2. **Nature of the instrument or the scale by which intelligence is measured:** In measuring a piece of cloth we use scales made up of absolute units. For measuring temperature of the body we use thermometers having degrees as units of measurement. In such measurement, we use scales made up of absolute units and the instruments give somewhat reliable and valid results. But in case of intelligence measurement we don't have such scales. Here, as Griffith observes "the standard of measurement is the group of performance." (1933, p. 138)

Therefore, when we measure intelligence of an individual with the help of an intelligence test we try to interpret the resulting score in the light of norms established (group performance) by the author of the test. In this way, one's intelligence is determined relatively to the classified group to which he belongs. So, while in the case of a piece of cloth absolute measurement is possible, in case of intelligence measurement we have relative measurement.

With the difference in the nature of measuring instruments, we can observe that while measuring a piece of cloth or body temperature, it is quite convenient to use the relevant measuring instruments for providing reliable and valid measures intelligence tests can not be used in such a way. In addition of giving a relative measurement of one's intelligence, the administration as well as interpretation of these tests require sufficient competency, skill and labour on the part of the examiner.

In this way, we can see the measurement of intelligence is not such a simple, definite, reliable and valid task as the measurement of a piece of cloth or the temperature of a body.

CONCEPT OF MENTAL AGE (M.A.) AND INTELLIGENCE QUOTIENT (I.Q.)

As we have already used the term 'mental age' and 'I.Q.' in the interpretation of intelligence test results, it is worth knowing something about them as well.

Mental age. The term mental age was first used by Binet. Its concept can be clarified with the help of the following example.

Suppose there is a test comprising 100 questions (like Jalota's test) and the majority of the subjects, whose age is 13 years 6 months, answer successfully 48 questions, then an individual who earns a score, 48, regardless of his chronological age, will be said to have a mental age of 13 years 6 months.

Intelligence Quotient (I.Q.) This term was initiated by the German psychologist William Stern and put into wide practice by Terman. It appeared to Stern that if a child was 6 years old (chronologically), but could do what an 8 years old normally does he would be 8/6 or 1.33 as bright as the average. And in this way, he made the ratio M.A./C.A., measure of the rate of mental development of an individual. The ratio was given the name of Intelligence Quotient (I.Q.). To do away with the decimal point, the ratio was a gain multiplied by 100 and thus the formula to calculate I.Q. is:

$$\text{I.Q.} = \frac{\text{Mental Age (M.A.)}}{\text{Chronological Age (C.A.)}} \times 100 \text{ (as used in Standard Binet Scale)}$$

or,

$$\text{I.Q.} = \frac{\text{Attained or actual score}}{\text{Expected mean score for age}} \times 100 \text{ (as used by Weschsler)}$$

Classification of I.Q.

By making use of the formula of I.Q. by Stem, Terman tried to classify the individuals into certain specific categories on the basis of the data collected through the administration of his intelligence tests for terming them average, below average and above average as given below:

I.Q.	*Level of Intelligence*
140 and above	Gifted or Genius
120–140	Very Superior
110–120	Superior
90–110	Normal or Average
75–90	Border Line and Dull
50–75	Morons
25–50	Imbeciles
Below 25	Idiots

However, as far as the classification based on the intelligence tests suitable to the Indian conditions is concerned, the following one presented by professor Uday Shankar may work well.

I.Q.	*Level of Intelligence*
140 and above	Genius
125–140	Very Superior
110–125	Superior
90–110	Average
75–90	Border Line and Dull
50–75	Morons or Feeble minded
25–50	Imbeciles
Below 25	Idiots

The Constancy of I.Q.

As mentioned earlier, intelligence grows till the age of 16 or 18 years, but I.Q. for most of the individuals remains constant. Primarily I.Q. provides a ratio for knowing how bright an individual is as compared with others of his own age.

Actually, it is an index which is independent not only of the particular score that an individual makes on a particular scale but also of the particular age at which he happens to make it. It is thus a measure which acquaints us with the relative brightness of intellectual possibilities of an individual more or less permanently (see Fig. 22.6).

It is true that an individual grows in intelligence but the whole group (the other individuals of his own age) also grows at the same rate. Thus I.Q., a measure of defining relative brightness or intellectual possibilities of an individual, remains practically constant. Under ordinary circumstances (accident or disease exempted), an individual's I.Q. is supposed to remain constant throughout his life or at least throughout the age limits covered by the scale. This property of I.Q. is referred to as constancy of I.Q. by psychologists.

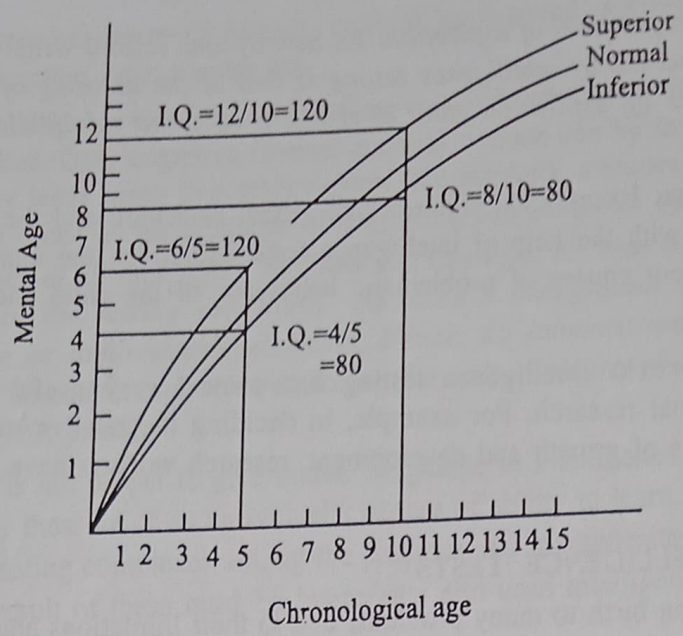

Fig. 22.6 Hypothetical growth curves which give a constant I.Q. (From H.E. Garrett's and M.R. Shneck, 1933)

Uses and Limitations of Intelligence Tests

Intelligence tests have their advantage as well as drawbacks. Below we list them one by one.

Uses of Intelligence Tests

1. **For the purpose of selection.** Intelligence tests are often used for the purpose of making selection of the suitable candidates for activities like—
   (i) admission in a particular course of instruction.
   (ii) deciding the cases of scholarships.
   (iii) choosing candidates for assigning some specific responsibilities.
   (iv) selecting candidates for participation in various co-curricular activities etc.

2. **For the purpose of classification.** Intelligence tests help the teacher classify the students as bright, dull or average and put them in homogeneous groups in order to bring efficiency in the teaching-learning process.

3. **For the purpose of promotion.** Intelligence tests can prove as one of the useful instruments in promoting the individuals not only in educational fields but in all other occupational and social situations where one studies to go higher on the ladder.

4. **For knowing one's potentiality.** Intelligence tests help in revealing the potentialities of an individual and thus make possible the predication of one's success in a particular field. The knowledge of such potentiality helps the teacher in the following ways :
   (i) ***Giving guidance.*** Teacher or a guidance personal can give guidance to the pupils in the selection of various courses of instruction and occupations.
   (ii) ***Helps in learning process.*** Teacher can plan teaching-learning activities with the help of this knowledge. *"Results of intelligence tests"* as Crow and Crow write, *"can help a teacher to discover what the child can learn and how quickly he can learn as well as the teaching methods that should be applied and the learning content that should be utilized to guide the learner to use his mental potentialities to their utmost."* (1973, p. 160)

(iii) ***To establish a proper level of aspiration.*** As Sawrey and Telford write. *"One of the most important ends served by intelligence testing is that of the assisting of the individual to establish a level of aspiration that is realistic in terms of intellectual potential."* (1964, p. 484).

5. For diagnostic purpose. Exceptional children like gifted, backward and the mentally retarded children can be detected with the help of intelligence tests. Moreover, the intelligence tests help in the diagnosis of the root causes of problematic behaviour of the child and likewise suggest possible remedies.

6. Helps in Research work. Intelligence testing has proved very useful in psychological, sociological and educational research. For example, in deciding the relative role of heredity and environment in the process of growth and development, research workers have made much use of intelligence testing.

Limitations of Intelligence Tests

Intelligence tests have given birth to many problems due to their limitations and shortcomings. We can list them as follows:

1. Intelligence tests and students. Intelligence tests label some students as superior and the others as inferiors. This type of knowledge creates many problems. Children who are slightly dull are still intelligent enough to realize through the results of the intelligence tests that they are slow to learn. It makes them disappointed and causes inferiority feelings and ultimately mars their future. On the other hand, students with a slight more I.Q. may become overconfident. There is every possibility that these students may not then give serious attention to their work. Also the consciousness of their superiority may result in misbehaviour on their part and can turn them into problem children.

2. Intelligence tests and teacher. Teachers, after knowing the I.Q. of the child, make a permanent opinion about the child's potentialities and abilities. They try to see him through his I.Q. They leave no attempt to discourage or create overconfidence in the students according to the level of their intelligence announced by their tests. Moreover, knowledge of the intelligence of the pupils for a teacher may result in slackness on his part. He may put the entire responsibility of a pupil's failure on his inferior intelligence and not care for a bright pupil thinking that he would be able to learn on his own. In this way, the knowledge of intelligence supplied by these may bring disastrous results to the teacher.

3. Given birth to Segregation and conflicts. Intelligence test results have been misused to uphold the theory of royal blood, segregation and sectarian outlook. In U.S.A., it has led to a conflict between the Negro and the white populations. The conflict, in actual sense, is the result of misconception about the predictive value of these tests and their correlation with hereditary factors. In defence, we can put forward the following points:

(a) No intelligence tests, including the most refined performance tests, can be claimed to be completely free of practice or coaching effects and independent of cultural, social, racial and other environment factors. Hence, they cannot be claimed as a measure of initial mental abilities and capacities of the individual and therefore it is quite unfair to deny or uphold the right of admission or job opportunities to the people on the basis of these tests. Now the contemporary researches in this direction have proved that intelligence tests results always favour healthy environmental conditions like improved sanitation, family

atmosphere, education of parents, cultural background, socio-economic conditions and better education opportunities etc.

(b) In fact, intelligence test helps in knowing very little about the total make-up of the child's potentialities. Only cognitive (mental actions) domain can be said to be touched by these tests. They leave many important aspects like interests, attitudes, motives etc. Hence they cannot be relied as the predictor of the future success of an individual.

(c) *"The results of all such tests,"* as Crow and Crow put it, *"may be effected by many factors inherent in the testing conditions, the child's background of experience and other favourable or unfavourable elements. Hence, no administrator, teacher or student of education should accept test results as the only measure of an individual's ability to learn."* (1973, p. 60)

In this way, it is not proper to give undue weightage to intelligence tests. They should not be accepted as the only measure of an individual's degree of ability to learn. They should not be made an instrument of creating complexes among the students and misunderstanding among the teachers. In a nut-shell, the result of these must be interpreted and used intelligently. They should be taken as the means and not the end in themselves.

SUMMARY

Intelligence may be considered as a sort of mental energy, an aggregate or global mental capacity of an individual for helping him in coping with his environment in terms of adaptation and dealing with novel situations as effectively as possible. It has many established facts regarding its nature like—(i) the distribution of intelligence in the population follows the properties of the normal distribution, (ii) It is a joint product of heredity and environment (iii) Differences in sex, race or culture do not create differences in intelligence etc.

Theories of intelligence try to explain the structural composition of our intelligence by pointing out specifically its different components or factors. *Unitary theory*, the oldest theory in this regard, for example holds that intelligence consists of only one single factor, i.e. simply a fund of intellectual competency which is universal for all the activities of the individual. Quite contrary to this, *multifactor theory* insists that one's intelligence consists of numerous separate elements or factors, each one being a minute part or component of an intellectual activity. *Spearman's two factor theory* asserts that there are two types of factors working in one's intelligence namely, the general intelligence (common to all the different cognitive tasks) and specific intelligence (quite specific to a specific task).

The group factor theory advocates that our intellectual activities can be categorized into certain specific groups and each of these groups is governed by a special type of intelligence component known as a group factor. Thurstone and his associates (the main propagator of the theory) have pointed out 9 such group factors as the constituents of one's intelligence. *Thomson's sampling theory* tries to provide an eclectic approach by giving place to general intelligence 'g', specific intelligence 's' and group factor 'G' in one's intelligence. *Vernon's hierarchical theory* put forward a hierarchical structure for explaining the structural composition of one's intelligence in the shape of factor 'G' representing an overall intelligence of an individual branching into two major group factors and various specific factors. *Gulford's theory* put forward by J.P. Guilford and his associates lay down a model of intellect involving three interrelated basic parameters — operations, contents and products for explaining the structural composition of human intelligence.

Measurement of intelligence is not possible in the same way as we measure a piece of cloth or the body temperature. However, it can be well assessed with the help of some or the other intelligence tests categorized as individual and group tests involving the use of verbal and non-verbal test material. In individual tests, we test one individual at a time but in group tests a group of individuals can be tested at a given time. In all these individual as well as group tests, we either try to make use of the verbal material, i.e. language, or non-verbal material for testing the intellectual level of our students. Performance tests are a typical example of such non-verbal (language-free) tests where we try to test the intelligence of a student on the basis of his performance in some intellectual tasks.

The concept of mental age and I.Q. is put into use for interpreting the raw scores earned on an intelligence test. The term 'mental age' coined by Binet stands for the mental level of a child against the level which is normal for the majority of children of his age. For the computation of I.Q., we make use of the formula I.Q. = Mental age / Chronological age multiplied by 100.

The data collected after administration of the intelligence tests have helped the psychologists to classify individuals into certain specific categories of average, below average and above average intelligence. It has helped us in the diagnosis and identification of gifted, backward and mentally sub-normal children among a particular group or population.

The results derived on the basis of I.Q. measurement have revealed one of its unique characteristics named as "the constancy of I.Q.". It postulates that I.Q., a measure of defining relative brightness or the intellectual possibilities of an individual, remain practically constant throughout his life or at least throughout the age limits covered by the scale (test utilized for measuring one's I.Q.).

Intelligence tests have their advantages as well as drawbacks. These can be properly utilized for the purpose of selection, classification, promotion, diagnosis and assessment of one's potentiality, besides being used in the task of guidance, counseling and research work. However, the results of these tests can also be misused by the students in perpetuating a number of complexes (inferiority or superiority), fears and disappointment etc. They may also colour the viewpoints of the teachers towards their students and give birth to many types of segregations and conflicts in the society.

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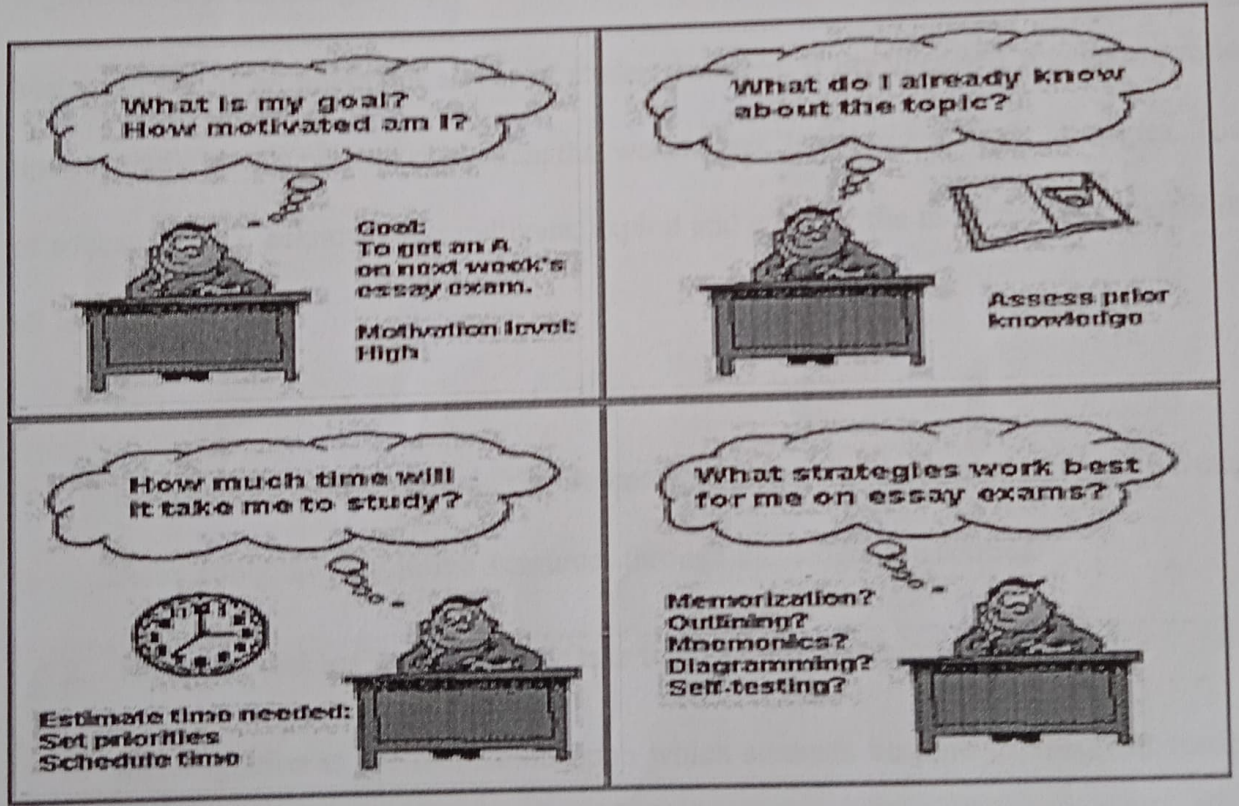
METACOGNITION

The term metacognition has its orgin from the Greek word meta and the Latin word cognito. Meta means higher or beyond, and cognition means thinking. Hence by derivation, metacognition means thinking higher or thinking beyond. That is think beyond the normal process of thinking. Metacognition is "cognition about cognition", "thinking about thinking", or "knowing about knowing". The term metacognition is introduced by Flavell in 1979. It includes knowledge about when and how to use particular strategies for learning or for problem solving.

Metacognition refers to higher order thinking which involves active control over the cognitive processes engaged in learning. Activities such as planning how to approach a given learning task, monitoring comprehension, and evaluating progress toward the completion of a task are **metacognitive** in nature.



Definition

- **Flavel,** *" metacognition is an individual's knowledge of their own cognitive processes and their ability to control these processes by organizing, monitoring, and modifying them as a function of learning."*
- **Everson.** *" metacognition is the awareness individuals have of their own mental processes and the subsequent ability to monitor, regulate, and direct themselves to a desired end."*
- **Mayer,** *" metacognition is the knowledge and awareness of one's own cognitive processes."*
- **Martinez** *" metacognition is the monitoring and control of thought."*

Significances of matacognition

Metacognition is an important aspect of student learning, It involves self regulation, reflection upon an individual's performance strengths, weaknesses, learning and study strategies. The task of educators is to acknowledge, cultivate, exploit and enhance the metacognitive capabilities of all learners.

1. Metacognition plays a critical role in successful learning, it is important to study metacognitive activity and development to determine how students can be taught to better apply their cognitive resources through metacognitive control.
2. This is the process where students take the control of learning.
3. Metacognition is the foundation upon which students become independent readers and writers

4. It motivates the learner.
5. It helps the learner to advance in a planned manner in his learning activities.
6. It reduces mental fatigue, helps the learner in effective memorization and longer retention.
7. It helps the learner to set priorities, manage time and effective utilization of resources.
8. It helps the learner to gain confidence and become more independent as learners.
9. It helps the learners to monitor and direct their own learning processes
10. It helps the learner to become a person who has learned to learn.

Metacognition is classified into three components/ factors of metacognition:

1. *Metacognitive knowledge* (also called metacognitive awareness) is what individuals know about themselves and others as cognitive processors.
2. *Metacognitive regulation* is the regulation of cognition and learning experiences through a set of activities that help people control their learning.
3. *Metacognitive experiences* are those experiences that have something to do with the current, on-going cognitive endeavor.

Metacognitive strategies for successful learning

Strategies for promoting metacognition include self-questioning (e.g, what do I already know about this topic? How have I solved problems like this before?), thinking aloud by performing the task, and making graphic representations(e.g, concept maps, flow charts, semantic webs) of one's thoughts and knowledge. Normally three levels of metacognitive strategies can be adopted for effective learning. They are

1. Awareness:

    a) Consciously identify what you already know
    b) Define the learning goal
    c) Consider personal resources
    d) Consider the task requirements
    e) Determine how your performance will be evaluated
    f) Consider your motivation level
    g) Determine your level of anxiety

2. Planning:

    a) Estimate the time required to complete the task
    b) Plan study time into your schedule and set priorities
    c) Make a check list of what needs to happen when
    d) Organize materials
    e) Take the necessary steps to learn by using strategies like outlining, mnemonics, diagramming etc.

3. Monitoring and reflection

    a) Reflect on learning process, keeping track of what works and what doesn't work for you
    b) Monitor your own learning by questioning and self-testing
    c) Provide your own feedback
    d) Keep concentration and motivation high

Chapter 18

Creativity

INTRODUCTION

The Almighty God, the creator of the universe, is the supreme-mind who possesses the finest creative abilities. He has created all of us and all that is revealed in nature. We are elevated to be called His creation. According to Indian philosophy, we are constituents of the Supreme Power as the rays of the sun are the constituents parts of their creator, the sun. Therefore, every one of us ought to possess creative abilities—and has these abilities. Every one of us is a unique creation, but does not possess the same creative ability as his pears. Some of us are endowed with high creative talents and contribute to advancement in the fields of art, literature, science, business, teaching and other spheres of human activity, and are responsible for propounding new ideas and bringing about social and cultural changes. Mahatma Gandhi, Abraham Lincoln, Homi Bhabha, Newton, Shakespeare, Leonardo da Vinci were some of the creative individuals who left their mark in their chosen fields. Though they were undoubtedly gifted with creative abilities, the role of environment in terms of education, training and opportunities in their development cannot be ignored.

Good education, proper care and provision of opportunities for creative expression inspire, stimulate and sharpen the creative mind, and it is in this sphere, that parents, society and teachers make a significant contribution. They are required to help the children in nourishing and utilizing their creative abilities to the utmost. The educational process, therefore, should be aimed at developing creative abilities among children. This can be achieved by acquainting the teachers and parents with the real meaning of the creative process and the ways and means of developing and nurturing creativity.

DEFINING CREATIVITY

The terms 'creativity' or 'creative process' have been defined in many ways. Some of these definitions are as follows:

Stagner and Karwoski (1973):

> Creativity implies the production of a 'totally or partially' novel identity.

Drevdahl (1956):

> Creativity is the capacity of a person to produce compositions, products or ideas which are essentially new or novel and previously unknown to the producer.

Bartlett (1958):

> Creativity is an adventurous thinking or a getting away from the main track, breaking out of the mould, being open to experience and permitting one thing to lead to another.

Spearman (1931):

> Creativity is the power of the human mind to create new contents by transforming relations and thereby generating new correlates.

Wallach and Kogan (1965):

> Creativity lies in producing more associations, and in producing more that are unique.

David Ausubel (1963):

> Creativity is a generalized constellation of intellectual abilities, personality variables and problem-solving traits.

M.J. Levin (1978):

> Creativity is the ability to discover new solutions to problems or to produce new ideas, inventions or works of art. It is a special form of thinking, a way of viewing the world and interacting with it in a manner different from that of the general population.

Paplia and Olds (1987):

> Creativity is the ability to see things in a new and unusual light, to see problems that no one else may even realize exist, and then to come up with new, unusual, and effective solutions.

Wilson, Guilford and Christensen (1974):

> The creative process is any process by which something new is produced—an idea or an object including a new form or arrangement of old elements. The new creation must contribute to the solution of some problems.

Stein (1974):

> Creativity is a process which results in novel work that is accepted as tenable to useful or satisfying to a group of people at some point in time.

There seems, however, to be considerable lack of agreement among these scholars regarding the true nature and concept of creativity—its process as well as its product. Some of them consider it to be purely a function of the mind, a component of the congnitive behaviour while Ausuble and others maintain it to be an attribute of the person as a whole involving his total behaviour and functioning of his whole personality. Some like Stein use a cultural frame of reference and opine that besides being novel, a creative product must be useful from the cultural and social angles while yet others view it in a personal frame and hold that:

> a product may be a creative one if it is new or novel to the individual involved, if it is his creation, if it is expressive of himself rather than dictated by someone else. It need to neither useful nor unique. Its social recognition and cultural impact may be zero, but if it is a unique personal experience, it is creative (Maslow, 1970 quoted by Telford & Sawrey, 1977).

By assigning the characteristic of "a unique personal experience" to the creative product, the scope has been so widened as to include any novel idea or thing including the rearrangement or reshaping of already existing and known ones. The definitions given above have considered creativity both as a process and a product, the thought as well as its result, but the central, essential condition of novelty or newness in the creation has not been overlooked by any one. By incorporating all these viewpoints, we may describe *creativity as the capacity or ability of an individual to create, discover, or produce a new or novel idea or object, including the rearrangement or reshaping of what is already known to him which proves to be a unique personal experience.*

Nature and Characteristics of Creativity

Creativity as a unique and novel personal experience, and on the basis of the experiences and findings of the various scholars, may be said to possess the following characteristics:

Creativity is universal. Creativity is not confined to any individual, groups of individuals, caste, colour or creed. It is universal and is not bound by the barriers of age, location or culture. Everyone of us possesses and is capable of demonstrating creativity to some degree.

Creativity is innate as well as acquired. Although many research findings and incidents favour the suggestion that creativity is a God-given gift and natural endowment, the influence of cultural background, experiences, education and training in the nurturing of creativity cannot be ruled out. Therefore, one's creativity may be correctly said to be a function of natural endowment as well as its nurturing.

Creativity produces something new or novel. Creativity denotes the ability of a person to produce something new or novel, but this novelty or newness does not necessarily imply the production of a totally new idea or object which has never been experienced or has never existed before. To make a fresh and novel combination of existing separate elements or to reshape or rearrange the already known facts and principles or to reform or modify previously known techniques, are as much acts of creative expression as the discovery of a new element in chemistry or a new formula in mathematics. The only precondition for naming an expression as creative is that it should not be repetition or reproduction of what has already been experienced or learned by an individual.

Creativity is adventurous and open thinking. Creativity is a departure from the stereotyped, rigid and closed thinking. It encourages and demands complete freedom to accept and express the multiplicity of responses, choices and lines of action. It is a kind of adventurous thinking, calling a person to come out in the open to express himself according to his will and to function unrestricted by routine or previous practice.

Creativity is a means as well as end in itself. Creativity as an urge inspires and persuades the individual to create something unique and thus acts as an impetus

for expression. This creative expression proves to be a source of joy and satisfaction to the creator. No one other than the creator can experience the warmth, happiness and satisfaction which he receives through his creation. Creation is a source of happiness and a reward in itself. The creator expresses himself as fully as possible through his creation and has his own perceptions about his creation. It is, therefore, not essential that a creative work would arouse the same feelings or give the same joy and satisfaction in others as is experienced by the creator himself.

Creativity carries ego involvement. There is complete involvement of one's ego in the creative expression. One's individuality and identity are totally merged in one's creation. One's style of functioning, philosophy of life and personality may be clearly reflected in his creation be it a work of art, or a piece of writing, etc. The creator takes pride in his creation and hence makes ego involved statements like, "it is my creation", "I have solved this problem", "it is my idea", etc.

Creativity has a wide scope. Creative expression is not restricted by any limits or boundaries. It covers all fields and activities of human life, in any of which one is able to demonstrate creativity by expressing or producing a new idea or object. It is not restricted to scientific inventions and discoveries or the production of works of art but covers multifarious human accomplishments like the composition of poems; writing of stories and plays, performance in the fields of dance, music, painting, sculpture, political and social leadership, business, teaching and other professions as also the mundane activities of daily life.

Creativity and intelligence do not necessarily go hand-in-hand. Research findings and observations have demonstrated that there is no positive correlation between creativity and intelligence. One is not the essential or necessary prerequisite of the other. Those found scoring high on intelligence tests may demonstrate little or no signs of creativity whereas individuals performing poorly in intelligence tests may sometimes create something very original.

Taking a consolidated view of the researches conducted on this issue, we may conclude that although intelligence and the creativity component of one's personality can function independently, a certain minimum level of intelligence is a necessary precondition for successful creative expression. Were it not so, a person of below average mental ability like a moron or an idiot could also be creative; but in actual-life situations we hardly come across any such instances. Conversely, although creative people generally tend to be relatively intelligent, beyond a certain level, a higher I.Q. does not necessarily predict creativity. In other words, as Kitano and Kirby (1986) state: "*an individual can be extremely bright but uncreative, or highly creative but not necessarily intellectually gifted*". Therefore, no clear relationship has been seen to exist between intelligence and creativity.

Creativity rests more on divergent thinking than on covergent thinking. Divergent thinking involves a broad scanning operation, enabling a person to evolve a general multiple possible solution and hence it is put into use when one is confronted with a problem which has many possible solutions. (Convergent

thinking, on the other hand, requires a narrowing process leading the individual to pin point the one most appropriate solution or response.) It is involved with situations, which require the production of only one correct solution or answer as for example, a multiple-choice test.

Divergent thinking has been considered to be more characteristic of highly creative individuals rather than of those not rated as being highly creative. That is why, in the tests designed to test creativity one is required to list as many uses as possible for some common article such as a knife or a brick, provide as many solutions of a problem as possible, give as many innovative combinations as possible, etc. Tests of this kind, requiring divergent thinking are, therefore, scored for divergence, i.e. the number, diversity and uniqueness of the responses and not for the convergent outcomes in the form of one single correct answer as is usually done in tests of intelligence.

Creativity cannot be separated from intelligence. In spite of the fact that intelligence or creativity may function independently and creativity involves more of divergent thinking as opposed to the convergent thinking employed in the demonstration of intelligence, it is not possible to entirely separate creativity from intelligence. This is because thinking is neither purely divergent nor purely convergent and always has elements of both which are simultaneously involved in the creative and the intellectual process. It, therefore, follows that when a person is considered to be creative, he has to have a minimum level of intelligence certainly above the average.

Creativity and school achievement are not correlated. No significant correlation has been observed between an individual's creative talent and his school performance. One may be creative but score quite low on achievement tests and, similarly, a topper in school or in the Board examination may show little or no creative output. The reason for this is that in the usual achievement testing, assessment is done in terms of the quality of reproduction of the informational input while the creativity testing requires greater output than the input in terms of formal as well informal teaching.

Sociability and creativity are negatively correlated. Creativity requires creative individual to be more sensitive to the demands of a problem than the evaluation of his social environment. The creative individual is more inner—than outer-orientated. He likes to utilize his energy and potential more for the satisfaction of his creative urge than to care for the pleasant security of positive peer approval. It is for this reason that the creative individuals are usually not very sociable.

Creativity and anxiety often go together. It has been noted that creative people demonstrate an above average state of anxiety. However, the anxiety of the creative individual is quite different from that of the neurotic individual with a disturbed personality. The high anxiety of the creative individual may be the result of his craving for the satisfaction of his creative urge and discontent with his status or rate of progress in attaining his creative motive. But creative individuals are quite capable of keeping their anxiety within manageable limits and directing it into productive channels.

From the foregoing theories of creativity, it seems that none of them provides a complete picture. Each one of them takes its own stand for explaining creativity either through the process approach or the product approach and hence each perception is, as Clark (1983) observes, only a fragment of the total. It is only through a holistic view, by the integration of the various divergent views of the different theories, that a meaningful picture of creativity may emerge.

INVESTIGATING CREATIVITY

Creativity, as Rock, Evans and Klein (1969) put it, may be satisfactorily investigated by adopting the following three basic approaches, namely, creativity as a process, creativity as a product and creativity as an attribute of one's personality.

The Creative Process

Many psychologists and scholars have studied the creative process in an effort to understand it. Let us summarize some of their findings.

1. Wallas (1926) described the process as consisting of four stages: preparation, incubation, inspiration or illumination, and verification or revision.

In the first stage—preparation—the conscious work on the problem is initiated and continued as long as possible. Initially, the problem is defined or analysed and the stage is set for its solution. The facts and material relevant to the solution are then collected and examined and the plan of action is formulated. Then, we start working to the set plan. In between, if essential, the plan of action is modified, we switch over to another method or take the help of other relevant data if those in hand fail to help us. In this way, a continuous and persistent effort is made. In case, it appears at some point that we cannot solve the problem, frustration leads us to set the problem aside for the time being.

This kind of deliberate or voluntary turning away from the problem is the beginning of the second stage, i.e. incubation. This stage is characterized by the absence of activity, or in many instances, even of thinking about the problem. We may rest, sleep or engage in other interesting activities. If this is done, ideas which were interfering with the solution of the problem tend to fade. In the absence of such interference our unconscious begins to work towards finding a solution of the problem Sometimes, the things we experience or learn in the meantime, may provide a clue to the solution (Archimedes found the solution of his problem when he was in his bath tub).

The stage of inspiration or illumination follows. During this stage the thinker is often presented with a sudden appearance of the solution of his problem. Such illumination may occur at any time, sometimes even while the thinker is dreaming.

The final stage, verification or revision comes next. During this stage the illumination or inspiration is checked out to determine whether the solution or idea which appeared through insight is in fact the correct one. In case it does not work out, fresh attempts are made to solve the problem. Sometimes, the earlier solution needs slight modification or change to become workable. The creative

thinker does not, at any stage, accept a solution as perfect and holds it open to modification or revision in line with subsequent findings.

2. Rosman (1933) has mentioned the following seven stages in the creative process:

   (a) Observation of a need or difficulty
   (b) Analysis of the need
   (c) Survey of all the available information
   (d) Formulation of all the objective solutions
   (e) Critical analysis of these solutions
   (f) Birth of a new idea—the invention
   (g) Experimentation to test the most promising solution, and selection and perfection of the final embodiment by some or all of the previous steps.

3. Torrance and Myers (1970) have defined the process as consisting of the following stages:

   (a) Becoming sensitive to or aware of problems
   (b) Bringing together available information
   (c) Searching for solutions
   (d) Communication of the results

4. Stein (1974) has attributed the following stages to the creative process:

   (a) Preparation or education
   (b) Hypothesis formation
   (c) Hypothesis testing
   (d) Communication of the results.

However, the stages mentioned by each of the different scholars should not be considered to be rigid and fixed stages followed every time by every creative thinker. One person may arrive at the solution of the problem before experiencing all the previous stages. Another person, on the other hand, may not find the solution even after passing through all stages of the creative process and may need to repeat the cycle several times before producing anything creative or arriving at an acceptable solution of the problem.

The Creative Product

Creativity is investigated, understood and identified through the outcome of the process of creation or the creative products. How creative one is, can thus be determined through one's output in the form of ideas, works of art, scientific theories, or even building designs. However, for a product to qualify as creative, certain minimum criteria must be met. Telford and Sawrey (1977) and Mackinnon (1978) have proposed originality or novelty and relevance or appropriateness as the two main criteria for judging a creative product.

However, according to these authors, originality or novelty of a product should not be judged independently of the second criterion of relevance or

appropriateness. To be creative, a so-called original or novel creation must fit or be useful within its relevant context. It must demonstrate proper relevance to a problem, situation or goal including the purposes of its creator.

In addition to these necessary and essential conditions, a creative product must also fulfil the following conditions:

1. It must be aesthetically pleasing and give joy and satisfaction to the producer as well as the user.
2. It should provide new perspectives in some areas of human experience and create new conditions of human existence.

The Creative Person

The creativity aspect can also be discussed on the basis of those personality characteristics of the creatives which distinguish them from the non-creatives. A number of researches have been done in this area and consequently different researchers have presented different lists of personality traits attributed to the creative persons. Reference in this connection may be made to the studies conducted by Cattell (1968), Torrance (1962), MacKinnon (1962) and Foster (1971), etc. These studies alongwith other personality studies have brought out the following behaviour characteristics or personality traits of a potentially creative individual:

1. Originality of ideas and expression.
2. Adaptability and a sense of adventure.
3. Good memory and general knowledge.
4. A high degree of awareness, enthusiasm and concentration.
5. An investigative and curious nature.
6. Lack of tolerance for boredom, ambiguity and discomfort.
7. Foresight.
8. The ability to take independent decisions.
9. An ambitious nature and interest in vague, even silly ideas.
10. An open mind with preference for complexity, asymmetry and incompleteness.
11. A high degree of sensitivity towards problems.
12. Fluency of expression.
13. Flexibility in thought, perception and action.
14. Ability to transfer learning or training from one situation to another.
15. A creative imagination.
16. Diversity and divergence of thought even in convergent and stereotype situations.
17. Ability to elaborate, to work out the details of an idea or a plan.
18. Absence of the fear of and even attraction to the unknown, the mysterious and the unexplained.
19. Enthusiasm for novelty of design and even of solution of problems.
20. Pride in creation.
21. Peace with his own self so that he has more time for creative pursuits.
22. High aesthetic values and a good aesthetic judgement.

23. Self-respect, self-discipline and a keen sense of justice.
24. Ebullient and easy nature with a relaxed attitude.
25. Awareness of obligations and responsibilities.
26. Ability to accept tentativeness and to tolerate and integrate the opposites.
27. Patterns of thought different from those of the less creative, particularly during creative activity.
28. Respect for the opinions of others and acceptance of disagreement and opinions different from one's own.
29. Spontaneity and ease of expression.
30. The capacity to fantasize and daydream.

Identification of Creative Potential

Although every one of us is endowed with some aspects of creativity, its distribution is neither equal nor universal and some individuals have greater creative potential than others. How can such high creative talent be recognized? Researches in this regard have established that creativity is not necessarily accompanied by a high level of intelligence. Guilford (1959) has clearly made the distinction by proposing the concept of convergent and divergent thinking, the latter being closely associated with creative thinking. Similarly, Getzels and Jackson (1962) have successfully argued that creativity was far more independent of I.Q., especially at the upper levels. Therefore, a genius or a gifted person may not have a very high I.Q. as creativity in its many shapes and forms is an expression of giftedness, and not of a high degree of intelligence. How then, can the creative individuals be identified.

Behaviour as we know is expressed through its cognitive, conative and effective components and creative behaviour is no exception. Consequently, an individual is creative to the extent to which he can demonstrate creative potential in his thinking, actions and feelings. For a total assessment of creative behaviour, we have to apply a multi-dimensional approach involving the use of the available creative tests and the multiple non-testing devices like observation, interview, rating scale, personality, inventory, situational tests, interest inventories, attitude scales, aptitude tests, value schedules and projective techniques etc. The characteristics and personality traists of the creatives mentioned earlier may also serve the purpose by providing reliable indications for the identification of creative potential which may be further verified by comparing the performance with standardized creativity tests.

Creativity Tests

Creativity tests may be used in the identification of the creatives in the same way as intelligence tests are used for the assessment of intelligence. There are many standardized tests available for this purpose in India and abroad. Some of these are now enumerated.

- *The tests standardized abroad*

1. Minnesota tests of creative thinking.

intelligence without having creative abilities. On the other hand, an adequate level of intelligence is a necessary condition for being creative. A mentally retarded person cannot be expected to be creative.

(iii) In intelligence testing, the speed and accuracy of the cognitive behaviour is emphasized while in creative tests novelty, flexibility and originality are given more weightage.

CREATIVITY IN CHILDREN

Identification of Creative Children

The term 'creativity' cannot be used synonymously with giftedness. Therefore, we should not make a mistake of considering every gifted child as a creative child. Creativity in its all shapes and forms is the highest expression of giftedness that may or may not be found in a particular gifted child. The problem then lies in the identification of the creative children.

Creative behaviour and expression, like other behaviour patterns, possesses its basic components in the form of cognitive, conative and affective behaviour. Consequently, we can label a child creative to the extent to which he is able to demonstrate creative aspect in his thinking, feeling and doing behaviour. For such labeling, we may employ two different approaches:

(i) making use of tests of creativity, and

(ii) making use of non-testing devices observation, interview, rating scale, personality inventory, check-list etc.

Let us discuss these approaches one by one.

CREATIVITY TESTS

As we make use of intelligence tests to label a child as intelligent, we have the use of creativity tests for labeling a child as creative. There are so many tests available in India and abroad for this purpose. We are mentioning a few of these tests below.

- **Tests Standardized Abroad**
  1. Minnesota tests of creative thinking
  2. Guilford's Divergent Thinking Instrument
  3. Remote Associate Test
  4. Wallach and Kogan Creativity Instrument
  5. A.C. Tests of Creative Ability
  6. Torrance Tests of Creative Thinking

- **Tests Standardized in India**
  1. Baquer Mehdi's Tests of Creative Thinking—Hindi and English.
  2. Passi's Tests of Creativity.
  3. Sharma's Divergent Production Abilities Test.
  4. Saxena's Tests of Creativity.

As pointed out earlier, creativity is a complex blend of a number of abilities and traits. Therefore, in all the creative tests, attempts are always made for the assessment of these abilities and traits with the help of verbal and non-verbal test items. The factors or dimensions commonly measured through these tests are fluency, flexibility, originality, divergent thinking and elaboration.

Let us now illustrate the measurement of creativity components with the help of two creativity tests—one standardized abroad and the other in India.

Torrance Tests of Creative Thinking. It is a set of two tests—one verbal and the other non-verbal. It has been developed by the famous American psychologist E. Paul Torrance and can be employed to test the creativity of the children from Kindergarten to graduation.

For testing the creativity through non-verbal and verbal performance, Torrance has thus developed figural form A and B and verbal form A and B (Forms B are the equivalent alternatives of the forms A).

The figural form (Non verbal testing device). The activities required in this test are of the non-verbal nature. The subject has to perform certain non-verbal activities, i.e. draw or make something as a response to the test items. This test has three sub-tests as described below:

(i) **Figure or picture completion test.** In this sub-test, there are some incomplete figures. The subject is asked to complete these figures in whatever way he desires.

(ii) **Picture or figural construction test.** In this sub-test, the subject in provided with a piece of coloured paper cut in a curved shape and asked to think of a figure or picture of which this piece or paper may be a part.

(iii) **Parallel lines test :** In this sub-test, there are several pairs of straight lines. The subject is required to draw as many objects or pictures by using such pair.

The verbal forms (used as a verbal testing device). Through the items of the sub-tests of this form, the subject is required to provide written responses. There are six sub-tests incorporating activities of the following nature.

(i) **Asking type:** Here the subject is encouraged to reveal his ability to perceive all things that are not normally perceived by others.

(ii) **Guess cause and guess consequences type:** Here the subject is encouraged to reveal his ability to formulate hypotheses concerning cause and effect, *i.e.* what is behind the situation in the picture and what its consequence may be.

(iii) **Product Improvement Type:** The subjects are asked to suggest ways and means to improve a toy, a machine or such other products.

(iv) **Unusual Uses Type:** These are meant to test the divergence about the ways of using a product. Here the subjects have to tell about as many unusual uses as they can point out to use a product.

(v) **Unusual Questions Type:** Here for a particular object or verbal description, the subjects are required to ask as many unusual questions as they can.

(vi) **Just Suppose Type:** The subjects are required to predict outcomes of unusual situations.

The responses of the subject are scored in all the sub-test items of both the forms (figural and verbal) and then his total score is computed for providing an estimate of his overall creative potential.

Baquer Mehdi's Tests of Creativity. This test has been developed by Dr. Baquer Mehdi. It has been published by National Psychological Corporation, Agra. There are four verbal and three non-verbal sub-tests under this. This verbal form has the following four sub-tests:

1. Consequence Test (duration 12 minutes). In this test, the subject is asked to think of as many consequences as possible for situations like—

1. What would happen if we could fly like a bird?
2. What would have happened if your school had wheels?
3. What would happen if you do not have any need for food?

2. Unusual uses test (duration 15 minutes). It includes test items like—Write as many novel, interesting and unusual uses for objects like a piece of stone, a wooden stick, water.

3. New relationship test (duration 15 minutes). It has the test items like below.

Think of as many relationships between the following pairs of words, as possible. (*i*) Tree, house (*ii*) Chair, ladder (*iii*) Air, water

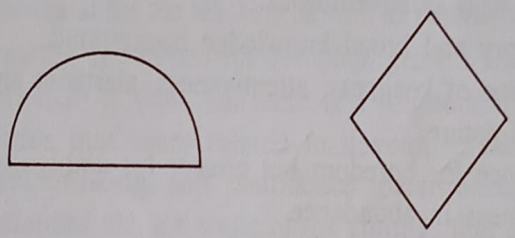
4. Product improvement test (duration 6 minutes). It consists of test items like below.

You have a toy horse. Now think of as many new things or features that can make it more useful and interesting.

Non-verbal Sub-tests: The three sub-tests of this category are of the following types :

(i) Picture construction test (duration 20 minutes). It contains test items like below.

In Fig. 23.1, there are two geometrical figures—a semi-circle and a rhombus. Construct and elaborate pictures using each figure as an integral part. For each picture give a separate title.



(a) A semi-circle (b) A rhombus

Fig. 23.1 Picture construction test.

(ii) Line figure completion test (duration 15 minutes). Below in Fig. 23.2, there are 10 incomplete line drawings. You have to draw meaningful and interesting pictures using each of them. Also give an appropriate title for each of your creation.

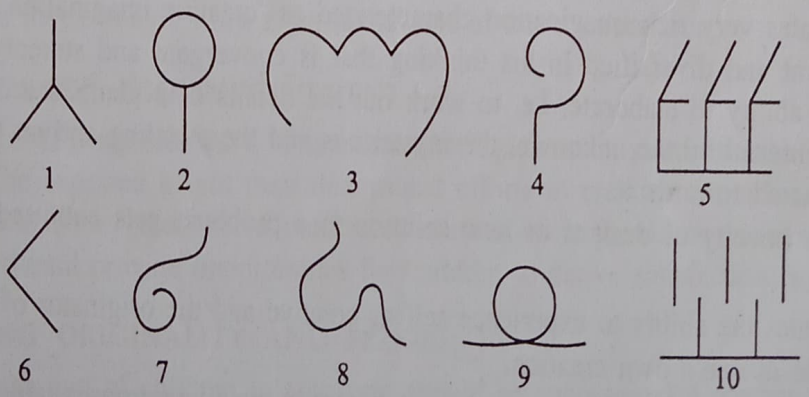


Fig. 23.2 Line figure completion test.

(iii) Picture construction test (duration 10 minutes). Here there are seven triangles and seven ellipses. Construct different meaningful and interesting pictures by using these figures in multiple associations.

In all such creativity tests as illustrated above, the verbal and non-verbal activities are evaluated in terms of related creative abilities like fluency, originality, flexibility and elaboration. A high score on this creative test increases the probability of declaring the subject as creative. However, such declaration may need further support from the results of the assessment made through some other testing devices.

USE OF NON-TESTING DEVICES

The creative aspect of a child can also be assessed through some non-testing devices like Natural observation method, Situational techniques, Rating scale, Check list, Interview, Personality inventories, Interest inventories, Attitude scales, Aptitude test, Value schedules, and Projective techniques, and so on. These devices help in the revelation of those personality traits and behavioural characteristics that are supposed to be present in a creative child. Some of these traits or characteristics, as identified by the research workers in the field of creativity, are mentioned below.

Personality and Behavioural Characteristics of a Creative Child

1. Demonstrates originality in ideas and actions.
2. Is more adaptable as well as adventurous.
3. Possesses good memory and broad knowledge background.
4. Possesses a high degree of keenness, attentiveness, alertness and power of concentration.
5. Is very curious about nature.
6. Possesses little tolerance for boredom but greater for ambiguity and discomfort.
7. Possesses foresightedness in abundance.
8. Has the capacity to take independent decisions.
9. Shows interest in vague and ambiguous ideas.
10. Enjoys a reputation of having strange and silly ideas.
11. Shows preferences to complexity, incompleteness, asymmetry and open mindedness.
12. Possesses a high degree of sensitivity towards problems.
13. Can express his ideas as fluently as possible.
14. Shows flexibility in his thinking, feeling and doing behaviour.
15. Demonstrates the ability to transfer learning or training from one situation to another.
16. Demonstrates very rich imagination characterized as 'creative imagination'.
17. Is divergent and diversified in his thinking that is convergent and stereotyped.
18. Possesses ability to elaborate, i.e. to work out the details of a plan, idea or outline.
19. Is not frightened by the unknown, the mysterious and the puzzling and on the contrary is often attracted towards it.
20. Welcomes novelty of designs or new solution to a problem, gets enthused and suggests other ideas.
21. Demonstrates the ability to experience self as creative and the originator of one's act and takes pride in one's own creation.
22. Has more of him available for use and employment in creative purposes rather than wasting his time and energy protecting him against his self.
23. Possesses high aesthetic values and good aesthetic judgement.

24. Possesses a high degree of the feeling of self-respect and is self-disciplined, sensitive and intolerant towards injustice. On account of these qualities, is often misunderstood and evaluated disobedient, rebellious and mischief monger.
25. Demonstrates human playfulness, lack of rigidity and relaxation in his behaviour and products.
26. Is always alive to his obligations.
27. Possesses the ability to accept tentativeness and ability to tolerate and integrate the opposites.
28. Has a richer fantasy life and greater involvement in daydreaming.
29. Shows different brain patterns than the less creative, especially during creative activity.
30. Pays respect to others' opinions and welcomes disagreement to his own suggestions.
31. Is always found to be more spontaneous and expressive.

Methods of Developing Creativity among Children

Creativity, as a natural endowment, needs stimulation and nourishment. Most of the creative talent, if not given proper training, education and opportunities for creative expression, results in wastage. Moreover, creativity, as we have emphasized earlier, is universal. It is not the monopoly of a few geniuses only. Every one of us, to a certain degree, possesses creative abilities. In a democratic set up like ours, it is not only the geniuses who are needed to create, manifest and produce. Others, whether mediocre or below average, are also required to think constructively and creatively.

Therefore, it becomes essential for the teachers as well as parents to realize the need of providing proper environment and creating conditions for complete growth and development of the creative abilities of children. The problem is vital, but there is a solution. It lies in the proper stimulation and nurturing of the abilities that seem related to develop creativity. Originality, flexibility, ideational fluency, divergent thinking, self confidence, persistence, sensitiveness, ability to see relationship and make associations etc. are some of the abilities that are attached to creative output. The following few suggestions can work satisfactorily in the stimulation and nourishment of these abilities:

Freedom to Respond

Most often we, teachers and parents, expect a routine type fixed response from our children and thus kill the very creative spark by breeding conformity and passivity. Therefore, we should allow adequate freedom to our children in responding to a situation. They should be encouraged to think about as many ideas as they may for the solution of a problem. Also we must let them have their own way when they strongly need a particular sort of novel expression.

Opportunity for Ego Involvement

The feelings like "It is my creation", "I have solved it", give much satisfaction to children. Actually, they can only be expected to put their determined efforts in creative activities when their ego is involved, i.e. when they feel that a particular creative work stands on account of their efforts. Therefore, we should provide opportunities for children to derive satisfaction from being a cause.

Encouraging Originality and Flexibility

Originality on the part of children in any form should be encouraged. Constant submission to the facts, unadulterated copying, passive reception, rote-memorization discourage creative expression and therefore, it should be checked as far as possible. In solving a problem or learning a task if they

need to change their methods of learning or solving the problem, they should essentially be encouraged to do it. Adequate training can also be given by making them answer the problems like: How would you dig the earth if you don't have a spade? Or how would you draw an angle if you do not have proper instrument for drawing it? Or how would you cross a river if there is no bridge over it?

Removal of Hesitation and Fear

Most of the time (particularly in countries like ours where there is too much inferiority complex) there is a great hesitation mixed with a sense of inferiority and fear in taking initiative for a creative expression. We, generally, listen to the comments like "I know what I mean, but cannot write or speak before others." The causes of such hesitation and fear should be discovered and removed as far as possible. The teachers and parents should persuade such children to say or write something, anything, no matter how crude it may be.

Providing Appropriate Opportunities and Atmosphere for Creative Expression

A healthy favourable atmosphere for creative thinking, and expression is an essential condition for the stimulation and nourishment of creativity among children. There is a need to balance the rate of learning with its application, the passive receptivity with challenging productivity, and the stable certainty with risk and adventure. There is a need for sympathetic atmosphere in schools as well as at homes. For providing opportunities for creative expression, we can make use of the cocurricular activities in schools. Our social festivals, religious and social get-togethers, exhibitions etc. can also provide the opportunity for creative expression. A regular classwork can be arranged in such a way as to stimulate and develop creative thinking among children.

Developing Healthy Habits among Children

Industriousness, persistence, reliance and self-confidence are some of the qualities that are helpful in creative output. Therefore, children should be helped to imbibe these qualities. Moreover, they should be made to stand against the criticism of their creative expression. They should be made to feel that whatever they create is unique and it expresses what they desired to express.

Using the Creative Resources of the Community

Children should be made to visit the centers of creativity for scientific and industrial creative works. It can stimulate and inspire them for doing some creative work. Occasionally, creative artists, scientists and creative persons from other fields may also be invited to schools. It can be helpful in enhancing the span of the knowledge of our children and kindle the spark of creativity among them.

Avoidance of Blocks to Creative Thinking

The factors like conservatism, faulty methods of teaching, unsympathetic treatment, fixed and rigid habits of work, anxiety and frustration, high standards of achievement for low levels of work, overemphasis on school marks, authoritarian attitudes of teachers and parents etc. are known to be detrimental towards fostering creativity among children. Therefore, as far as possible parents and teachers should try to avoid such factors in upbringing and educating the children.

Proper Organization of the Curriculum

Learning experiences in the form of curriculum should be so designed that it fosters creativity among children. For this purpose we should organize the school curriculum primarily on the basis