,classifying and checking data, collecting data ,working with data and so on will involve the use of physical instruments and can be labeled as laboratory work. Some of this work can be done in the classroom that is suitable arranged and equipped (mathematics Laboratory) and some can take the form of elementary field work. Most students find such work highly interesting and through such activities they can develop many Mathematical Concepts and insight with an interest and a clarify often not attained through a strictly intellectual approach.

The activities involved in laboratory type work in Mathematics fall broadly into two classes, namely demonstrations and ‘experimental activities’. In demonstration some physical instrument or device is used to illustrate and clarify the explanation of a Mathematical Concept or a method.

Experimental activities include the kind of activities which are carried on individually or by small groups working together and are primarily aimed at helping experiments themselves to understand concepts/ideas clearly. In the high school mathematics, properties of geometric figures and concepts of distance, angles, weights, areas, volumes and etc.can are given a monivivid impact through experimental activities than through any other means.

Materials & Equipments for a Mathematics Laboratory

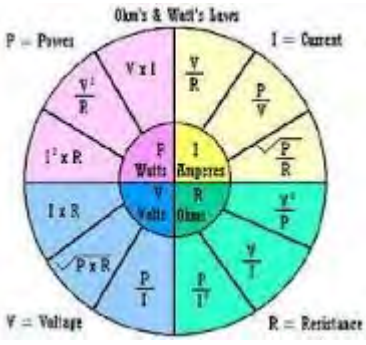
For the effective functioning of a Mathematics Laboratory, it should be well occupied. A mathematics Lab may contain the following type of materials & equipments.

Materials

* ***Concrete Materials***

The Mathematics Lab should contain materials such as beads, pebbles, sticks ball frames, seeds, balances, weight measuring tapes,scisssors,pins,abacus, carboard,boardpins, chart paper, graph paper,etc. which are very helpful for demonstrating elementary mathematical concepts.

* ***Pictures & Charts***

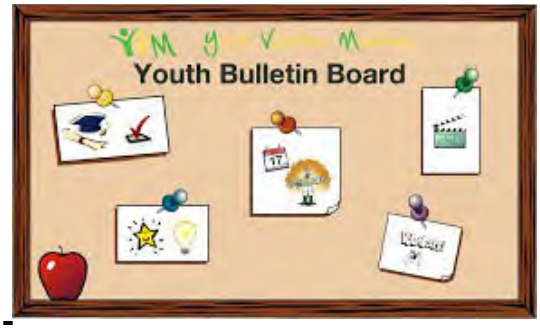


Pictures & Charts depicting different mathematical concepts should find a place in a Mathematics Laboratory, Pictures of Mathematicians; charts showing the contributions o mathematician, History of Mathematics, biographers of mathematicians are also very helpful for demonstrating students and can be placed in the Mathematical Lab.

* **Models**

Various Mathematical models which will offer opportunities for students to explore and investigate should be placed in the mathematical Laboratory.

**** Bulletin Board***



There should be at least one bulletin board in the mathematics laboratory to display various illustrations concerning mathematics. Information relating to Mathematics and its application collected from different sources like Magazines, Journals & Newspapers can be displayed for the benefit of the peoples.

**** Black Board***

A Blackboard should be provided in the mathematics lab. This helps in writing instructions, drawing geometrical figures and illustrations necessary for performing the laboratory work.

Instruments & Equipments.

**** Drawing Instruments***

In Mathematics Lab, the students are required to draw and sketch geometrical figures, graphs and so on. Therefore in every Mathematics lab there should be a set of drawing instruments like compass, rulers, protractor, etc. for the teachers to demonstrate the drawing on the black board and instrument boxes for the students' use.

**** Weighing & Measuring Instruments***

Mathematics Lab work quite often, involve the important activities of weighing and measuring. Therefore, instruments used for measuring tapes, balances of different types measuring jar and graduated cylinder should be there in a mathematics lab.

**** Surveying Instruments***

Laying out right angles, finding the angular distance, estimating weight of a building, estimating the distance of an object, finding the angle of elevation and depression are all useful activities which make use of surveying instruments.

**** Proportional Dividers***

This instruments works on the principle of proportionality of similar triangles. It can be used for enlarging or reducing figures, pictures, maps, graphs, etc.

Functions of a Mathematics Laboratory

The primary functions of a mathematics lab are to:

- Make Mathematics teaching & learning interesting and purposeful for the students.
- Provide activities that arouse the curiosity of the students & maintain their interest in learning.
- Enable students to develop proper skills in handling equipments & gadgets.
- Make students appreciate the practical applicability of Mathematical Principles and laws.
- Concretized the abstract Mathematical Concepts.
- Help the students develop powers of observation, analysis and drawing inferences.

Do your students rejoice mathematics or are phobic to it?

"The essence of mathematics is not to make simple things complicated but to make complicated things simple."

CONCLUSION

Mathematics Laboratory is a place where students can learn and explore mathematical concepts and verify mathematical facts and theorems through a variety of activities using different materials.These activities may be carried out by the teacher or the student to explore, to learn, to stimulate interest and develop favourable attitude towards mathematics.

THE END

Objective Type Test: Meaning, Merits and Limitations |

After reading this, you will learn about:- 1. Meaning of Objective Type Test 2. Merits of Objective Type Test 3. Limitations 4. Construction.

Meaning of Objective Type Test:

Simply, an objective type test is one which is free from any subjective bias either from the tester or the marker. It refers to any written test that requires the examinee to select the correct answer from among one or more of several alternatives or supply a word or two and that demands an objective judgement when it is scored.

Objective-Centered Test/Objective based Test:

When questions are framed with reference to the objectives of instruction, the test becomes objective-based. This type of test may contain essay type and objective type test items.

An essay test may be objective-centered or objective-based, though it may be difficult to score it objectively. An objective type test, on the other hand, can always be scored objectively, though it may not be objective-centered if it is not planned with reference to the objectives of instruction.

Objective-type tests have two characteristics viz.:

1. They are pin-pointed, definite and so clear that a single, definite answer is expected.

2. They ensure perfect objectivity in scoring. The scoring will not vary from examiner to examiner.

Merits of Objective Type Test:

1. Objective type test gives scope for wider sampling of the content.

2. It can be scored objectively and easily. The scoring will not vary from time to time or from examiner to examiner.

3. This test reduces (a) the role of luck and (b) cramming of expected questions. As a result, there is greater reliability and better content validity.

4. This type of question has greater motivational value.

5. It possesses economy of time, for it takes less time to answer than an essay test. Comparatively, many test items can be presented to students. It also saves a let of time of the scorer.

6. It eliminates extraneous (irrelevant) factors such as speed of writing, fluency of expression, literary style, good handwriting, neatness, etc.

7. It measures the higher mental processes of understanding, application, analysis, prediction and interpretation.

8. It permits stencil, machine or clerical scoring. Thus scoring is very easy.

9. Linguistic ability is not required.

Limitations of Objective Type Test:

1. Objectives like ability to organise matter, ability to present matter logically and in a coherent fashion, etc., cannot be evaluated.

2. Guessing is possible. No doubt the chances of success may be reduced by the inclusion of a large number of items.

3. If a respondent marks all responses as correct, the result may be misleading.

4. Construction of the objective test items is difficult while answering them is quite easy.

5. They demand more of analysis than synthesis.

6. Linguistic ability of the testee is not at all tested.

7. Printing cost considerably greater than that of an essay test.

Guidelines for Constructing Better Objective Type Test Items:

To be a good item writer, one should have:

(a) A thorough understanding of the subject matter;

(b) A thorough understanding of the pupils tested;

(c) Perseverance; and

(d) A little creativity to prepare fertile kind of items.

It is of paramount importance for him to be cognizant of the pitfalls involved in writing objective type test items.

We shall now offer some general guidelines for the writing of objective type test items:

1. Each item must be clearly expressed i.e. there must be precision in writing the test items.

2. Test for important facts and knowledge and not for trivial details; e.g.,

(a) Give the name of the ship that Columbus was on when he discovered America.

(b) Give the date (and/or time) when Edison invented the light bulb.

These items test the ability to recall or supple trivial details and therefore are unsound.

3. Avoid ambiguous statements. Each item should be subjected to one and only one interpretation.

Poor:
Rabindranath Tagore wrote Gitanjali in..... The item is ambiguous because the examinee does not know whether the teacher wants to know the year, the date, the language or the place.

Better:
In which language did Rabindranath Tagore write Gitanjali?

4. Quantitative rather than qualitative words should be used. Words such as few, many, low, high, large, etc. are vague, indefinite, and, therefore, should be avoided.

Poor:
TF Many people are literate in Orissa.

Better:
TF About 85% of the people are literate in Orissa.

5. Use good grammar and sentence structure to improve clarity.

Poor:
TF In a triangle, whose one of the angle's measure is 90°, the hypotenuse is equal to the square root of the sum of the squares of the other two sides.

Better:
TF In a right-angled triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.

6. Avoid lifting statements verbatim from the text-book. The use of text book language in a test encourages a pupil to memorise rather than to understand the subject matter.

7. There should be only one correct answer.

Poor:
Fill in the blank by inserting an operational symbol.

2..... 2 = 4

Here, some students may write +, others may write X.

8. Avoid negative questions whenever possible. An indiscriminate use of the negative should be avoided. It takes more time to answer.

Poor:
TF The longitude of Bombay is not 73°E.

Better:
TF The longitude of Bombay is 73°E.

9. Directions to questions should be specific. Ambiguous wording and double negatives should be avoided in questions.

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The challenge

Anyone who's been teaching for longer than a day understands the fact that communicating certain ideas to our students is a real challenge. PowerPoint is a tool that *can* make that task easier, but it can also serve as a barrier to effective communication. Our specific challenge when using PowerPoint is to use it so that it's truly a learning tool and not a distraction. This handout will cover several topics that will help you use PowerPoint more effectively as a math or science teacher.

Assumptions

Before we proceed, I must mention that I'm making four assumptions about you:

1. You're already using PowerPoint, and you're not expecting this to be a "how-to" tutorial about how to use it.
2. You're already using either the Equation Editor that's built-in to Microsoft Office, or its more feature-packed big brother, MathType.
3. You're fairly competent in both, but you don't consider yourself an expert in either.
4. You'll pass along to me any tips you have that you've gathered from years of teaching with PowerPoint.

The best tool for the job

From time to time it may be the case that for the particular topic you're presenting, PowerPoint may not be the best tool for the job. That's what you get the big "teacher bucks" for—to decide what's best for each lesson.

Office Open XML file format

This is the official name of Microsoft's new document format that was introduced with Office 2007 for Windows, and is also incorporated into Office 2008 for Macintosh. Don't confuse the term ***Office Open XML*** with a similar-sounding product, ***Open Office***. The latter is a free office suite; the former is a document format. Whether you're using Office 2007/2008 or not, it's important to realize that the document format is different from that of previous Office versions. If you're using an earlier version of Office, you can't open documents created in Office 2007/2008 without downloading the file converters from Microsoft. Here's where to get them:

- For Windows: http://tinyurl.com/y5a879
- For Macintosh: http://tinyurl.com/35yel7 ← That's a lower-case "L", not a "1" next to the 7.

Creating transportable PowerPoint presentations

If you've done much PowerPoint, you've no doubt been there – you've slaved until midnight making your presentation perfect, and you load it on your USB flash drive to take to school. You arrive at your classroom only to discover there's been a broken water pipe and you'll have to use a different classroom

today. You fire up the computer in the new room and begin showing the lesson to your students when one of them points out that some of your equations look funny. Sure enough, some symbols are missing and other symbols are replaced by other, seemingly random, symbols. What's the problem?

The problem is caused by the fact that MathType creates equations with fonts. If the computer you're showing your presentation on (or printing your Word document from) doesn't have the MathType fonts installed, your equations won't look right. What's a teacher to do?

Luckily there are several solutions, all of which are fairly easy. Some of them *can* be difficult, depending on how hard your technology guru is to get along with, but at least one of them you can do yourself (and that one won't work on the Mac! If you're a Mac user, your options are 1, 2, or 3 below):

1. If your school has a school license for MathType, it's perfectly all right to install MathType on the network or to install it on each individual computer at the school. You can even use it at home and load it on student laptops (K-12 schools only, not colleges) – all under the same school license!
2. If you don't have a site license for MathType, it's OK to load the MathType fonts onto any computer you want them on. If you have a MathType CD, they're on the CD. If you have MathType installed on a home computer or a laptop, they're in your MathType folder in a sub-folder labeled Fonts. Just copy them over. (Check with your IT person if you're not sure where they go.)
3. Download the MathType trial version from our website: www.dessci.com. You can install it on whatever computers you want it on, and even after the 30-day trial period expires, the computers you've loaded it on will continue to be able to show PowerPoint presentations and print Word documents with MathType equations in them.
4. Embed the fonts in your presentation. There are just a few easy steps to accomplish. (This is the one you can't do on the Mac.) The steps are similar to accomplish the same thing in Word.
    a. Click View > Master > Slide Master. (In PowerPoint 2007, it's View > Slide Master.)
        i. On the **Title Master**, click inside the Footer.
        ii. Change the font to **MT Extra**. Press the spacebar. Repeat this step for each equation font you need to embed. You don't need to embed any font you've used in the text of your slides nor any "standard" font you've used in your equations (like Symbol).
        iii. On the **Slide Master View** toolbar or tab, click **Close Master View**.
    b. Save the document. If you've saved it previously, use the **Save As** command.
    c. In the **Save As** dialog, click **Tools**. This will be in the upper right of the dialog unless you're using Office 2007, in which case it will be in the lower left.
    d. Choose **Save Options**.
        i. In **PowerPoint 2003 & earlier**, click the box labeled **Embed TrueType fonts**. Leave other default options set. Specifically, **do not** click the box labeled "Embed characters in use only", because this will result in embedding only the space character from the math fonts. Click OK, then click Save (naming the presentation first, if you haven't already done that).
        ii. In **PowerPoint 2007**, click the box labeled **Embed fonts in the file**, then click the button labeled **Embed all characters**. Click OK, then click Save (naming the presentation first, if you haven't already done that).

Customizing PowerPoint

The first step in getting more out of PowerPoint is to customize it.

"End with black slide"

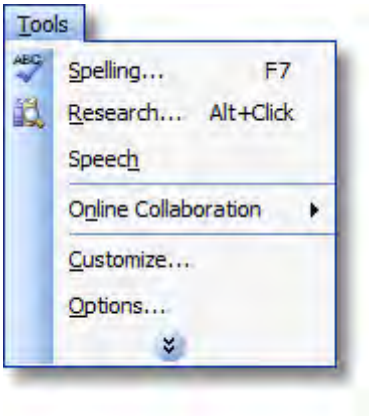
This is the only customization I consider an "absolute". What you don't want to happen is to get to the end of your presentation, and when you click the mouse one more time, the slide show ends and what the audience sees is your PowerPoint screen with all the toolbars, etc. Very unprofessional. To make this change, click on Tools > Options > View. Check the box labeled "End with black slide".
Mac: PowerPoint > Preferences > View.
PowerPoint 2007: Office Button > PowerPoint Options > Advanced > Slide Show.

While you're in the Options or Preferences dialog, do yourself a favor and take the time to explore the other custom settings available to you there. (I don't just mean the ones mentioned in this handout; I mean *all* of them!)

"Customize"

In the software world, I know of only one thing the word *customize* means, and that's to change the layout of your menus and/or toolbars. On both Windows and Macintosh versions of PowerPoint earlier than PowerPoint 2007, this item appears on the Tools menu. On PowerPoint for Mac, there is a separate fly-out menu with two items on it. Choose the item labeled "Customize Toolbars/Menus". (On Windows, just click Tools > Customize.) **If you're using Office 2007,** read on, because parts of this section still apply to you.

I want my menus back! (Office 2003 & earlier, Windows only)



The first thing I recommend changing on the Customize dialog applies only to Office for Windows, and applies equally to Word, PowerPoint, and Excel. If you are one of the few people who actually *like* the style of menus you see at the right, then skip to the next section. If you prefer to get the entire menu when you click it, rather than having to wait for what seems like forever before the menu expands, just click on the Options tab in the Customize dialog and select the option labeled *Always Show Full Menus*. While you're there though, I recommend also checking the box labeled *Show Standard and Formatting toolbars on two rows*. I recommend this option because that lets you see your entire toolbar without scrolling to the right or clicking the "expand" button.

Equation Editor icon (Office 2004 and earlier, Windows & Macintosh)

(This step is not necessary for MathType users.) On the Customize dialog (**Mac:** "Customize Toolbars/Menus") click the Commands tab. In the Categories section, click Insert. In the Commands pane on the right, scroll down until you find the Equation Editor icon. Click and drag it to your toolbar.

While you're there, go ahead and look to see if there are other icons you want on your toolbar. Likewise, if there are icons on your toolbar you don't use, simply drag them off. You can always put them back on the toolbar later, and now you know how!

***Drawing* Toolbar** (All versions of PowerPoint for Windows & Macintosh *except* PowerPoint 2007)

For now, click Close to close the Customize dialog (**Mac:** click OK). Click on the View menu and hover over the Toolbars fly-out menu and you'll see a list of all the toolbars available. The ones that are checked are the ones you're currently using. If *Drawing* is not checked, click it to select it. The default location for the Drawing Toolbar is the bottom of the window for PowerPoint for Windows, and the left side of the screen on the Mac. Now that this toolbar is visible, go back to the Customize dialog and add icons to make it more usable. Here's what my Drawing Toolbar looks like for PowerPoint 2003:

Quick Access Toolbar (Office 2007 only)

In Office 2007 for Windows, the only customizations you can make easily are adding things to and removing things from the "Quick Access Toolbar", or QAT for short. The easiest way to do that is to right-click an item on the Ribbon and choose the command labeled "Add to Quick Access Toolbar". For more control, click the icon and click "More Commands".

Templates & Themes

PowerPoint is so feature-packed that it's easy for two things to happen. First, it's easy to let yourself get so wrapped up in discovering all of PowerPoint's cool features that you don't have time to prepare your lesson. Second, once you discover a cool feature, you want to try it out on your class. Trying out new features is something I definitely encourage, but not when it distracts from the lesson. PowerPoint's **Design Templates** (Office 2007 & 2008: "Themes") are definitely in the category of things that can distract if you let them. From this point forward, when the discussion applies equally both to Templates and Themes, I'll simply refer to Templates.

When it comes to templates, you basically have 3 choices:

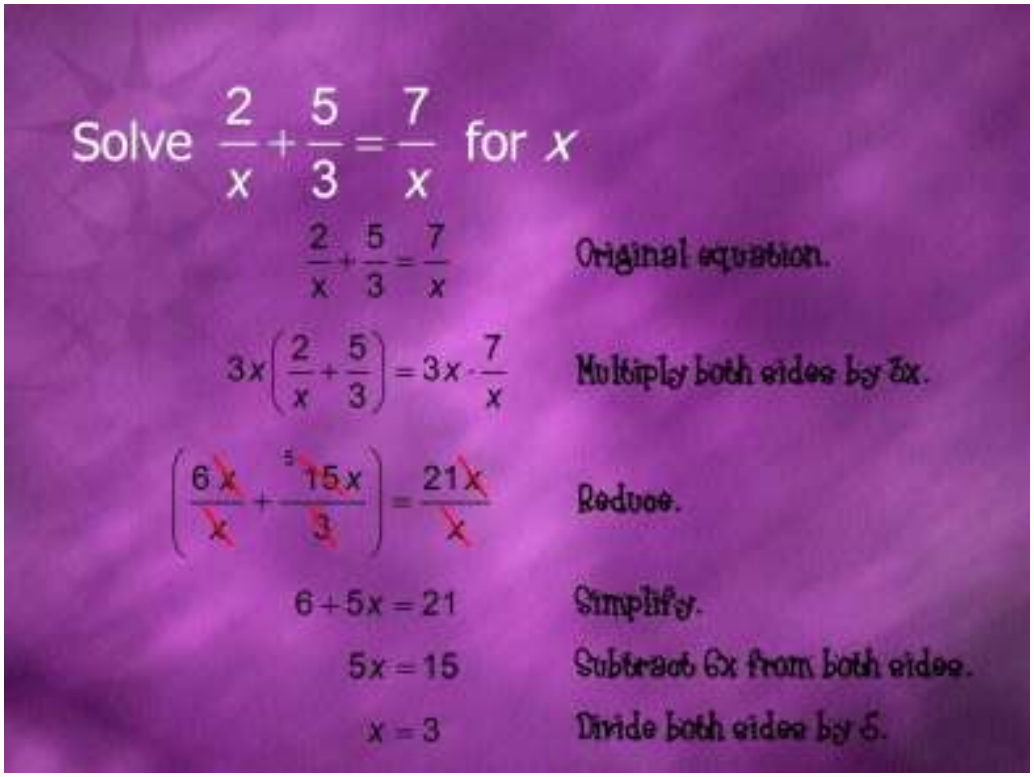
1. You can use a standard template (i.e., one that came with PowerPoint).
2. You can create your own template or use one that someone else created. We have a guided tutorial that shows how to create your own design template: www.dessci.com/template
3. Don't use one. Even if you go this route though, you're still using one. The template titled "blank.pot" is what the new presentation is based on that appears when you first open PowerPoint (for PowerPoint 2007, it's the theme titled "blank.pptx").

Whichever of these choices you make, I have 2 recommendations. First, keep your slides simple—as simple as you can make the slide and still get your message across. Second, ***if*** you use a template other than "blank", either create your own or use one based on a simple design.

Compare the two slides on the next page. Which one do *you* think would be more effective?

Solve $\frac{2}{x}+\frac{5}{3}=\frac{7}{x}$ for x

$\frac{2}{x}+\frac{5}{3}=\frac{7}{x}$	*Original equation.*
$3x\left(\frac{2}{x}+\frac{5}{3}\right)=3x\cdot\frac{7}{x}$	*Multiply both sides by the LCD: 3x.*
$\left(\frac{6\cancel{x}}{\cancel{x}}+\frac{\overset{5}{\cancel{15}}x}{\cancel{3}}\right)=\frac{21\cancel{x}}{\cancel{x}}$	*Reduce.*
$6+5x=21$	*Simplify.*
$5x=15$	*Subtract 6x from both sides.*
$x=3$	*Divide both sides by 5.*



Using AutoShapes

PowerPoint's AutoShapes are practically indispensible for teaching math, and the better you know *how* to use them, the more *often* you'll use them, and the more effective you'll be at it. (In Office 2007 & 2008, AutoShapes are just called "Shapes", but in this handout we'll use the term "AutoShape" to refer to them all.) Although this will not be even close to a full tutorial on using AutoShapes, I have a few suggestions.

Customize your Drawing Toolbar

Before you even start thinking about using AutoShapes, you should put the most commonly-used items on the drawing toolbar. Space-permitting, I recommend these items as a minimum (some of them are there by default): Grid settings; Group, Ungroup, & Re-group; Mirror; Flip; Send to Front; Send to Back; Align Left, Center, Right, Top, Middle, Bottom; Fill On/Off; Line On/Off.

The way you use AutoShapes is to select the one you want, and click on it. When you do that, your cursor changes to this one: ┼. Click on your slide where you want to start drawing the AutoShape, and drag to draw it. That's pretty much all there is to it, but knowing a few additional techniques will make your life easier…

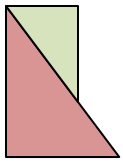
The Shift key is your friend

You'll notice there's quite a limited assortment of shapes, but by knowing how to use the Shift key, you can get some that aren't on the palette. For example, there's no equilateral triangle, but there is an isosceles triangle. You *could* choose isosceles triangle and drag the mouse until you have what *looks* like an equilateral triangle, but all you need to do is to hold down the Shift key as you drag, and the proportions will be constrained so that you have an equilateral triangle. In general, **the Shift key makes a regular polygon out of any polygon on the palette**.

Drawing lines

Since a line is not a polygon, what's the effect of the Shift key on the line AutoShape? If you depress the Shift key as you drag the mouse to draw a line, the line will be horizontal, vertical, or at an angle that's a multiple of 15°. This default of 15° cannot be changed, but is very useful information to remember.

Similar shapes



Another use of the Shift key is for creating similar shapes. Let's say you have a 3-4-5 right triangle, and you want to create a similar one and arrange them so their hypotenuses are tangent and vertices touching – like the 2 triangles to the right. Just copy & paste the first one, and when you re-size the copy, hold down the Shift key and drag until it's the size you want. Keeping the Shift key depressed will keep the original triangle's proportions, ***but*** it's important that you **release the mouse button *before* releasing the Shift key**. If you mistakenly release the Shift key first, just press Ctrl+Z (undo – ⌘+Z Mac), and try it again.

Snap to grid/Snap to shapes

When working with AutoShapes, you'll almost always want your grid setting set so that "Snap to grid" is not checked, and "Snap to shapes" (or "Snap to other objects") is checked. You'll find these in the Grid and Guides dialog. In PowerPoint 2003 click Draw > Grid and Guides. In PowerPoint 2004, click the  icon, then in the **Snap** flyout menu, make sure "To Grid" is not checked and "To Shape" is checked. In PowerPoint 2008, it's View > Guides > Snap to Grid & Snap to Shape. In PowerPoint 2007, find the Drawing group on the Home tab of the Ribbon. Click Arrange > Align > Grid Settings.

Equations and Graphs

Equations with Equation Editor & MathType

We have a full tutorial on our website that deals with *Using MathType with PowerPoint*. Although this tutorial doesn't specifically deal with Equation Editor, if you're using Equation Editor, you can still benefit from the tutorial. You can read this tutorial at www.dessci.com/ppt. Since the tutorial deals with all the issues involved in using equations in your slides, we won't handle that here. There are, however, two important equation-related issues that are important to mention.

1. Changing the size of equations

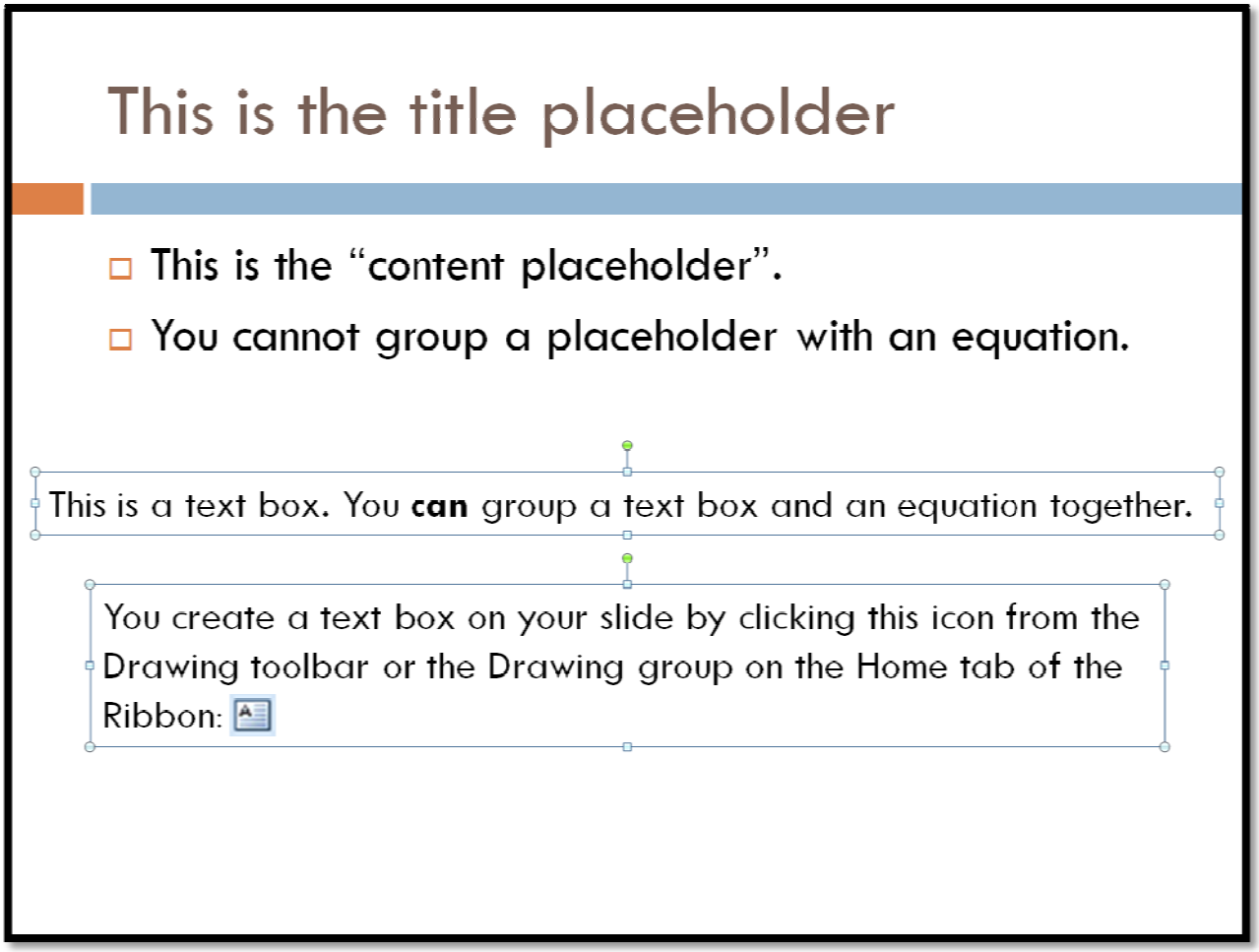
The *right* way to change the size of an equation is by going through the Size menu; the *wrong* way to do it is to drag the corner of an equation to make it larger. To do it the right way, click Size > Define, and set the Full size to be the same size as your text in PowerPoint. If you're using MathType, the remaining sizes will be defined as percentages of Full size, and you can leave them as they are. If you're using Equation Editor, you'll have to change this, but once you change it you can leave it set for both Word & PowerPoint. Set the Full size as described above. For the remaining sizes, Subscript/Superscript, Sub-Subscript/ Superscript, Symbol, and Sub-symbol, use these values: 58%, 42%, 150%, and 100%, respectively. (Be sure to type the % symbol.)

There are at least two reasons why dragging the corner of an equation is the wrong way to do it. First, if you do that, no two equations in your presentation will be exactly the same size, and none of them will be the same size as the text on your slide. You're using Equation Editor/MathType so that your presentation looks perfect; you're not using them so your presentation will look "good enough", so you might as well size your equations the right way. The second reason you shouldn't drag an equation's corner to resize it is because this will sometimes cause problems like reversed (mirror-image) equations, and you may not notice this until you're presenting the lesson to your class!

2. Grouping equations and text boxes

First, let's make sure we understand ourselves. The phrase "text box" refers to something very specific. It ***does not*** refer to the area in PowerPoint where you normally type your "bullet text". That area is called a "placeholder". If you want a text box on your slide, you must specifically insert one. See the screen shot on the next page. By "grouping", we mean selecting multiple objects on a slide and grouping them together so they act as one object (primarily for the purpose of animation).

Simple subject here: PowerPoint does not allow you to group a placeholder with any object, whether that object is an equation, clip art, or any other object. A text box, however, is treated just like any other object, and you can group it with an equation or any other object.



Adding graphs to your slides

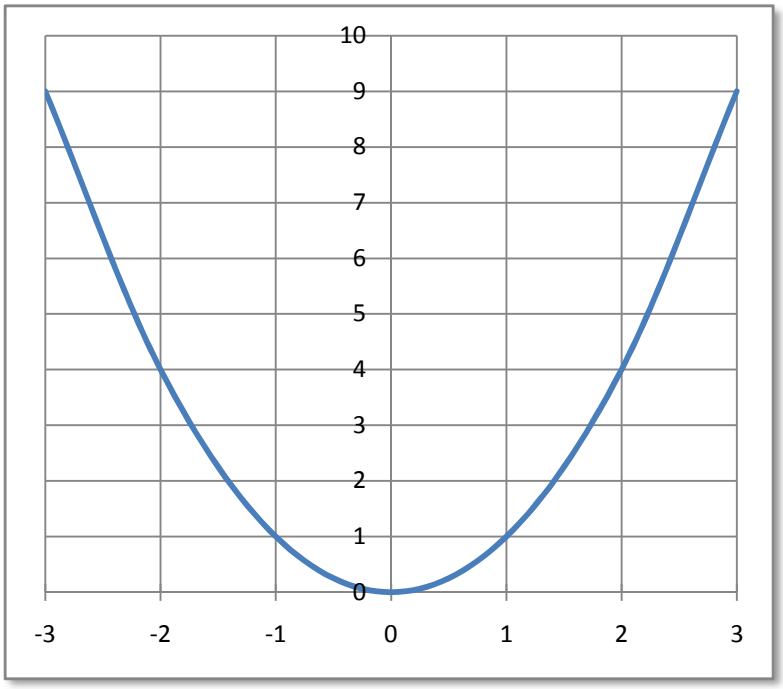
When it comes to graphs, you basically have 5 choices, three of which are worthy of consideration:

1. You can use what you've already got. Presumably you've got Microsoft Office if you're using PowerPoint, and you can create graphs with Excel and paste them into PowerPoint. If you're using a different office suite, such as Open Office or iWork, it's a sure bet you'll have a spreadsheet application as part of the suite, and you can create graphs with that.
2. You can use commercial software, such as Autograph.
3. You can use free software, such as WinPlot, GCalc, or Graph.
4. You could write your own graphing software.
5. You could sketch the graph by hand, scan it, and insert the scanned graph into PowerPoint.

We'll not even consider choices 4 and 5.

Using Excel or other spreadsheets

To get a usable graph from a spreadsheet, you'll need to enter an *x*-*y* table of values and create the graph from this table. Of course, the more inflection points your graph has, the more points you'll need to include in the table if you want a smooth graph. The next page shows such a graph with its corresponding table of values.



x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

Graph created with Excel, and the table of values used for the graph

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Using Autograph or other commercial software

Excel is adequate for simple graphs like the one above, but for more complex graphs or for special needs such as conic sections and other relations, you might want to consider Autograph ($165) or other commercial software.

Free software

Most of the time you get what you pay for, and many free software applications are simply stripped-down versions of products you'd normally have to pay money for. In the case of graphing software though, there are at least 3 really impressive and feature-packed free products: Winplot, GCalc, and Graph. The appendix to this handout gives the URLs where you can download these products.

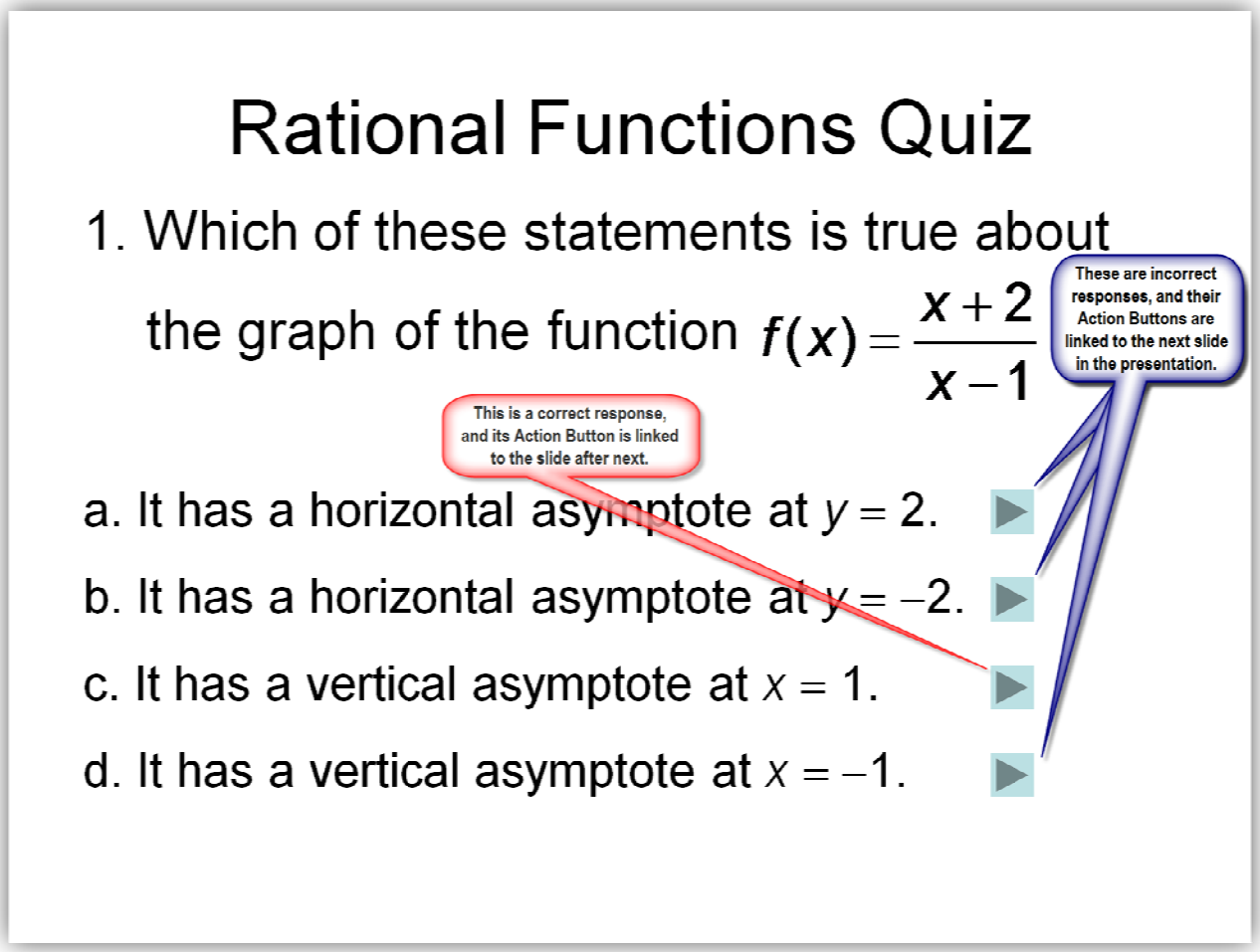
Interaction

Interaction is the key to producing things like educational games and quizzes with PowerPoint. Interaction is achieved by combining animation, action buttons, and action settings. Animation is a basic

PowerPoint feature, and although there are some really advanced ways to use animation, we'll not cover those techniques here.

Action buttons

Action Buttons are a special type of AutoShape. What's special about Action Buttons is that after you drag the mouse to "draw" the button, an "Action Settings" dialog appears, giving you a pretty good variety of options of things you can do when you click or hover the mouse pointer over the button during the presentation. You can do things like hyperlink to another slide in the current presentation, hyperlink to a slide in another presentation, run a program, open a file, play a sound or a movie, etc. Since we'll be creating quizzes, the most useful of these actions is hyperlink to another slide in the current presentation.



Actually, in this example, you don't *really* need Action Buttons for the incorrect responses since they just link to the next slide in the deck, and clicking anywhere on the slide will take you there. It's obvious why the buttons are there though—if they weren't there, it wouldn't take long for the students to figure out that the correct answer is the one with the Action Button! Of course if you want to, you can build the slides for the incorrect responses such that the slide explains why the response was incorrect. In that

case, you'd need one button linking to the next slide, one linking to the slide after that, etc. On the slides showing the correct and incorrect responses, whichever slide comes last won't need an action button.

See Appendix 2 for a discussion on how to use macros with action buttons.

You can also use Action Buttons to create games like Math Jeopardy and other games to enhance the lesson.

Design Principles

> "Making use of contrast can help you create a design in which one item is clearly dominant. This helps the viewer "get" the point of your design quickly."
>
> Garr Reynolds, *Presentation Zen*

Contrast

Effective use of contrast applies in so many elements of presentation design that it's impossible to cover them all here. There are two main ways you can be effective with contrast, one rather basic and one specific to math.

Design Template/Theme

If you choose a design template with a dark background, the lighter a color you can choose for your text, the better the contrast will be, and the more readable your slides will be. The opposite is true for templates with a light background. Keep in mind that some in your audience will most likely be colorblind (according to a recent study, about 10% of American adults are), and the better the contrast, the better they'll be able to read your slides, regardless of the colors you have chosen.

Focus attention on part of an equation with a contrasting color

This is something you can't do with Equation Editor, since it won't let you change color. With MathType though, you can change the color of your equations to match your text color in PowerPoint, and you can mix colors in a single equation if you'd like too. You don't want a rainbow, of course, but let's say for example you're discussing solving quadratic equations, and are teaching the value of the discriminant. You might have the quadratic formula in a dark blue color to match the color of your PowerPoint font, but your discriminant could be bright red, making it show up in stark contrast. Something to keep in mind here is the colorblindness issue. Individuals who are colorblind most often have trouble with red and green, so don't use color as the sole means of distinguishing part of an equation or expression.

> "Many people fail to make an effort to apply the alignment principle, which often results in elements being almost aligned but not quite. This may not seem like a big deal, but these kinds of slides look less sophisticated and overall less professional."
>
> Garr Reynolds, *Presentation Zen*

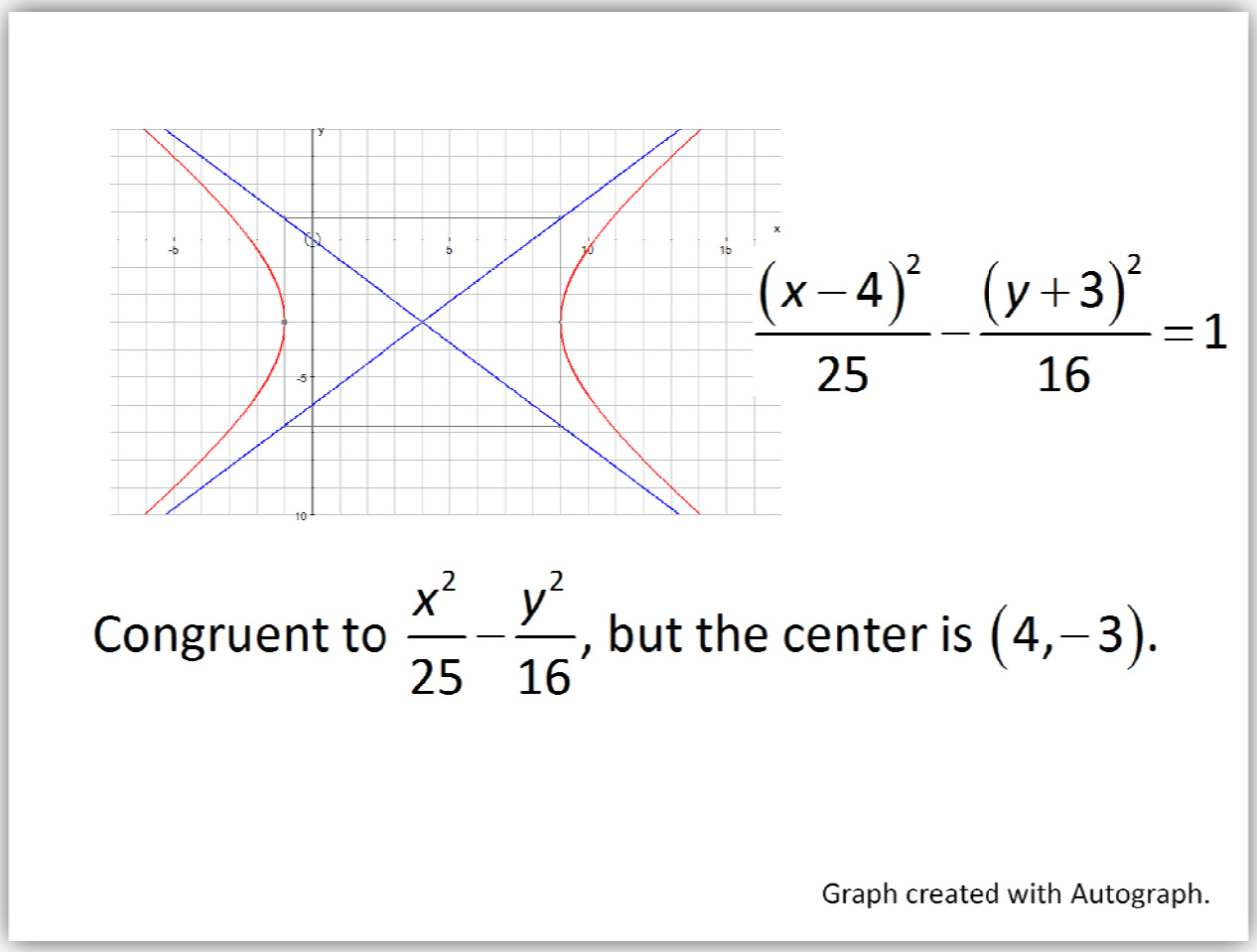
Alignment

With this issue too, there are too many aspects to consider in a short handout, but let's consider these…

Rule of Thirds

You're no doubt familiar with the Golden Ratio. Art, architecture, and even objects as simple as soda cans are often designed with Golden Ratio proportions in mind. The idea is that these properties make the object more aesthetically pleasing—at least on a subconscious level.

Closely related to, and derived from, the Golden Ratio is the Rule of Thirds. Very simply, divide your paper (or canvas, or camera viewfinder, or whatever) into thirds, both vertically and horizontally, and you'll have four "power points" (no pun intended, but it fits) at which to position the main subject for maximum effect. Most of the time in a math lesson, your PowerPoint slides will not lend themselves to this type of positioning, but at times it will be useful to keep in mind. Consider this slide …



This PowerPoint slide models the Rule of Thirds. The center of the hyperbola is at one of the "power points", the equation of the hyperbola is one-third down from the top of the slide, and the "congruent" statement is one-third up from the bottom of the slide.

Alignment of equations

Equation alignment is applicable to several different situations, but let's consider two: step-by-step processes, and systems of equations/inequalities.

Step-by-step processes

You've seen the textbooks that show step-by-step how to solve an equation, factor a polynomial, or something else requiring multiple steps. They usually have the steps on the left with an explanation on the right. The example slides on Page 8 of this handout don't show the *only* way to align items in this type of process, but it's arguably the *best* way to do it. By aligning the relational operators in the stack of equations, students can more easily compare one step with the previous one. Left-justifying the explanations at some point on the right half of the slide is more or less an aesthetic move, but also provides an extra measure of readability.

Systems of equations or inequalities

In a system of equations, it's necessary to compare one equation with another if you're going to solve them algebraically. Consider these examples:

$$\begin{cases} 3x+4y+z=17 \\ x+y=4 \\ 2x+3y+2z=15 \end{cases} \qquad \begin{cases} 3x+4y+\ z=17 \\ x+\ y\ \ =\ 4 \\ 2x+3y+2z=15 \end{cases}$$

Example 1 ***Example 2***

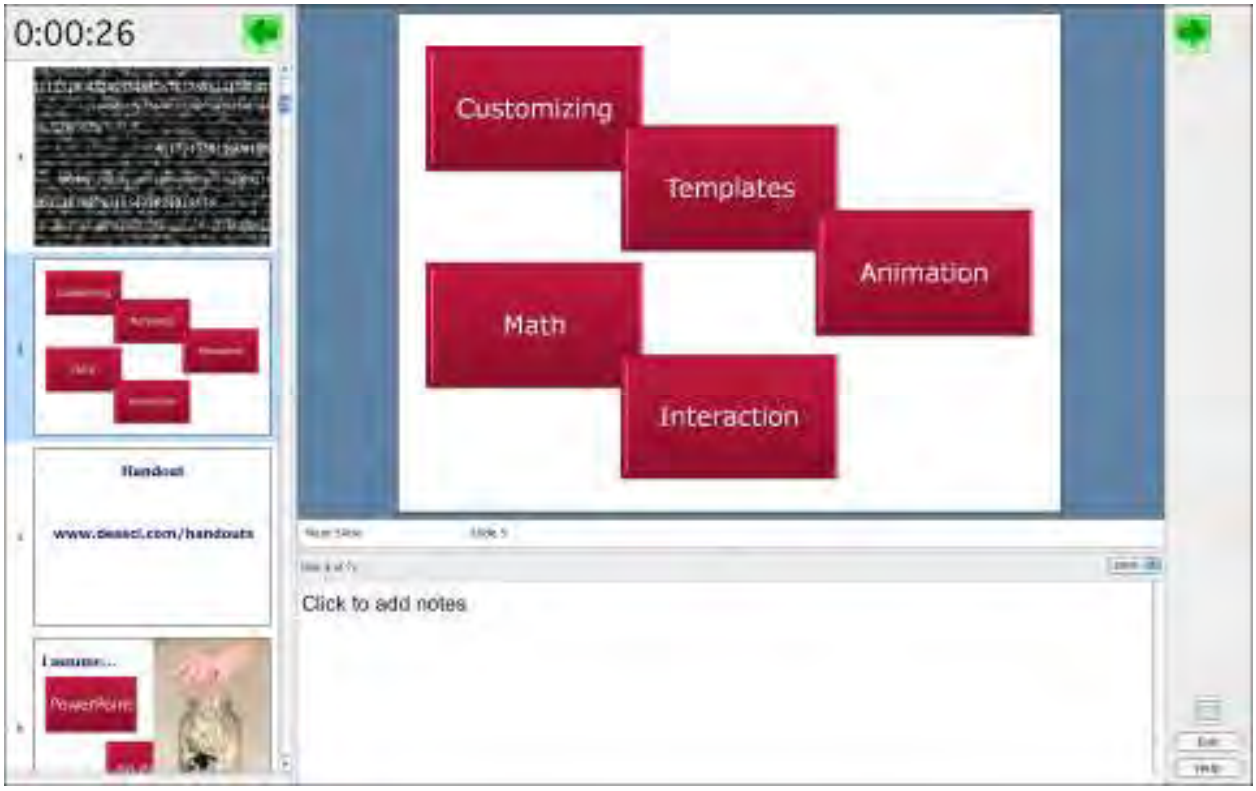
For someone proficient in solving such systems algebraically, it's no real challenge in either example to notice that a good first step would be to multiply the second equation by –3 or –4, or to multiply the first equation by –2. For someone not proficient in this type of solution, the first step is much easier to see if the equations are aligned as in Example 2.

Presenter View

PowerPoint has a very nice feature called Presenter View that I highly recommend. Presenter View is available both on Windows and Macintosh, and allows you to see a different display than what the students see. There will be some times when you won't use Presenter View – such as when you're not physically in front of your computer when you present the lesson – but it does provide some real advantages:

- You can see the last slide you presented, the current slide, and the next slide in the deck.
- In the Mac version, you can see the next animation.
- You can see the Notes Pane. This allows you to put less information on the slide itself, making for a cleaner slide, and allowing the students to focus their attention on you rather than trying to read gobs of text on the slide.

On the next page is a screen shot of Presenter View in PowerPoint 2004 on the Macintosh.



Turning Presenter View on and off

Turning Presenter View on and off on the Mac is no big deal; in Preferences > Displays, just uncheck the "Mirror displays" box. On Windows, it's more complicated. Select Control Panel > Display. In the Display Properties dialog, click on the Settings tab, click on the blue rectangle labeled **2**, and check the box labeled "Extend my Windows desktop onto this monitor". Click OK, and your monitors are ready for Presenter View. In PowerPoint, click Slide Show > Set Up Slide Show, and check the "Show Presenter View" checkbox. To turn off Presenter View, you don't need to reverse all of these steps, just uncheck the "Extend my Windows desktop" checkbox on the Display Properties dialog.

Conclusion

Presenting math lessons with PowerPoint presents some unique challenges, but general rules of good design practice will almost always apply. Keep your slides simple and well-organized, and your students will find it much easier to grasp the lesson's concepts because they won't have to read your slide and listen to you at the same time. Part of "keeping it simple" is using animation and sound only when it enhances the lesson; overuse of these will detract from the message you're trying to get across.

Just as you should always be on the lookout for better teaching methods, you should also be seeking to increase your proficiency with PowerPoint. The resources listed in the Appendix of this handout are a good place to start.

Appendix 1:

Resources for using PowerPoint as a math or science teacher

Websites

1. Design Science website:
   - Tutorial: *Using MathType with PowerPoint*: **www.dessci.com/ppt**
   - Tutorial: *Creating a PowerPoint Design Template*: **www.dessci.com/template**
2. Tutorials, tips, free templates: **www.indezine.com**
3. Tutorial: *PowerPoint in the Classroom* (not from Design Science): **www.actden.com/pp2003**
4. Free backgrounds & templates: **http://etc.usf.edu/presentations/index.html**
5. Pre-built PowerPoint lessons for Harcourt (gr. 3-5), McDougal Littell (6, Pre-Alg, Alg I, Alg II), Prentice Hall (Pre-Algebra & Algebra I): **www.MathSlideShow.com**

Software

1. Autograph: **www.autograph-math.com**
2. WinPlot: **www.peanutsoftware.com**
3. GCalc 3.1: **www.gcalc.net**
4. Graph 4.3: **www.padowan.dk/graph**
5. Clip art:
   - **http://school.discovery.com/clipart** (free)
   - **www.clipart.com** (**not** free)
   - **http://office.microsoft.com/clipart** (free)
   - **http://etc.usf.edu/clipart** (free)

Blogs & Newsletters

1. Design Science News: **http://designscience.typepad.com/news**
2. Teaching Math with Technology: **http://tcmtechnologyblog.blogspot.com**
3. PowerPoint Tips: **www.ellenfinkelstein.com/powerpoint_tips_blog.html**
4. Indezine: **www.indezine.com**
5. Presentation Zen: **www.presentationzen.com**

Books

1. *PowerPoint for Teachers*: **http://www.amazon.com/gp/product/078799717X**
2. *Cutting Edge PowerPoint for Dummies*: **http://www.amazon.com/gp/product/0764598171**

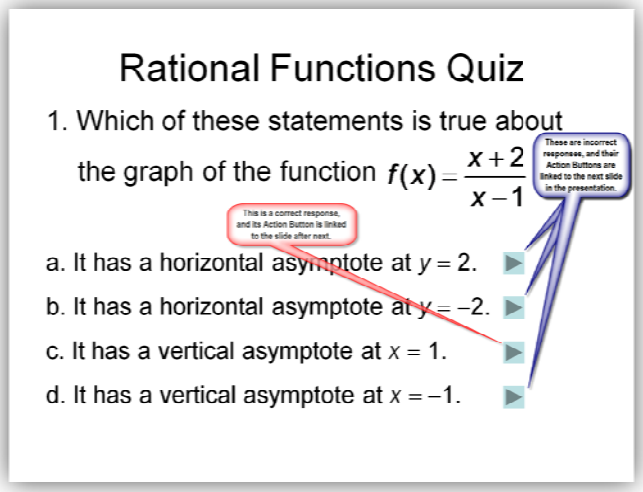
Miscellaneous

1. For more information about color: **www.colormatters.com**
2. Generate your own PowerPoint color schemes: **www.defencemechanism.com/color**
3. For more information about contrast & colorblindness: **www.vischeck.com**
4. Screen shots in this presentation created with Snagit: **www.techsmith.com**
5. Interactive and motion paths examples from this presentation:
   For PowerPoint 2007: **www.dessci.com/interactive07**
   For all other versions: **www.dessci.com/interactive**

Appendix 2:

Using macros with action buttons to create an interactive quiz (*not* PPT 2008)

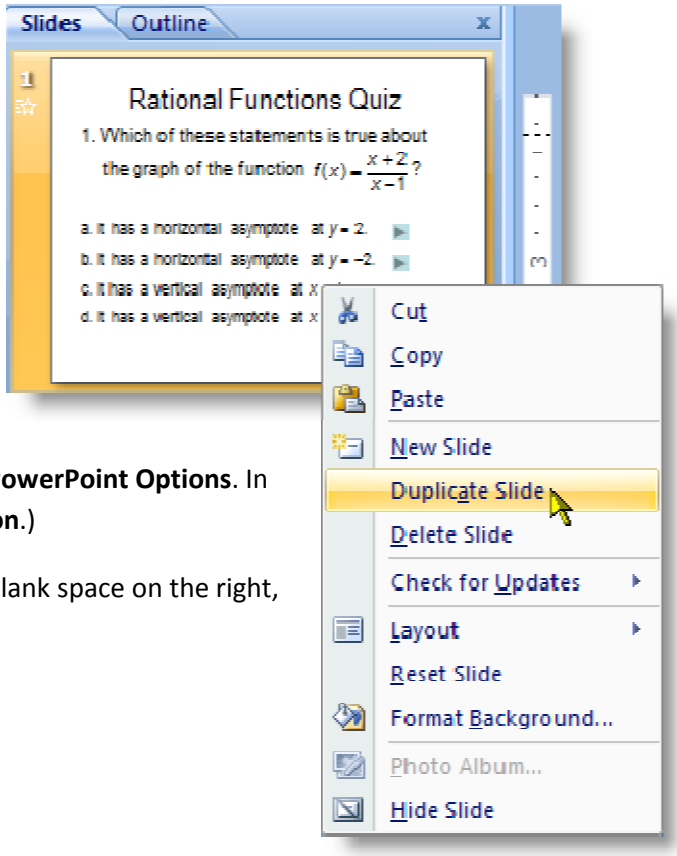
For this example, let's look at the same slide we used in the earlier discussion about action buttons:



Step 1: Create the question slides

The first step is to create the question slide, including not only the questions, but all of the responses as well. Create one action button for each of the responses, but don't assign an action to it yet. (When the Action Settings dialog appears, just click Cancel for now.)

It's a good idea now to create duplicates of this slide for however many questions you're going to have in the quiz. If you'll have 5 questions, create 4 duplicates. The easiest way to do that is to use the **Duplicate Slide** command. You can activate that command several ways, but the easiest way is to ***click on the slide*** in the **Slides Pane** (i.e., click on the **Slides** tab in the Slides/Outline Pane on the left side of the PowerPoint window), and use the shortcut key for **Duplicate Slide**. In Windows, the shortcut key is **Ctrl+D**, and on the Macintosh, it's ⇧⌘D. If you don't like shortcut keys, right-click (Mac ctrl+click) the slide and click on **Duplicate Slide**.



Step 2: Create macros

The reason this won't work with PowerPoint 2008 is because Microsoft didn't include Visual Basic for Applications (VBA) in Office 2008. If you're using PowerPoint 2004 (Macintosh), see specific instructions in Step 2a. Do this ***before*** following the steps below.

From the Tools menu, choose Macro > Visual Basic Editor. (PPT 2007, click on **Visual Basic** in the Code section of the Developer tab on the Ribbon. If your Developer tab isn't showing, click the **Office button**, then **PowerPoint Options**. In the **Popular** section, click **Show Developer tab in the Ribbon**.)

We'll start with the code for the wrong answer. In the big blank space on the right, type the following three lines:

```
Sub Wrong()
MsgBox ("Sorry, that's not right. Please try again.")
End Sub
```

If you make a mistake, the editor will warn you, but the message may not be clear to you. Most often the mistake is a result of mistyping the code. You may have left out one of the quotation marks or the closing parenthesis at the end of a line. Double-check your typing and make adjustments until the Editor shows no warnings.

Next is the code for the right answer. At the end of the line reading “End Sub,” press the ENTER key on your keyboard. This begins a new code group. Type the following four lines below your first code group:

```
Sub Right()
MsgBox ("That's right!")
SlideShowWindows(1).View.Next
End Sub
```

This code is similar to the previous macro, except for its “SlideShowWindows” line, which advances the quiz-taker to the next slide.

On the final slide, you don't want the slideshow to advance to the next slide because that starts the presentation all over again. Instead, you want viewers to use a button that exits the slideshow. So after the previous “End Sub,” hit the ENTER key again and type your final piece of code:

```
Sub RightLast()
MsgBox ("Congratulations!")
End Sub
```

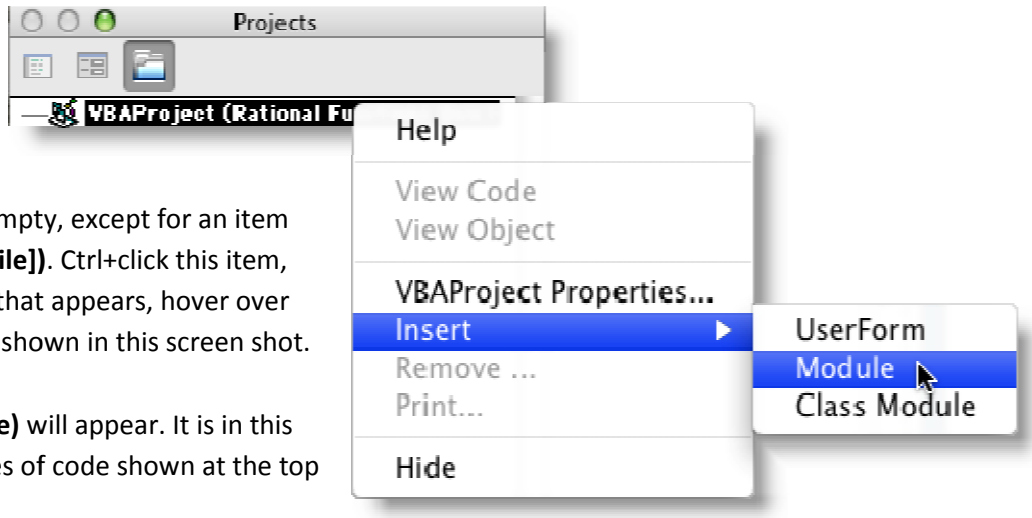
This is what your set of 3 macros will look like now:

```
Sub Wrong()
MsgBox ("Sorry, that's not right. Please try again.")
End Sub
Sub Right()
MsgBox ("That's right!")
SlideShowWindows(1).View.Next
End Sub
Sub RightLast()
MsgBox ("Congratulations!")
End Sub
```

Notice the 2 horizontal lines separating the 3 macros. This is something the Visual Basic Editor will include for you; you don’t need to add them yourself.

Step 2a: *If you're using PowerPoint 2004…*

From the Tools menu, choose Macro > Visual Basic Editor. Two new panes will open up—the **Projects** pane and the **Properties** pane. Both of these panes should be totally empty, except for an item labeled **VBAProject ([name of file])**. Ctrl+click this item, and from the contextual menu that appears, hover over Insert, then choose **Module**, as shown in this screen shot. A new window labeled **[name of file] – Module 1 (Code)** will appear. It is in this window that you'll type the lines of code shown at the top of the previous page.



Step 3: Attach macros to buttons

To return to PowerPoint from the Visual Basic Editor, click on the **View Microsoft PowerPoint** icon (upper left-hand corner, under the FILE or menu link). It's OK to leave the Visual Basic Editor open in the background. In PowerPoint, save the presentation, as this will save the new macros as well. (If you're using PowerPoint 2007, be sure to save with a .pptm extension.)

Go to your first question slide and select the action button with the correct answer. Right-click the button (Mac: ctrl+click) and choose **Action Settings** from the contextual menu (in PowerPoint 2007, choose **Hyperlink**). The Action Settings dialog box will appear. Choose the **Mouse Click** tab, and from the "Action on click" area, check the "Run macro" radio button and select your new "Right" macro from the drop-down list. (Notice that all the macros on this list are named for the three pieces of code you created in the Visual Basic Editor.) Click OK.

Now select each of the wrong answers and follow the same procedure, except select the "Wrong" macro from the drop-down list.

Before going on to the other slides to assign the proper macros, try out the buttons on the first slide. Start the slide show. (Convenient Windows keyboard shortcuts are **F5** to start the slide show from the beginning, or **Shift+F5** to start the slide show from the current slide.) Click on a wrong answer. A message box should pop up indicating you have chosen the wrong answer. Click OK to close the box. Check the other wrong answers on the slide to make sure they also work. Finally, select the correct answer. This time, the message box should indicate you have chosen the right answer. Click OK and the slide show will automatically advance to the next slide.

With the first slide working properly, edit the rest of the presentation, attaching the appropriate macros to the buttons. On the last slide, assign the correct answer to the "RightLast" macro so that quiz-takers stay on the last slide.

On your final quiz slide, you may want to create a button to end the slide show. Right-click on that button and choose **Action Settings** (PowerPoint 2007: **Hyperlink**). In the **Action Settings** dialog box, choose the **Hyperlink to** option and choose **End Show** from the drop-down list. Click OK. Quiz-takers can use this button when they're finished answering all the questions. Of course, if you're using this "quiz" as a pre-lesson warm-up, your whole lesson is yet to come, so you won't need an **End** button.

Once you have assigned macros to all of the action buttons, save the PowerPoint file.

---

*Much of the text in Appendix 2 is taken from Ellen Finkelstein's **PowerPoint Tips** website, and appears here with her permission. The URL for Ellen's website is shown in the **Blogs & Newsletters** section of Appendix 1. Much of Ellen's stuff is free, but two of her works are especially appropriate to mention here:*

- *101 Tips Every PowerPoint User Should Know – available from the website at* http://www.ellenfinkelstein.com/estore/101tips2003.html
- *PowerPoint for Teachers – a book available through Amazon.com and elsewhere. Amazon URL for this book is listed in the **Books** section of Appendix 1*

RCEM APPROACH

- This approach was developed by the Regional College of Education, Mysore, Karnataka, India.

- **RCEM consists of three aspects as follows :**
- **1. INPUT**
- **2. PROCESS**
- **3. OUTCOME**

RCEM-INPUT

- **Input refers to the objectives of the plan. They are known as expected behavoiural outcome. (EBO). They are clsiified into following categories :**

EBO

- 1. KNOWLEDGE.
- 2. UNDERSTANDING.
- 3. APPLICATION.
- 4. ACTIVITY.

RCEM-PROCESS

- The process refers to the teaching strategies. They are:
- Communication strategy.
- Instructional aids.
- Learning situation.
- Technique of motivation

RCEM-OUTCOME

- **Refers to the real learning outcome. This includes general and specific objectives.**

RCEM FORMAT-LESSON PLAN

- Name of the teacher :
- Name of the subject :
- Name of the topic :
- Name of the unit :

- Class/Group/Batch :
- Size of the class :
- Data & Time :
- Venue :
- Previous knowledge :
- Method of teaching :

- **AV aids :**
- **General objectives :**
    1.
    2.
- **Specific objectives :**
    1.
    2.
    3.

RCEM FORMAT

INSTRUCTIONAL OBJECTIVES	CONTENTS	TEACHING ACTIVITY	LEARNING ACTIVITY	EVALUATION
General & Specific objectives	•Intro •Aims •Presentation •Explanation •Summary •Assignment	•Explanation •Clarification	• Listening • Notes taking	•Recapitalization

Teacher's Handbook

CBSE has taken several initiatives towards qualitative improvement of education. Making every stakeholder- teacher, student, parent, principal, school management - feel responsible and a part of this improvement process is necessary. Simultaneously, it is felt that there should be a resource which contains all information related to each of these stakeholders at one place. With the focus on making students future-ready, it has been felt that in addition to being aware of the expectations from the teachers by the Board, our teachers must also be equipped with the information required by them regarding their learners and related to their career improvement and advancement. We believe that a well-informed teacher can do wonders in a classroom. The present Handbook for Teachers is a source of information to teachers for the procedures, policies, roles, responsibilities, awards and resources related to their professional life. Beginning from basic information about appointment and qualification, this Handbook also contains a range of information, such as, teacher self-evaluation framework, details about the board examinations, subjects offered, use of technology, disaster management procedures to be followed, awards that teacher may apply for, and several other important and much-needed information about CBSE policies in the matters involving teachers. It is expected that this handbook will answer most queries pertaining to the professional lives of teachers with regard to their association with the CBSE.

Textbook

Introduction

The mathematics text book is another important source for learning mathematics and it plays a key role in effective teaching and learning. Therefore it is important that these text books merely supplyinformation and facts, but also enable the student to understand and appreciate concepts and principles and their relevance in day to day life. A text book should stimulate reflective thinking and develop problem solving ability among students the text books should present real learning situations which are challenging and interesting for the students and should not render itself as a means of rote learning.

NEED AND IMPORTANCE OF A GOOD TEXT BOOK IN MATHEMATICS

A mathematics text book is very useful for a teacher in the following ways.

-

A text book is written according to the syllabus and gives the outline of the course. Therefore it helps the teacher to

decide about the limits and depth of the content to be presented to the students while teaching.

- • A text book provides insight to the teacher in planning lesson, in selecting the problems to be worked out, the methods of teaching to be adopted and the teaching aids to be used.
- • The logical and psychological sequence followed in a text book helps the teacher in presenting the subject matter in an orderly and systematic sequence
- • A good text book presents a variety of worked out examples on each topic. This helps the teacher in getting acquainted with different types of problems and the methods to solve them. This gives more self confidence while teaching
- • A text book save a lot of time for the teacher as he need not spend time to prepare problems and the solutions as they are readily available in the text books.

• A text book is an important aid for learning mathematics. It helps the pupils to relate what they are learning to life.

• It helps to foster the right study attitude among the students since the text book presents defined and concrete details in scientific and intensive manner which could arouse the students interest and curiosity.

• The well graded exercises provided after every topic in the text book help the teacher in assigning suitable homework and assignment to the student.

- • It encourages self study and independent work among the students.

- • The text book provides important source of materials for reviewing and recapitulating the lessons taught in the class.

  ## Conclusion

  " Few tools have been so misused as textbooks in teaching." It will be no exaggeration to say that text book have become ends in education. The teachers follow them blindly. They are read out loudly, para by para in the class by each of the pupils in turn; brief explanations and comments are given by the teachers, and

the entire matter covered is to be memorized by the pupils in the class as well as at home. The text book is valuable only when it is used properly. The text book should not be used as the only source of instructional material. It should be used as an aid in teaching, not a substitute for teaching.

QUALITIES OF A GOOD MATHEMATICS TEXTBOOK

1. The appearance of the textbook should be appealing with an attractive cover page.

2. The paper used in the textbook should be of superior quality.

3. The printing should be bold and easily readable.
4. The binding of the book should be strong and durable.

5. The price should be moderate.
6. It should have been written in accordance with the aims and objectives of teaching the subject in that particular class.

7. It should be prepared according to prescribed syllabus and every aspect of the syllabus should be adequately covered.
8.It should be written by qualified, experienced and competent teachers of mathematics or a committee of experts constituted for the purpose.
9. It should be written in simple and easily understandable language and the presentation should be within the grasp of the pupils.
10. The style and vocabulary used should be suitable to the age group of students for whom the book is written.
11. It should relate classroom learning to the real life needs and physical and social environments of the learners.

12. It should provide adequate opportunities to motivate the students to solve problems, by presenting an adequate number of worked out problems and problems that reflect daily life situations requiring the student to apply mathematical principles and formulae for their solution.

13. It should foster the right attitude towards self-study and self-reliance among pupils by suggesting project work, field work and laboratory work.

14. It should make provision for recapitulation of the subject taught in previous classes.

15. The new development and invention in the field of mathematics should find their place in the textbook.

16. It should facilitate the use of analytic, synthetic, inductive, deductive, problem-solving and heuristic approaches to teaching.

17. It should provide accurate and up-to-date content. It should organize the content in the increasing order of difficulty.

18. The content should have a direct, practical and social utility value.

19. It should carefully organize the subject matter with reference to the logical as well as the psychological considerations which make teaching effective.

20. The presentation of the subject matter must be attractive and interesting with appropriate illustrations in terms of

pictures, diagrams and figures. The diagrams used in the text book should be easily recognizable and geometric constructions should be in proportion to the measurements prescribed by the problem.

21. It should use the terms and symbols which are popular and internationally accepted. All the terms, concepts and principles used in the text should be clearly and accurately stated and defined.

22. It should provide for individual differences. It should meet the needs of students of varying abilities, interests and attitudes.

23. It should stimulate initiative and originality of the students. It should give well-graded exercises at the end of every topic to satisfy the needs of all types of students.

24. It should contain some difficulty problems or exercises to challenge the mathematically gifted students.

25. It should contain sufficient provision for revision, practice and review. It should satisfy the demands of examination.

UNIT 2 UNIT AND LESSON PLANNING

Structure

2.1 Introduction

2.2 Objectives

2.3 Unit Planning

- 2.3.1 Meaning of Unit Planning
- 2.3.2 Need and Importance of Unit Planning
- 2.3.3 Steps Involved in Unit Planning
- 2.3.4 Development of Unit Plan
- 2.3.5 Limitations of Unit Planning

2.4 Lesson Planning

- 2.4.1 Meaning of Lesson Planning
- 2.4.2 Need and Importance of Lesson Planning
- 2.4.3 Steps of Lesson Planning
- 2.4.4 Methods of Lesson Planning
- 2.4.5 Features of a Good Lesson Plan
- 2.4.6 Development of a Lesson Plan
- 2.4.7 Limitations of Lesson Planning

2.5 Let Us Sum Up

2.6 Unit-end Exercises

2.1 INTRODUCTION

You would agree that success of any activity depends largely upon its planning. Proper planning of activities leads to fruitful results. The same is true with teaching as well. As a teacher you are given charge of a certain class to teach mathematics. So you have to cover the given course in the available time span and also ensure effective learning amongst children. Now the challenge is to do it successfully. This very idea may generate thinking with regard to sequencing, ordering, arranging and grouping the items of the curriculum, matching these with the available time slot and identifying suitable activities to be performed with children etc. This is nothing but planning for teaching.

You may plan teaching in various ways. Firstly you may develop a rough layout for the whole year in which you may decide before and how much time you would devote to various topics or units in the curriculum. Secondly you may like to develop a detailed planning of the separate units of work where in you may decide the number of lessons for each segment of work along with the method or approach to deal with them. Thirdly you may like to go into details of activities pertaining to each lesson. So the planning for teaching involves the process of making decisions about why, how and what to teach which may range from one lesson to the whole curriculum for the year. In this unit we will discuss the various aspects of unit and lesson planning in mathematics.

2.2 OBJECTIVES

After going through this unit, you will be able to :

- recognize the need and Importance of unit and lesson planning;
- list various steps involved in unit planning;

- develop a unit plan for teaching of a given unit;
- enlist various steps of lesson planning; and
- develop lesson plans for teaching lessons in mathematics.

2.3 UNIT PLANNING

The curriculum of mathematics may be available to you in terms of either content/ concepts or competencies. Your target would, therefore, be to ensure acquisition of certain understanding and skills among children with regard to dealing with mathematical content and processes. In other words you may intend to develop mathematical competencies amongst children under your charge. You may recall that in the document titled, "Minimum Levels of Learning at Primary Stage" (Ministry of Human Resource Development report published by the NCERT, 1991) the necessary competencies have been listed under five major areas of mathematical learning. Further classwise arrangement of competencies is also available within each area. Since there would be a long list of competencies/ prescribed for each class unit planning may be of great help to you in guiding your actions leading to success. The following sub-sections cover the meaning of unit planning, need and importance of unit planning and the process of developing the unit plans.

2.3.1 Meaning of Unit Planning

Let us first understand what do we mean by a unit in mathematics. A unit in mathematics comprises of a chunk of interlinked competencies/concepts/content which have some common basis or characteristics. So, within any area of mathematical learning several units can be formed. It is the nature of competencies content and the experience of the teacher about teaching mathematics and his/ her perception of learning styles of children which will enable him/her to decide about formulating the units.

Now you will appreciate that teacher has to organize the given set of competencies/ content prescribed for the given class in a meaningful manner which will make his/her teaching and evaluation systematic and convenient. A unit in mathematics may be covered in one day, several days or even several weeks. You will have to decide the number of lessons to be delivered under one unit.

Having arranged the mathematical competencies in a graded manner and divided them into units for purposes of classroom transaction, you would like to think of the ways of communicating the same to the children. This will obviously make you think of the sequence of lessons within a unit, the method of teaching instructional aids, students' activities and the evaluation procedures. This decision if presented in an organized manner, would result into a unit plan.

2.3.2 Need and Importance of Unit Planning

You may like to ask why we need a unit plan or can't we do without a unit plan? The answer is simple that unit planning may bring about significant changes in the quality of teaching-learning. The following points highlight the advantages of unit planning and thus clarify how unit planning makes teachers talk easier and effective:

- It helps teachers to have a holistic view of teaching-learning, which may help in organizing time and resources available at his/her disposal.
- It helps in designing a systematic, sequential and graded arrangement of course content which may give insight to develop teaching activities in the best possible manner.

- It helps in giving a balanced emphasis to various aspects of course content or competency under reference.
- It provides an opportunity to correlate textual content with the competencies to be dealt with in the class.
- It may help thinking about alternative approaches to teaching-learning and adapt to individual differences.
- It may help unit-wise evaluation of children and in organizing remedial teaching and undertaking enrichment measures as per the requirements.

2.3.3 Steps Involved in Unit Planning

Unit planning involves two major processes, namely, sequencing and selection. The main focus of unit planning should be to ensure effective learning on the part of children. After arranging the given set of competencies/content into a teaching-learning sequence, a unit can be formed on the basis of identification of meaningful segments of competencies/content which may also be viewed in terms of time available for teaching-learning. Some people divide the course content to be covered month-wise and call them 'units'. Still more important is the nature of course content or competencies and, as such, some units may be small and some big in terms of time taken for teaching them. So a teacher has to apply judgment. Since we can not leave the whole thing on intuitive ways of formulating units, some steps to be followed are suggested below:

a) Estimate the whole course content/set of competencies for the class during the year.

b) Estimate the teaching time available to the teachers.

c) Arrange the given course content /set of competencies in a teaching-learning sequence.

d) Identify inter-linked aspects of course content /competencies.

e) Distribute the whole course content/competencies into units. Hence you may like to consider the following:

   i) A unit should not be too small or too lengthy.

   ii) It should have some element of commonness within its components.

   iii) It should be such that it should not require more than a month in any case to complete in the class, and

   iv) It should be such that its completion develops a sense of accomplishment to both the teacher and the students.

f) For each listed unit, further breaking up of teaching lessons would be required.

g) For each lesson within the unit, decide about the appropriate teaching methods, teaching aids, students activities and the evaluation procedure.

h) Present these decisions and the break-up in a tabular form which may be considered to be unit plan.

2.3.4 Development of Unit Plan

Development of unit plan may be attempted differently by different people. But the development of competency among children should be the main point to be kept in mind while developing a unit plan. One way of looking at unit planning could be to do it area wise the number of competencies listed in each area for a class which are to be taught in about ten months duration. So theoretically speaking,

there should be at least five units, each concentrating on one of the areas. But it will not be a practical way of doing things since there may be a large number of competencies in an area. So further break-up would be necessary. Although it should not be taken as the norm but for practical reasons there should not be more than 10 competencies in an area and it should not be planned to be taught in more than 20 working days. The similarity in the nature of content involved in competencies identified for a unit should also be given due consideration. Now various lessons may be planned within a unit and points related to organization of teaching-learning may be drawn as suggested. The following example of a unit plan may give you an idea of the format and particulars of a unit plan :

UNIT PLAN

Unit Plan No..... Name of the Teacher.....

Subject - Mathematics

Area - 1 (understanding whole numbers and numerals)

Competencies Covered: 1.3.1 (Recognition and writing of numerals from 100 to 1000.)

1.3.2 (Writing of number names from 1 to 100.)

S. No.	Competency	Lesson No.	Method of Teaching	Teaching aids	Students Activies	Evaluation
1.	1.3.1. (a) Recognizes numerals from 100 to 999	1 to 3	Play way method and demonstration	Flash cards	Various games and group work	Oral testing
	(b) Recognizes numeral 1000	3	–do–	–do–	–do–	–do–
	(c) Writes numerals from 100 to 1000	4	–do–	–do–	Individual and group activities	Oral as well as written
2.	1.3.2 Writing of number names from 1 to 1000	5 and 6	–do–	–do–	–do–	Oral and written test

2.3.5 Limitations of Unit Planning

While unit planning is of much value to teachers it may suffer from the limitations mentioned below:

- It is sometimes difficult to clearly anticipate the teaching-learning approach in advance.
- The division of content / competencies is artificial.
- It gives a piecemeal view of the competencies developed during a year.
- I requires a conscious effort on the part of a teacher. A less experienced teacher sometimes find it difficult to plan units.
- It puts a check to the flexibility of the teacher when followed rigidly.

Check Your Progress

Notes: a) Write your answers in the space given below.

b) Compare your answer with the one given at the end of this unit.

1. What is a Unit Plan?

.....

.....

.....

2. State briefly how unit planning is helpful to teachers.

.....

.....

.....

3. Mention two limitations of unit planning.

.....

.....

2.4 LESSON PLANNING

According to G.H. Green, the teacher who has planned his/her lesson wisely, related to his/her topic and to his classroom without any anxiety is ready to embark with confidence upon a job s/he understands and is prepared to carry it to a workable conclusion. S/he has foreseen the difficulties that are likely to arise and prepared her/himself to deal with them. S/he knows the aims that her/his lesson is intended to fulfill and s/he has identified her/his own resources for the purpose. And because s/he is free of anxiety, s/he will be able to estimate the value of her/his work as the lesson proceeds, equally aware of failure and success and prepared to learn from both. The following paragraphs have been devoted to the meaning, need and importance of lesson planning and the process of developing lesson plans.

A proper planning of the lesson is the key to effective teaching. The teacher must know in advance the subject matter and the mode of its delivery in the classroom. This gives the teacher an idea of how to develop the key concepts and how to correlate them to real-life situations and how to conclude the lesson. Lesson planning is also essential because effective learning takes place only if the subject matter is presented in an integrated and correlated manner and is related to the pupil's environment. Though lesson planning requires hard work it is rewarding too. It conceives a lesson as 'Plan of Action' implemented by the teacher in the classroom.

2.4.1 Meaning of Lesson Planning

A lesson plan outlines in detail the various steps which the teacher proposes to undertake in his/ her class. As such, a lesson plan concerns itself with the teaching of one period. Planning for a lesson means identification of the sequence and style of presentation and evaluation procedure to be adopted for classroom teaching of a lesson. Hence it is a proposition in advance which establishes a linkage between the why, what and how of teaching in one period. While attempting to do this the teacher may foresee likely problems in classroom communication and may arrange certain materials and decide about techniques to be adopted to ensure a smooth and effective teaching-learning situation. Thus a lesson plan is a means of taking advance decisions about the selection, sequencing and execution of various activities to be performed in a classroom with a view to ensuring learning of children.

2.4.2 Need and Importance of Lesson Planning

When you go for teaching a lesson in the classroom, usually you get prepared for it, though informally. But sometimes you find that you are not able to teach the entire content which you prepared or on the other hand, the content to be covered is not sufficient for full period. Sometime, you may get stuck-up while teaching and so get nervous. May be that you are not aware of the objectives of teaching a lesson and so did not bother about its attainment. How to overcome all such problems? This can be done through systematic lesson planning. You get a chance of thinking about all these problems in advance while planning your lesson and deciding about taking corrective steps for possible hurdles. The process of developing a lesson plan is such that these problems get tackled automatically.

Lesson planning helps the teacher in the following ways:

- It makes teaching systematic and well organized.
- It helps teachers in identifying adequate content and its proper sequencing for teaching a lesson.
- It helps teachers to learn to foresee and tackle learning difficulties of children.
- It enables teachers to utilize the available time properly.
- It helps in developing insights about learning needs and abilities of children.
- It helps teachers to develop the habit of undertaking immediate corrective measures.
- It gives confidence to teachers during teaching.

2.4.3 Steps of Lesson Planning

While developing a lesson plan, first of all you have to decide about the objectives of teaching that particular lesson. The objectives will be both general as well as specific. In order to achieve the objectives, some subject matter or content is required. This content is to be selected as per the competence with reference to the specific objectives of the lesson as well as the previous knowledge of the learner. So the content has to be local specific, interesting and related to the previous knowledge of the learner. Another important aspect of lesson planning is to detail out the method to be used for transacting the required material to the learners. The choice of method will depend on the nature of the content, the class/grade as well as the ability of the learners. While specifying the method of delivery, the teachers' activities as well as the learners' activities are to be specified along with the evaluation exercises/questions. The evaluation has to be based on the material transacted in the classroom and the competency aimed to be developed. At the primary stage, the evaluation questions have to be very simple, keeping in view the learners' physical and mental growth.

The following issues need to be decided for developing a lesson plan.

1. **Objectives:** The objectives of teaching a particular lesson should be stated as per the competency to be developed amongst children. Generally teachers state only general and specific objectives of the lesson.
2. **Content:** The subject matter that is intended to be covered should be limited to the prescribed time. The matter must be interesting and it should be related to the pupils' previous knowledge. It should also be related to daily life situations.
3. **Methods:** The most appropriate method be chosen by the teacher. The method selected, should be suitable to the subject matter to be taught. Suitable teaching aids must also be identified by the teacher. The teacher may also use supplementary aids to make his/her lesson more effective.

4. **Evaluation:** A teacher must evaluate his/her lesson to find the extent to which he/she has achieved the objectives of his/her lesson. Evaluation can be done even by recapitulation of subject matter through suitable questions.

2.4.4 Methods of Lesson Planning

A lesson may be planned in various ways. Several methods have, therefore, been evolved. The most commonly used method is the Herbertian method. The steps followed in Herbertian method of lesson planning are:

1. Introduction
2. Presentation
3. Association (or comparison)
4. Generalization
5. Application
6. Recapitulation, and
7. Home assignment / home work

1. Introduction

It pertains to preparing and motivating children to the lesson content by linking it to the previous knowledge of the student, by arousing the curiosity of the children and by making an appeal to their senses. This prepares the child's mind to receive new knowledge. This step, though so important, must be brief. It may involve testing of previous knowledge of the child. Sometimes the curiosity of pupil can be aroused by some experiment, chart, model study or even by some useful discussion.

2. Presentation

It involves stating the object of the lesson and exposure of students to new information. The actual lesson begins and both teacher and students participate. A teacher should make use of different teaching aids to make this lesson effective. She/He should draw as much as is possible from the students making use of judicious questions. In mathematics lessons It is desirable that a heuristic atmosphere prevails in the class.

3. Association

It is always desirable that new ideas or knowledge be associated to the daily life situations by citing suitable examples and by drawing comparisons with the related concepts. This step is all the more important when we are establishing principles or generalizing definitions.

4. Generalization

In mathematics lessons generally the learning material problem leads to certain generalizations which then lead to the establishment of certain formulae, solving problems, principles and laws. An effort should be made that the students draw the conclusions themselves. A teacher should guide the students only if their generalization is either incomplete or irrelevant.

5. Application

In this step of a lesson plan the knowledge gained is applied to certain situations. This step is in conformity with the general desire of the students to make use of generalization in order to see for themselves if the generalizations are valid in certain situations or not. This is used for assessing the effectiveness of the lesson by asking students questions on the contents of the lesson.

6. Recapitulation

Recapitulation can be done by giving a short objective type test/problem solving method to the class.

One important point to remember is that the steps given above for lesson planning are formal Herbertian steps and teacher should not try to follow these very rigidly. These are only guide-lines and in many lessons it is not possible to follow all these steps. So this method should be followed to the extent possible.

2.4.5 Features of a Good Lesson Plan

1. Through lesson planning the teacher will be able to pinpoint for himself the objectives of teaching that particular lesson. The objectives should be such that they are : (a) attainable during a span of one period only. (b) in sequence with the objectives already attained by the learners.
2. The teacher will discover whether the subject matter is adequate enough to be transacted during the period.
3. He will identify, in advance, the activities to be carried out by the learners.
4. He will be able to anticipate the expected answers of the learners.
5. A good lesson plan should present good linkage between the objectives, teacher and student activities, on the one hand and the method, the teaching aid and the evaluation items on the other.
6. The plan should neither be too short nor too long.
7. It should focus on specific piece of content so as to attain the competency in hand.
8. The activities planned should be quite interesting to the young learners.
9. It should focus on the development of a clear understanding among children instead of rote memorization.

2.4.6 Development of a Lesson Plan

Keeping in view the steps of lesson planning and the methods discussed in the preceding sections, lesson plans may be developed. The following examples will demonstrate some approaches to lesson planning. You may learn to develop lesson plans by adapting these to the competency in hand and the anticipated teaching-learning situation.

LESSON PLAN - 1

Name of School : XYZ — Date: 10/8/2002

Class : III

Subject : Mathematics — Period: II

Topic : Place value of 3 digit numbers — Competency: Students state the place value of the digits within a 3 digit numeral.

General objectives of the lesson : To develop understanding of the place value of the digits in numerals.

Specific objectives of the lesson : Students will be able to state place value of the digits within a 3 digit numeral.

Teaching/Instructional material :
- ordinary classroom material.

- spike abacus.
- a chart showing 3 digit numbers marked as units, tens and hundreds.
- flash card containing 3 digit numbers.

Previous knowledge : i) Students recognize and write numbers 1 to 1000

ii) Students state the place value of digits in a 2 digit number.

iii) Students write number names of 3 digit numbers.

Introduction

Teacher will put some questions to the students:
(Writing a few two digit numbers on the blackboard.)

1. What are the numbers written on the blackboard?

   24, 40, 39

2. In 24, which number represents units?
3. In 24, which number represents tens?
4. What is the place value of numeral 4 in 24.
5. What is the place value of numeral 2 in 24?
   (Teacher may ask similar questions for the numerals 40 and 39.)
6. What is the place value of 2 in 246.
   (Writing number 246 on the blackboard.) (No answer)

Statement of aim: Children, today we will study the place value of numerals in a 3 digit numbers.

Teacher-Pupil Activity

(Showing the flash card containing 3 digit numbers.)

1. What numeral is shown on the flash card ?
2. Write the number name for this number (246)

   (Two Hundred Forty Six)

   (Covering the numeral 2)
3. What is the numeral left now?

   (Forty Six)

   (Showing the flash card again)
4. What numeral is there on the third place from right side?

   (2)

   (Asking to compare the numerals by reading their number names 246 and 46.)
5. What additional you had to say for 246 as compared to 46?

(So you have to say two hundred because of the numerals 2's placement at 3rd place from the right. Hence the place value of 2 in 246 is 200.)

Teacher will now take 3-4 examples of 3 digit numbers and get the place value chart filled in with the involvement of students.

3 digit Numerals	Place values					
	Hundreds		Tens		Units	
	Numeral	Place Value	Numeral	Place Value	Numeral	Place Value
246	2	200	4	40	6	6
759	7	700	5	50	9	9
483	4	400	8	80	3	3
908	9	900	0	00	8	8

The chart will be further discussed using flash cards if children find it difficult. Another explanatory chart can be developed through students involvement as under:

3 digit Numerals	Place value								
	3rd place from right			2nd place from right			1st place from right		
	Numeral	Place	Place value	Numeral	Place	Place value	Numeral	Place	Place value
785	7	Hundred	7×100=700	8	Tens	8×10=80	5	Unit	5×1=5
462	4	Hundred	4×100=400	6	Tens	6×10=60	2	Unit	2×1=2
407	4	Hundred	4×100=400	0	Tens	0×10=00	7	Unit	7×1=7
370	3	Hundred	3×100=300	7	Tens	7×10=70	0	Unit	0×1=0

Generalization

Teacher to assist children in generalizing, on the basis of above examples, the following:

i) Place value of the digit in 1st place from right side is the number represented by the digit itself.

ii) Place value of the digit in 2nd place from right side is the digit multiplied by 10.

iii) Place value of the digit in 3rd place from right side is the digit multiplied by 100.

iv) The place value of the digit in a numeral increases ten times as we move from right to left.

Place value of 2 in 12 is 2 × 1

in 24 is 2 × 10

in 247 is 2 × 100

Recapitulation

1. What is the place value of 3 in 138?

   (30)

2. What is the place value of 3 in 13?

   (3)

3. What is the place value of 3 in 347?

   (300)

4. State the place values of numerals in 754.

Numeral	Place value
7	700
5	50
4	4

Home Work

State the place values of the digits in the following 3 digit numerals 393, 408, 790, 456.

LESSON PLAN – 2

Name of School: XYZ — Date: 10/1/98

Class: V — Duration: 40 Minutes

Subject: Mathematics — Period: Third

Topic: Volume of cuboid

Competency: Students compute the volume of a cuboid.

General objective of the lesson: To develop the thinking and reasoning powers of the students.

Specific objectives:
i) Students understand the concept of volume.
ii) Students find the formula of the volume of cuboid.
iii) Students apply the formula of the volume of cuboid to relevant problems.

Teaching/Instructional Material

1. Ordinary classroom materials
2. One dm cube of wood or any solid material
3. A chart showing diagrams of square and rectangle
4. Two cuboids with different dimensions
5. A tin of cuboidal shape
6. A graduated cylinder
7. One centimeter cube piece of some solid

Previous Knowledge

The students know the concept of areas of square and rectangle.

Introduction

To test their previous knowledge and to prepare them for the new lessons, the following questions will be put to them:

1. (By showing the diagram of a square in the chart)
   How do you calculate the area of this diagram?
2. (By showing the diagram of a rectangle)
   How will you calculate the area of this diagram?
3. (By showing the tin)
   If you have to say that this tin can contain so much oil, how can you express?
4. Similarly, if you want to say that a tank can contain so much of water, how can you express?
5. What is the space of a tin or a tank?
6. (By showing the cuboid)
   How would you name this solid?
7. How will you find out the space or volume of this cuboid?

Statement of the Aim

The student will not be able to answer the last question and the teacher will announce. "Today we shall find out the method of calculating the volume of a cuboid". The aim will be simultaneously written on the blackboard.

Presentation

Teacher - Pupil Activity	
1. By showing the 1 cm. cube. (Long, broad and thick)	1. What are the dimensions of the solid? 2. What is its shape? 3. What is the difference between a cube and a cuboid ? Pupil- Teacher Statements: "It is known as a cube. The cube has all the three dimensions uniform, whereas in the cuboid these may be different." 4. What is the volume of this cube? Pupil-Teacher Statement: "Let us measure it with the help of a graduated cylinder" The initial reading of the water level will be taken and then the solid will be immersed. The water will rise by one cubic centimetre.
By showing the 1 cm. cube	5. What are the dimensions of this cube? Ans.: Length = 1 cm Breadth = 1 cm Thickness or Height = 1 cm 6. What is the volume of this cube? Ans. : It is one cubic centimetre (One cubic centimeter is taken as the units of volume).

By showing the cuboid of soap

7. What are the dimensions of this cuboid?
   Ans: Length = 5 cm
   Breadth = 3 cm
   Thickness or Height = 2 cm
8. In how many parts have its length, breadth and thickness respectively been divided?
   Ans.: i) The length is divided into 5 parts.
   ii) The breadth is divided into 3 parts.
   iii) The thickness is divided into 2 parts.
   (The teacher will promptly cut this cuboid alongwith lines of division. It will result into 30 parts.).....(i)
9. What is the shape of each small part?
   Ans.: It is cube.
10. What is the dimensions of this small cube?
    Ans.: Length = 1 cm
    Breadth = 1 cm
    Thickness = 1 cm
11. What is the volume of this small cube?
    Ans.: It is one cubic cm
    This cube will be compared with the cuboid already shown to the students.
12. What is the volume of the whole cuboid?
    Ans. : The volume of the cuobid = 30 cubic cm.....(ii)

By showing the second cuboid of soap

13. What are the dimensions of the cuboid?
    Ans.: Length = 6 cm
    Breadth = 4cm
    Thickness or Height = 2 cm
    (Similarly it will result in 48 small parts)..... (iii)
14. What is the volume of one small cube?
    Ans.: It is one cubic cm.
15. How many such cubes are there in all?
    Ans.: There are 48 such cubes.
16. What is the volume of the whole cuboid?
    Ans.: The volume of the cuboid is 48 cubic cm ..... (iv)

Generalization

For the purpose of generalization, the teacher will draw the student's attention to the parts (i), (ii), (iii) and (iv) and will ask them to observe these to find out some relationship between the dimensions and the volumes of cuboids.

1.	What are the dimensions in the first case?	Length = 5 cm Breadth = 3 cm Height or thickness = 2 cm
2.	What is the volume in this case?	Volume = 30 cubic cm.
3.	What are the dimensions in the second case?	Length = 6 cm Breadth = 4 cm Height or Thickness = 2 cm
4.	What is the volume in this case?	Volume = 48 cubic cm.
5.	What is the relation between the volume and dimensions?	Volume is the product of these three dimensions.

Dimension of Cuboid			Volume of Cuboid
Length	Breadth	Height	
5 cm	3 cm	2 cm	5 × 3 × 2 = 30 cu.cm
6 cm	4 cm	2 cm	6 × 4 × 2 = 48 cu.cm
L	B	H	L × B × H

There Volume of Cuboid = Length × Breadth × Height or Thickness or L × B × H or T.

Blackboard Summary

1. The cuboid has all the three dimensions:
   a) Length
   b) Breadth
   c) Height or Thickness
2. Volume of a cuboid
   = Length × Length × Height or Thickness

Relation

1. What is the use of finding out the volume of air in a room?

Ans : While sitting in a room the person should get a regular supply of fresh air. The minimum essential volume of air should be available to everybody. With the help of total volume of air in a room, a classroom or a hall, we can fix its comfortable seating capacity. If we try to accommodate more than this fixed number, this will be uncomfortable and suffocating for every body.

Recapitulation

1. What do you mean by volume?
2. What is the difference between a cube and a cuboid?
3. What is the formula for the volume of a cuboid?
4. What is the need of finding out volume in different cases?

Home Work

1. What is the volume of air in your classroom, if its dimensions are as follows:
   a) Length = 5 Metres
   b) Breadth = 4 Metres
   c) Height = 3.5 Metres

2. Find the volume of water in a tank if its dimensions are as follows:

   a) Length = 350 cm.

   b) Breadth = 200 cm.

   c) Depth = 100 cm.

The examples given above will help you develop insights into the process and procedure of lesson planning. You may plan your activities in a variety of ways wherein children should be able to learn things in an interesting manner.

2.4.7 Limitations of Lesson Planning

You would have seen that lesson planning provides an opportunity to the teacher to think in advance about the sequence of likely classroom events and anticipate the possible problems and sort them out before the actual delivery of the lesson. Yet lesson planning has its own limitations. A few are mentioned below:

- It makes teaching organized but rigid.
- If followed strictly, it leaves no room for innovativeness on the part of the teacher.
- Too much of emphasis on it may make things routinized.
- It is good for beginner teachers. Experienced teachers usually have little faith in structured classroom behaviours.
- It is difficult to anticipate all possible kinds of classroom situations in advance and therefore lesson plans lack relevance.

The above mentioned limitations however, do not suggest that lesson planning is of no value. The only caution reflected through the above statements is that it should be developed carefully and experience counts for much. It may be noted that detailed lesson planning may be practiced in the beginning and brief lesson planning should serve as an indispensable tool in the hands of a teacher throughout his/her career as a teacher.

Check Your Progress

Notes: a) Write your answers in the space given below.

b) Compare your answer with the one given at the end of this unit.

4. What is a Lesson Plan?

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.....

5. Mention three ways in which lesson planning helps the teachers.

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.....

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6. Mention two limitations of lesson planning.

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2.5 LET US SUM UP

After going through the preceding sections you would be able to appreciate the need and importance of unit and lesson planning and also the methodology of developing unit and lesson plans. Unit and Lesson Plans do help teachers in organizing their actions in advance and help them undertake teaching in an interesting and efficient manner. If planned properly, unit and lesson plans may lead to better quality of learning amongst children. It is, therefore, important for every teacher to develop a habit of unit and lesson planning and keep doing it throughout his/her teaching career. Greater details may be required in the beginning while brief plans may be followed there after.

2.6 UNIT-END EXERCISES

1. Explain the difference between a unit and a lesson plan.
2. List the important steps of unit planning.
3. List the important steps of lesson planning.
4. Discuss the advantage and limitations of lesson planning.

ANSWERS TO CHECK YOUR PROGRESS

1. A unit plan is the statement of proposed decisions taken about teaching-learning and evaluation of a segment of inter-linked content/competencies.
2. • systematic and balanced way of teaching various concepts,
   • evaluating pupils progress, and
   • the proper management of time and resources.
3. i) The division of content /competencies is artificial.
   ii) It may put a check on flexibility of teachers if followed rigidly.
4. Lesson plan is a detailed statement of proposed actions with regard to classroom activity particularly the selection, sequencing and execution of activities to be performed during a period to ensure learning amongst children.
5. i) It helps teachers to identify the relevant content and its sequencing.
   ii) It helps teachers to foresee the learning difficulties of children.
   iii) It helps to develop confidence amongst teachers.
6. i) It brings rigidity in teaching-learning.
   ii) It leaves no room for teacher's innovativeness