CHAPTER-I

INTRODUCTION

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INTRODUCTION

1.1 GENERAL INTRODUCTION

Human being is the best entity in the world because of its super organism. The modern man is a result of long term evolution. The evolution made a complex neuromuscular mechanism of man. This mechanism makes him able to think and act, according to his thinking. The modern men are the evolutionary result of their intellectuality and mechanical application of the body. Human beings are said to posses' highest form of life only because they have learnt in the environment to modify, strengthen, weaken or at times completely check their drives, urges and impulses bestowed on them by nature. Biologists have proved beyond doubt structural and functional inter connectibility of organic systems so commonly reflected in behavior.

Behavior is a mechanism of reflex which is highly related with mental process. From the childhood stage human being learns to behave according to the conditions (internal and external). And most learning process precedes motor processes i.e. we observe, think and act. All these observations, thinking ability and action largely depend upon the five sensory receptors viz. ear, eye, tongue, nose and skin. The coordinated activities of all these five organs play a vital role to our normal life. Apart from these five, there exists another sense which gives one greater feeling. Sometimes we meet some person who has better predictability than general persons. They can suspect, what is going to happen from vague clues. We call them extra ordinary. But the question arises what is the power that separate them from others?

From the biological point of view it is revealed that today’s modern man is able to run fast, to grip firmly or to throw higher or longer due to their basic need. They used to run fast to save themselves; used to jump to overcome the streams or used to throw stones to the fierce animals in self defense. Their basic needs played as the stimulus caused storage centre or memory drum to ‘play back’ the particular activity. This is such feeling that a person concerned is not always aware of it. It helps a person to react directly, systematically and according to the situation (Fox, 1981).
Therefore, growth, maturity, opportunity for motor activity etc. are very important factors causing behavioral changes. Learning on the one hand is a result of ‘felt need’ emanating from within the organism because it serves biological ends, and on the other, it is a social necessity because it humanizes and socialize the child. It is truly a cooperative affair. The child learns by impulsion and compulsion, invitation and imitation and adaptation and assimilation. So learning cannot be categorized into physical and/or mental compartments. To categorize behavior into purely physical and/or mental compartments is to destroy the unity of organism. Some behavioral acts no doubt predominantly mental and others predominantly physical but neither is purely either. In fact, compartmentalization of behavior into external and internal is only arbitrary, not scientific (Wenger, Jones and Jones, 1956). The mechanism and dynamics of behavior, made it amply clear that perception, cognition and motor phases of a learning experience form an unbreakable continuum. However, for the sake of convenience and understanding of how behavioral transformations take place, psychologists categorize learning into cognitive, affective and motor types (Kamlesh 2002).

1.1.1 Cognitive ability and children

Cognition covers every mental activity that is commonly regarded as “thinking or knowing, perceiving, recognizing, learning, conceptualizing, imagery, problem-solving, remembering, reasoning and judging” (Guinness, 1990). It is the ability of a person in the areas of problem-solving, concept-formation, reasoning and acquisition of knowledge through memory and/or understanding. This type of ability predominantly mental in nature – depends greatly on the brain process which deals with conscious awareness of the external environment and the acquisition of all kinds of knowledge.

In infancy and childhood, interaction with the environment and the experiences arising there from enable the individual to program his mental software in order to do able to solve complicated problem, make decisions, think rationally, judge correctly, form concepts, assimilate ideas, innovate and create things. Much of the class-room academics e.g. study of history, geography, philosophy, mathematics, language, science etc. fall under cognitive learning. At low pole, cognition is simple observation of the external phenomenon, at high pole; it comprises intellectual
activity involving thought-process of very complex nature. Tolman conceptualized learning as ‘an interaction of internal mental processes with the external events of environment’. He was emphatic that behavior is not learnt from trial and error but from thinking and considering alternatives. Thus, behavior is not purely mechanistic – a case of reflexes – but involves mental process (Kamlesh, 2002).

The school of thought arising from this approach is interested in how people mentally represent information processing. The propagators of this school of thought were Max Wertheimer, Wolfgang Kohler, Kurt Koffka, Kurt Lewin, Kurt Goldstein and Jean Piaget etc. They use psychophysical and experimental approaches to understand, diagnose, and solve problems, concerning themselves with the mental process mediate between stimulus and response. Cognitive theory contends that solution to problems take algorithms-rules that are not necessarily understood but that do not always guarantee solutions. Ulric Neisser coined the term 'cognitive psychology' in his book published in 1967 (cognitive psychology), wherein Neisser provides a definition of cognitive psychology characterizing as dynamic information-processing systems whose mental operations might be described in computational terms. He refers ‘cognition’, to all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used. All these process of sensory input can be divided in two primary aspects as perceptual-motor ability and academic abilities (Gallahue, 1976). Perceptual motor development deals with the interrelationship of the mind and body working as one to producer harmony with environment. Kephart considered that if learning is to take place effectively, perception and movement must be matched, a process that occurs through wide variety of sensory experiences and movement opportunities. As a result movement and perception are joined and functions as one (Kephart as cited by Asmheim & Sinclair, 1976). Cognitive development also involves the introduction and learning of basic academic concepts. The experiences can be effectively used as a medium for learning through movement. Educators are now recognizing that important perceptual motor skill and fundamental academic concepts can be effectively dealt with in a movement education program (Gallahue, 1976).

Early childhood educators have long believed that rich, early experiences and quality time with a caring and loving family are critical to a child’s development. These believe have been supported by the discoveries of neuroscientists that have
made about brain growth in the early years. Brain research is a line of study documenting the impact of early experiences on the architecture of the brain and on the nature and extent of adult capacities. During the early years, the brain has the greatest capacity for change. How the brain develops hinges on a complex interplay between a young child's genes (heredity) and life experiences (environment). The developing brain is malleable, flexible, and plastic and has the ability to explode with new synapses or connections. The brain's neural plasticity allows it to constantly change its structure and function in response to external experiences (Fox and Schirrmacher, 2011).

The environment affects not only the number of brain cells and number of connections among them, but also the way those connections are wired. On the positive side, brain growth can be positively stimulated. The brain develops in an integrated fashion over time so an enriched environment addresses multiple aspects of development simultaneously. It thrives on taking in unexpected information, as long as the unpredictability isn't accompanied by insecurity or perceived threat (Heath and Wolf, 2004). On the negative side, however, neglect or abuse can impede the child's developing brain functions. If a child receives little stimulation early on synapses will not sprout, and the brain will make few connections. The harmful impact of stress on early brain development damages overall growth and development, placing the child at much greater risk of developing a wide range of cognitive, behavioral and physical problems. In some cases, these effects may be irreversible. While traumatic events may significantly influence the behavior of adults, they actually change the organizational framework for a young child's brain. Life experiences are now believed to control both how the infants' brain circuitry is wired. Early experiences are decisive impact on the architecture of the brain and on the nature and extent of adult capacities. Early experiences directly affect the way the brain is wired.

In reviewing the literature on the development of the brain, Shore (1997) as well as Richey and Wheeler (2000) found that experiences and opportunities afforded to children during the early childhood years are critical to the development of neural pathways that govern cognitive, motor, and socio-emotional learning and development. Early in child's life, the brain has many more cells (neurons) than the child would need (Allen and Marotz, 2010). Connections among neurons are formed as children explore their environment, play and develop attachment to others.
Connectivity is a crucial feature of brain development because the neural pathways formed during the early years carry signals and allow one to process information throughout life. Timing is also crucial. Even though learning continues throughout life, there are critical periods during which the brain is particularly efficient at creating neural pathways that facilitate specific kinds of learning. Experienced children have during these sensitive periods stabilized neural pathways and lay the foundation for optimal development. Lack of experiences during critical periods will result in underdeveloped neural pathways. Thus the architecture of the brain reflects the presence or absence of a wide range of Physical, Cognitive and Socio-emotional experiences during the early years.

Play is a critical element in early childhood because it provides the context for experiences that are vital to the development of neural pathways. Children must have to practice and master the skills they have learnt before moving on to learning new ones, and learning must take place in a meaningful context and in an environment of love and support (Galinsky, 1997).

1.1.2 Motor creativity and children

Before presenting any further arguments for the motor aspect of creativity, the term 'motor creativity' must be described sufficiently. In a study in which a test of motor creativity was developed, Wyrick (1968) defined the term as the combination of perceptions into new motor patterns. These perceptions could be a solution to a given problem or an idea which is expressed through movement. Another similar definition for motor creativity describes it as a children's effort to produce movements that represent answers to motor stimuli or solutions to motor problems (Zachopoulou, 2007).

Although motor creativity may be communicated in completely different ways from creativity in arts, it can be argued that it derives from the same cognitive mechanism. However, even if certain subjects are considered more suitable for enhancing creativity, it does not mean that the skills acquired in one subject can be transferred to others as well. For example, a person that manifests creativity in arts is not necessarily equally creative in science. If children learn the 'fundamentals' of
being creative in an ‘environment’ more appealing to them such as movement programs, then possibly they can use this experience in other subjects too.

Programs or activities that are considered more suitable for enhancing creativity in young children must enhance children’s intrinsic motivation and provide ample opportunities for various forms of play.

Movement during early childhood is considered one of the most basic tools of children for expression, action, learning and non verbal communication (Gruber, 1986). Thomas and Burke (1981) suggest a distinction between verbal and non verbal expression of creativity. Since movement programs are a domain where most tasks are nonverbal, it should be considered ideal for practicing creative thinking. All these arguments support the influence movement education can have on creativity. In this regard creativity is necessary to be discussed.

A critical aspect of creativity is whether it is domain specific or could be considered as “transferable skill.” On one hand researchers (e.g. Cleland, 1994), claim that the ability to produce many different drawings and associated word titles – based on the Torrance Test of Figural Creativity- is not related to producing different movement patterns. On the other hand, it has been argued that although musical creativity or motor creativity may be expressed in different ways from mathematical creativity, it is “nevertheless” driven by the same under pinning curiosity combined with imagination (Craft, 2005). So could it be argued that some subjects lend themselves more readily to creativity than others? Or, as Craft (2002) argues, all subject areas in the school curriculum (or beyond) are inherently conducive to the development of a learner’s creativity?

Runco (2003) described creativity as the construction of personal meaning and Craft views creativity as a form of knowledge. Learning is also considered to be more effective when young children try to attribute meaning to something through experimentation, raising questions and searching for solutions (Klein, 1990). Hence, any learning that does not imply mere content acquisition entails a component of creativity (Ferrari et al., 2009).

Creativity and motor development of preschool children are two interrelated developmental procedures during early childhood. Vyogotsky (1981) suggests that the development of one affects the other and also one procedure can be developed
through the other. A representative result of these two areas is motor creativity, which is children's effort to produce movements that provide solutions to motor problems.

Children need movement experiences and activities on a daily basis. According to Carmichael (2007), research indicates that regular physical activity improves blood flow and releases chemicals that make the brain more receptive to learning. So including movement activities in curriculum will support children's learning of content and the development of their bodies.

1.1.3 Kinesthetic sense and children

Under most conditions we are consciously aware of the position of the various parts of our limbs relative to each other and whether they are moving or still. This awareness has been given, among others, the names of "kinaesthesia" and "position sense." These two terms are usually treated as synonymous and both taken to cover all aspects of the awareness, whether static or dynamic (Goodwin, McCloskey and Matthews, 1972).

A factor that is very much involved in movement and specially in learning specific skills is kinesthetic sense. Kinesthesis may be defined as the sense that gives the individual an awareness of position of the body or parts of the body as it moves through space (Barrow and McGee, 1979).

As a result of this information received from the senses, the individual is able to control his movements more accurately. This position sense is found in receptors located in the muscles, fascia of muscles, tendons, and joints. These receptors act as feedback mechanisms for making the individual aware of the intensity of stretch or contraction of the muscle, or the stress placed on the tendon, muscle fascia, or joint. With this information, the performer can tell with varying degrees of accuracy the position of the body and / or body part as it moves into space. This awareness of movement position is an important factor in learning a movement. It operates to a degree each time the body or part of it is called upon to change the forces of gravity in sports exercise, and daily tasks. It is significantly related to balance and plays a dynamic part in establishing and maintaining a pattern of good posture. In the highly complex skill encountered diving, gymnastics, trampolining and some forms of dance, this sense enables the performer to distinguish his position in space with a degree of
accuracy and consistency. As a result of this awareness the performer can acquire the ability to execute the designated movement more accurately and effectively.

The term proprioceptor is commonly used as kinesthetic perception of kinesthetic sense. It is the ability to perceive the position, effect, and movement of parts of the body during muscular action is sometimes referred to as the sixth sense. In reality, we have more than just sixth sense; in fact kinesthetic sense could be considered as several senses with in itself. The term proprioceptive sense is also used to refer this sense. The sources of proprioceptive of kinesthetic perception are presumably located in the joints, muscles & tendons (Nelson & Jonson, 1988).

**Proprioceptors**

Proprioception, from Latin proprius, meaning “one’s own” and perception, is the sense of the relative position of neighboring parts of the body. Unlike exteroception, by which we perceive the outside world, and interoception, by which we perceive the pain and movement of internal organs, proprioception is a third distinct sensory modality that provides feedback solely on the status of the body internally. It is the sense that indicates whether the body is moving with the required effort, as well as where the various parts of the body are located in relation to each other. The receptors for movement sense and those which give information about the position of the body in space are called proprioceptors (Sherrington, 1906).

![Fig. 1.1: Lobs of the cerebrum.](image-url)
Visual auditory perception enables humans to receive, organize, integrate, and interpret a vast amount of never-ending stimuli. Such is also the case with kinesthetic perception. Instead of using an eye or an ear to receive information, the kinesthetic system utilizes proprioceptors located in tissues surrounding and adjacent to joints and in joint capsules. Whereas eyes and ears help people to remember a sight or sound, proprioceptors help us remember a movement or body position. This is a valuable system, one that is constantly used in the teaching and learning of many movement skills. Three skills are closely related to kinesthetic perception—balance, body awareness, and laterality (Fait and Dunn, 1984).

**Balance**

Balance is the ability of the individual to position the body in response to the effects of gravity, is controlled in part by the vestibular system. This system, located in the inner ear, is a very important mechanism in helping individuals maintain balance in both a stationary and a static position, or when changing body positions. The latter type of balance is referred to as dynamic balance. Some hearing impaired individuals have a defective vestibular system and they require a wide base of support to maintain balance when they walk.

**Body awareness**

Body awareness refers to and understanding of the position of the body in space and the relationship of body parts to each other and to external objects. Newborns are not capable of perceiving much about their environment. As children grow, they become aware of their capability of moving their extremities, head, and trunk. Later on, children learn labels and associate particular terms with various body parts. The labeling of body parts is one of the first body awareness characteristics a child develops. De Oreo and Williams indicate that at the age of five years, 55 percent of the children accurately label their body parts. Linear improvements are found until age 12 at which point there is 100 percent accuracy.

**Laterality**

An important aspect of the development of body awareness is the concept of laterality. This means simply that children develop an ability to distinguish between the two sides of the body. This trait is developed in children by the age of three to four. Although they may not be able to correctly apply the label left or right, young
children do understand that they have two feet, two hands, and two eyes and that they are on two different sides of the body. Laterality is considered by many as the foundation for the development of other body awareness characteristics. Sensory dominance, the preferential use of one of the eyes, hands, and feet over the other, is closely related to the development of laterality. Individuals who develop a preference for the use of the eye, hand, and foot on the same side of the body are said to have pure dominance. Those who happen to have one of the preferred body parts on the opposite side of the body have mixed dominance. Children normally exhibit a hand preference by age four and foot preference by age five. Eye preference appears later, and in some instances, a pure preference for one eye over the other apparently never fully develops. Preferential use of the eye and hand on the same side of the body shows a definite developmental trend with age. The eye-hand preference of five and six year olds has a trend toward being mixed, whereas the eye-hand preference of nine to eleven year olds has a trend toward pure preference.

**Directionally**

Directionality is a kinesthetic sense that is closely related to laterality. The ability to identity and relate objects and their positions to one another without the use of one’s own body is referred to as directionality. More simply stated, directionality is evident when a child can indicate that an object in the room is to the right of a second object in the second object in the room without using his or her own body as a reference system. Children who have difficulty with directionality find it necessary to position their body between the two objects before they can indicate which is to the left or right of the other. Some educators have also speculated that in complete development of directionality leads to a variety of learning disorders, such as the inability to distinguish between the letters b and d. Although this hypothesis appears plausible, there are few available studies to support or refute this contention.

**Development of perception**

The Gestalt psychologists of the early 1900s felt that perception was not learned but was instead a factor of maturation. It was reasoned that perception matured at a predetermined rate and experiences had little influence on the development. However, research accomplished since the early 1900s provides sufficient evidence to reject that theory. Today’s evidence does support the concept that the process of perceiving can be improved through certain educational
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procedures. Perception does not necessarily improve automatically as the result of engaging in a given activity, however. Some children, through participation in an activity that involves the utilization of a specific sense, learn by themselves through trial and error to make and appropriate motor match with the sensory input. Others, because of learning disabilities, do not; they require specific assistance in interpreting sensory input and reacting to it with a suitable response.

The human body perceives through different sense modalities. Each modality is different in function, providing a specific type of stimulation. The modalities that are usually involved in increasing the sensitivity and in improving the interpretation and reaction to the interpretation are sight, hearing, touch and pressure, and kinesthesis (the sensation of the location of body parts and of movement in muscles, tendons, and joints).

Children with learning disabilities cannot organize a sufficiently great amount of sensory information at one time to enable them to make an effective motor response. The amount of sensory stimuli directed at learning-disabled children must be reduced to that which the child is able to absorb. The task at hand may be made simpler by breaking it down into its components, thereby reducing the inputs of many different sensory stimuli at one time. This does not mean that various methods of providing sensory information should not be utilized. If the teacher finds that the student is not assimilating the information from one source of sensory input, other sources should be tried. For example, a child may not learn how to perform a skill by watching a demonstration, but may get the idea when manual kinesthesis is used to lead her or him through the required movements.

Although it is not clearly established how sensory interpretation and response to interpretation can be improved it is generally conceded that practice in utilizing the senses and responding to the interpretation of the sense perceptions has value in effecting improvement of the process. The practice has to include cognition or conceptualization of the process of perception-interpretation; that is, there has to be an analysis of the deficient perception supplemented by analysis of the perception of the normally functioning senses to arrive at an interpretation that will produce the desired result. For example, children with problems of visual discrimination in size must use the normal perceptions from senses other than sight to evaluate the size of the object.
they are looking at. They then compare the result with the visual input they receive ordinarily and make the necessary adjustments to achieve agreement between the visual input and the input from the other senses. Much practice in simple repetitive exercises designed specifically for the deficiency is required to improve the interpretation of the stimuli.

Much the same procedure is utilized with children who have problems in reacting with appropriate motor movement to a sensation. For example, a child who cannot balance well on the balance beam must first analyze the sensations she or he receives just before losing balance. Then, through experimentation she or he must discover the movements of the body that eliminate those sensations. Practice in consciously substituting these for the unsatisfactory movements will eventually result in an automatic response of the muscles to maintain balance when a fall is imminent.

In utilization of motor activities to enhance the perceptual process, one must keep in mind that some of these movements require complex muscular condition, as in throwing or kicking a ball, and others require intellectual recall, as in naming the body parts, and hence are relatively specific, i.e., not automatically transferred to the performance of other activities of coordination or intellectual recall. It is not known how general the perceptual processes are.

Because of the specificity of coordination and the possibility that perceptual processes may also be somewhat specific, a large number of experiences in sorting figure-ground relations and reacting in various situations are necessary to establish a general ability to distinguish a figure from its background. This would be true not only in the example given for figure-ground recognition activity but also for all of the perceptual process (Fait and Dunn, 1984).

The process of perception depends upon the receptors associated with nervous system is called sensory receptors or neural receptors to differentiate them from the receptors on target cells for chemical communication. A sensory receptor can be defined as a biological transducer which can convert (transduct) various forms of energy into action potential (AP) in the sensory nerves to which they are connected. These receptors are necessary for collection of information by the nervous system to react in order to maintain homoeostasis. Receptors can also be called interpreters, as

A study on cognitive ability motor creativity and kinesthetic sense of children with reference to chronic exercises
these can translate different languages (e.g., pressure, temperature, light, sound, etc.) into electrical language which the nervous system can understand.

**Types of receptors**

There are various types of changes in our external as well as internal environment which are to be properly interpreted by the CNS; hence there are various types of receptors to sense these changes.

A sensory receptor may be a) **free nerve endings** (peripheral end of a sensory nerve without any obvious special structure in it), e.g., the receptors for pain, touch, temperature, etc. b) **expanded nerve endings** (the nerve endings are thickened to form specialized structures), e.g., Merkel's disc, Ruffini end bulbs, etc., for touch-pressure. c) **encapsulated endings** (nerve endings covered with multilamellar capsules), e.g., Krause end bulb, Pacinian corpuscle, etc., for touch. d) **specialised cells** (the nerve ending is attached to a cell which acts as receptor), e.g., rods and cones for light, hair cells in cochlea for sound, etc. e) **sense organs** (where the receptor cells along with other cells form a group), e.g., taste-buds for gestation.

**Muscle spindle**

Muscle spindle is a very important receptor for stretch reflex as well as for proprioception. It is the sensory organ of skeletal muscles. Muscle spindles are situated in between the skeletal muscle fibres (extrafusal fibres) and are connected to them in parallel. It is a fusiform body, enclose in a fibrous sheath, composed of 3 to 10 modified muscle fibers (intrafusal fibres). These intrafusal fibres are two types: a) Nuclear bag fibres: In these fibers the nuclei are aggregated in a bag-like swollen middle portion of the fibre, hence the name. b) Nuclear chain fibres: Nuclei of these fibres are arranged in a single row alone the long axis of the fibres in the form of a chain.

The ends of each intrafusal fibre have contractile elements, so only the ends of these fibres can contract. (William F. Ganong 2005).

**Neural connection of muscle spindles**

The muscle spindles are supplied both by motor and sensory nerves.

**Sensory connection**

Group Ia sensory fibres form the annulospiral endings (primary endings) on the mid portions of both types of intrafusal fibres.
Group II sensory fibres form the flower-spray endings (secondary endings) situated only on the chain fibres on either side of the annulospiral ending.

Motor connection

$\alpha\gamma$ fibres, simply called $\gamma$ motor fibres, supply the ends of the intrafusal fibres containing the contractile elements. These $\gamma$ motor fibres are of two types: dynamic $\gamma$ and static $\gamma$. The dynamic $\gamma$ with plate-endings supplies the bag fibres and the static $\gamma$ with trail-endings supplies the chain fibres. When this muscle spindle is stretched, the receptors are stimulated.

Muscle spindles regulate body tone and posture as well as facilitate the myotatic reflex (McClintic, 1978). They are fibers that are directly attached to either the muscle fibers (extrafusal fibers) or to the filaments of tendons. The spindle consists of two parts, the nuclear chain fiber and the nuclear-bag fiber. Spiral sensory endings called afferent neurons wrap around the central portion of both fibers. The fibers receive gamma efferent neurons. These serve to set the “tone” or sensitivity of the spindle.

On the other hand Golgi tendon organs are proprioceptors encapsulated in tendon fibers and are located near the junction of the muscle and tendon fibers. Like the spindles, the tendon organs are sensitive to stretch. However they are less sensitive than the spindles and therefore require a strong stretch before they are activated. Actually, because of their location with respect to the muscle fibers, the Golgi tendon organs are activated mainly by the stretch placed upon them by the contraction of the muscles in whose tendons they lie. Given such a stretch, sensory information is sent to the central nervous system, causing the contracted muscle to relax. In other words, in contrast to the spindles, which are facilitatory (i.e., they cause contraction), stimulation of the tendon organs results in inhibition of the muscles in which they are located. This can be interpreted as a protective function in that during attempts to lift extremely heavy loads that could cause injury, the tendon organs effects relaxation of the muscles. A good example of the tendon organs in action is given by arm-wrestling. It has been suggested that the loss of the contest occurs when the tendon organ inhibition overcomes the voluntary effort to maintain contraction (O'Connell, 1972).
It should be pointed out that the spindles and tendon organs work together, the former causing just the right degree of muscular tension to effect a smooth movement and the latter causing muscular relaxation when the load is potentially injurious to the muscle and related structures (Fox, 1981).

In the field of sports and activity of life moment is the basis of a human life. A voluntary movement such as punting a football is initiated. Impulses are transmitted downward through the pyramidal tract to excite the appropriate muscles. Impulses are also simultaneously transmitted to the cerebellum. As the signals arrive at the muscles, proprioceptors (muscle spindles, Golgi tendon organs, and joint receptors) send the “punting” signal back to the cerebellum. The cerebellum then compares the two sets of information and elicits an impulse (correction factor) from the motor cortex, where the original stimulus was initiated: the movement is then executed.

An example of one of the many fascinating but extremely complicated feedback circuits begins in the motor cortex and return to it via proprioceptors and the cerebellum. This servomechanism type of feedback has been compared to control systems such as those used in industry, guided missiles, automatic pilot mechanisms, and anti aircraft guns. For example, the guided missile continuously transmits radar signals which are received and fed to a computer. The computer which is analogous to the cerebellum monitors the signals and compares them to a prewritten program. In this manner, it can detect any errors in the missile’s path and radio a correction signal. In somewhat the same fashion, the cerebellum compares the information from the motor cortex to the execution of the football punt. The ‘error’ is calculated by the cerebellum, and a correction is immediately relayed to the motor cortex (Fox, 1981).

It is in the preceding manner that cerebellum exerts a dampening effect on such pendular movements as the golf swing and throwing and kicking a ball. As the arm or leg moves, momentum is developed with a resulting tendency for the limb to overshoot its mark. The dampening or ‘correcting’ effect is administered by the cerebellum so that the limb stops at the intended position.

Similarly, the cerebellum predicts eventual limb position. The incoming information from the proprioceptors is used by the cerebellum to guide all body parts during the performance of a skill. Through the motor cortex the cerebellum exerts control over both the antagonist and agonist muscles. So, the things in the world
outside ourselves come via body (sense organs) into our mind, and the things in our mind reach the outside world through the body i.e. limbs or muscles. This harmony of mind and body has made man an autonomous creature (Verma). The body is the medium of experience and the instrument of action. Through its actions we shape and organize our experiences and distinguish our perceptions of the outside world from sensations that arise within the body itself (Miller, 1978). Thus, the study is focused on the primary role of sensation processes and the relationship between conscious processes and association.

1.1.4 Relation of Cognitive ability, motor creativity and kinesthetic sense

In the beginning of the 1980s, Zaichkowsky, Zaichkowsky and Martinek (1980) suggested that not only do movement and play enhance: a) learning to employ cognitive strategies, b) understanding themselves in psychological terms and c) learning how to interact with other children. During that same time, Torrence (1981) suggested that kinesthetic modality for eliciting the creativity of most preschool children, since skills in these modalities are the most practiced at preschool age. Through creative movement, children have the ability to express their feelings and their thoughts and to act using their body this expressiveness, through the body, manifests itself more prevalently than speech. In this way, many children are able to explore experiences through movement that are not available to them through words (Jones, 1972). The importance of movement at this developmental stage was also supported by Capel (1986), who claimed that movement activities provide children with the opportunity to exercise and develop their inventiveness, creativity and their spirit of adventure.

However, despite the studies showing evidence of inter-relation between motor creativity and critical thinking, very few studies attempted to provide evidence concerning the role movement can play in the development of creativity. In addition, little attention has been given to the possibility of fostering creativity through movement programs in the development and enhancement of creativity in ECE (Early Childhood Education). In Danky's article (1999), Kogan suggested “the existence of a mechanism that could involve a carrying over a positive affect and intrinsic motivation from playful activity to problem-solving situation” (p.407). Perhaps with a
similar mechanism the experience children acquire from movement programs could be carried over from solving movement tasks to any problem-solving situation and from creative movement to all aspect of creativity.

The organismic growth, in fact begins with motor movements of reflex type. Sherrington views muscles as “the cradle of recognizable mind” which “seems to have arisen in connection with the motor act, where motor integration progressed and where motor behavior progressively evolved, mind progressively evolved”. Therefore, motor learning is at the root of cognitive and affective learning. Being predominantly physical, it aims at establishing and strengthening of stimulus-response connections both by classical and operant conditioning (Kamlesh, 2002).

Cognitive ability, motor creativity and kinesthetic sense are closely related with each other. Several research studies revealed that these qualities are governed by the psychomotor process of brain (mental & nervous). It is believed that effect of cognitive learning, motor creativity (Tocci, Scibinetti and Zelli) and kinesthetic sense will be different on different pupil in respect of age. A mature individual will react more effectively after analyzing the stimulus whereas an adolescent is emotionally carried out and the reaction does not depend upon reasoning while a child neither analyses the stimulus nor is emotionally carried out and thus reacts differently.

It has long been known that exercise has a positive influence on health and fitness. A number of researchers have shown a qualitative development among athlete and exercise participant in respect of various system of body (Astern, Sheper, Shelton etc. However research findings on the young children in respect of exercise stress are scanty. Exercise stress also has some potential benefit on adult’s mental health and behavior pattern. In this study on attempt will be made to look into this aspect that is the influence of exercise on behavior pattern of children in general and particularly on cognitive ability, motor creativity and kinesthetic sense.

1.1.5 Child Development and Exercise

Scientifically based and individualised exercise programs help to improve child’s psycho-motor, physical and neuro-motor development. Physical activity is used as the key to realizing these goals within a Kinderkinetics program, adapted according to the developmental needs of the child and the specific program that is
offered. Physical activity is described as any bodily movement that is caused by the skeletal muscles and which leads to energy output (Caspersion et al., 1985).

Developmental programs that are offered during early childhood, offer a variety of challenges as young children are unique, diverse and possess comprehensive developmental needs during this period. Garcia et al. (2002) describe early childhood as a unique period in a child’s life as it is a period when they develop physically, emotionally, intellectually and socially and as a result require specialised knowledge to realize the full deployment of potential in these ages. Movement play a critical role in the development of young children as it reflects neurological organisation and provides stimulation to the neurological systems that are essential for development and optimal functioning. Neuro-scientists originally thought that the structure of the brain during birth was genetically predetermined, but have found that although the neurons are present at birth, it is the experiences of each day which eventually determine the structure of the brain and as a result determine the nature and extent of the child’s abilities. Physical activity is the trigger of comprehensive activity in the cerebral and motor cortex of the brain and neuro-scientists (Berthox, 2000) found that movement provides a form of stimulation to the brain which allows the neural pathways to develop and contributes to the eventual structure of the brain. Therefore, movement plays a critical role in the sensory and physiological stimulation of the brain which results in the development of more synapses during early childhood (Changeux & Conic, 1987; Hannaford, 1995) and in so doing, contribute to neural growth. The plasticity of the brain indicates that it can continually adapt and that the structure thereof can be changed by various forms of stimulation, which includes movement stimulation. During the developmental period of the neural network formation, plasticity of the brain is described as high and as a result is regarded as a critical period/window of opportunity where the brain is more receptive to appropriate stimulation than at any other time (Chugani, 1999). This plasticity does, however, decrease with the increase in age and as a result the window of opportunity for neural growth closes again. This means that, in theory, if a child misses this opportunity for further brain development, it could mean that the brain is denied the opportunity to develop neural networks to its full potential. The main emphasis of the motor development programs at a young age should be aimed at development of gross motor (0-5 years), perceptual-motor (3.5-7 years) and fine
motor skills (0-9 years), as this is the time when stimulation with regard to these aspects are the most essential (Gabbard, 1998).

Physical activity, movement experience and exposure to structured movement development programs are critical to contribute to the development of fundamental movement patterns, perceptual motor skills and self confidence. It is also a critical aspect of a young child’s school readiness make-up as it is related to a positive cognitive outcome and also associated with health consequences (Coe et al., 2006). Children’s development to a proficient learner also goes through various phases of which kinaesthetic learning is the first phase on which learning is based (Wilken, 2008). As a result it is not strange that problems associated with learning problems are regarded as intrinsic and attributed to the dysfunction of the central nervous system (Lerner, 1993).

A good movement development foundation can therefore be regarded as the foundation of total development in young children, which can affect all other facets of their development and impede their total-well being. As a result it is clear why specialists regard this period as a period of essential play with the viewpoint that play is the most important job of a child in his early developing years. This phase as the optimizing phase for health, as children are equipped during this phase with the necessary skills and a love for movement which will make them lifelong movers (Pienaar et al., 2007).

As children age, different demands are made on them regarding physical activity. Physical activity is a complex multidimensional behaviour that can be characterised into frequency, duration, intensity and type of activity (Miles, 2007). During early childhood a child should be equipped with skills which enable him to also be physically active later in his life. For general public health, daily activity in the moderate intensity zone is suggested, as activity that meet this requirement, stimulate the cardiovascular system, muscular-skeletal and metabolic systems and as time goes on adapt it to be more efficient with regard to function (as a result the body becomes fitter).

There exists much epidemiological and experimental proof that the human body flourishes on regular physical exercise, and that the body, in contrast, will react negatively to regular periods of inactivity. Biologists and anthropologies are of the
opinion that humans receive a genetic genome within which there are genes that can
only come to full expression within an environment of regular physical activity
(Booth et al., 2002). These researchers indicate that when activity is lower than the
acceptable norm, the expression of these genes change and clinical defects such as
cardi vascular diseases, metabolic diseases and certain types of cancer will manifest.

The first guidelines touching on acceptable amounts of physical activity in
children were formulated in 1988. The American College of Sports Medicine made an
opinion statement, based on the guidelines for adults with regard to the amount of
physical activity that is needed for optimal functional capacity and health, which was
20–30 minutes of vigorous exercise each day. An International Physical Activity
conference was held in 1993 where empirical based guidelines were comprised.
Following this, the Health Education Authority of England developed a modified set
of guidelines for children in 1998 (Department of Health, 2000), which contained
primary recommendations (one hour of moderate activity per day, accumulated) and
secondary recommendations which suggest that activity on at least two days of the
week should include activities that will improve bone health, muscle strength and
flexibility. A systematic literature overview was published in 2005 (Strong et al.) with
regard to physical activity, in which the findings with regard to suggested guidelines
were similar to the existing guidelines.

Four main reasons for the promotion of physical activity in children regarding
health advantages of exercise are highlighted. Firstly it contributes to healthy growth
of the muscular skeletal and cardiovascular system. In this regard it has been reported
that although exercise increased skeletal growth in prepubesant children, there is
increasing proof that it gains the greatest advantage with regard to bone health during
early puberty (Mosley & Lanyon, 2002). Literature indicated that the bone mineral
density of boys and girls increase significantly during the childhood and adolescent
years, but that it especially takes place during the rapid growth phase at approximately
age 12 years in girls and 14 years in boys. The accumulation of bone density during
these growing phases will hold long-term advantages as it is this accumulation of
bone mass during this time that counteracts the loss of bone mass as age increases.
Physical activity is secondly important to maintain an energy balance (to ensure
healthy weight). In terms of risk factors for cardiovascular diseases, the primary role
of physical activity is indirectly to prevent excessive weight from accumulating.
Chronic disease has a long incubation period and childhood and adolescence forms the early phases of accumulated exposure to risk factors throughout the life cycle, therefore it is thirdly important to prevent risk factors such as hypertension (high blood pressure) and abnormal lipid profiles through regular physical activity. Fourthly it is important to offer opportunities for social interaction, mastering of skills and mental health by means of participation in physical activity. Research indicates that children with low levels of physical activity, exhibit more symptoms of psychological stressors as shown with higher physical activity, while a positive relationship was also found between physical activity and wellness, regardless of social class or health status. Children with higher physical activity levels also often exhibit better cognitive functioning.

The childhood and adolescent years provide the biggest opportunity to establish good attitudes with regard to physical activity. Children who completed their school years with a positive attitude towards their body and their skills will probably also are active adults. The quality of physical activity experiences during childhood apparently also plays a large role in the continuation of an active lifestyle as adults than the quantity of the physical activity (Engstrom, 1991; Telama et al., 1994; Taylor et al., 1999). The nature of the experience of exercise and sport at school impacts directly on continue participation during adulthood (Health Education Authority, 1992). It is often the improved mental condition, a feeling of achievement, relaxation or unloading of daily stress which ensures participation in physical activity by children, rather than the health advantages obtained from it.

From the foregoing discussion relating to the cognitive ability, motor creativity, kinesthesia and its connection with exercise if any has not yet been established by scientific experimentation. However many researchers have attempted to derive into definite conclusion. But the concept appears to be more theoretical rather than strong experimentation. Research findings which the present investigator could accumulate are mostly from foreign lands. Such findings of Indian researchers are scanty. Therefore, the present researcher nurtured in his mind a research problem relating to this issue.
1.2 STATEMENT OF THE PROBLEM

Present study was planned for understanding cognitive ability, motor creativity and kinesthetic sense of children in relation to chronic exercise. Accordingly the problem of the study is "A study on cognitive ability motor creativity and kinesthetic sense of children with reference to chronic exercises."

1.3 PURPOSE OF THE STUDY

The purposes of the present study were as follows:

1. To observe cognitive ability of three different age groups of children.
2. To observe motor creativity of three different age groups of children.
3. To observe kinesthetic sense of three different age groups of children.
4. Intragroup analysis of these qualities will be conducted to find age specific characteristics, if any.
5. To observe the influence of exercises on children of different age groups in respect of cognition ability, motor creativity and kinesthetic sense.
6. To observe the relationship among these three parameters (cognitive ability, motor creativity and kinesthetic sense).

1.4 DELIMITATION OF THE STUDY

The study was confined to the following:

a) Only primary school students were selected as subjects for this study (6 years to 8 years of age).

b) Only male students were chosen for the investigation.

c) The study was confined to the district of Jalpaiguri, West Bengal.

d) Only 180 male students (60 from each age group) were studied in the investigation.
e) For collecting data of cognitive ability non verbal tests of Raven's Progressive Matrices Test, Wisconsin Card Sort Test and Academic Performance Test were conducted.

f) For collecting data of motor creativity a motor creativity test battery was used.

g) Out of so many standard kinesthetic sense tests only the 'distance perception jump' was used to collect the data of kinesthetic sense.

h) Only ten weeks chronic exercise program was conducted to the experimental groups.

1.5 LIMITATION OF THE STUDY

During the course of the present study the investigator had to encounter the following shortcomings which might influence the result in some way or the other:-

Due to lack of time and finance small group of subjects could be brought under the preview of the present investigation which might hamper in generalizing the result.

Subjects were from different socio-economic groups therefore nutritional status of the subjects and their growth rate were different which might influence result differently.

All the subjects were day scholars, thus any psychological influence of family members or elders, which might influence the result was beyond the control of the investigator.

Interest, attitude, motivation and such other mental factors were also limiting factors for analyzing psychological profile of the subjects.

The environmental condition of different tests days although were more or less same. Changing of environmental condition, were beyond the control of the researcher.
1.6 HYPOTHESIS

H₁: There may not be any variation among three different age groups of children in respect of cognitive ability.

H₂: There may not be any variation among three different age groups of children in respect of motor creativity.

H₃: There may not be any variation among three different age groups of children in respect of kinesthetic sense.

H₄: Exercise in all probability has no influence on cognitive ability.

H₅: Exercise in all probability has no influence on motor creativity.

H₆: Exercise in all probability has no influence on kinesthetic sense.

H₇: It is expected that these three cognitive ability, motor creativity and kinesthetic sense are related to each other.

1.7 SIGNIFICANCE OF THE STUDY

It is believed that the results of the study will help us to know the following aspects:

1. The study will give an idea about the physical profile of primary school children of three different age groups.

2. The study will give an idea to the Physical Educators, coaches, and Sports Administrators about the cognitive ability of primary school children of three different age groups.

3. The result status of motor creativity of different age group of children will be known.

4. The study will reveal the fact regarding the kinesthetic sense of different age group of children.

5. The effect of chronic exercises on the children of different age group may envisage in respect of cognitive ability, motor creativity and kinesthetic sense.

6. The study would provide important information for future research in the relevant field.
1.8 DEFINITION OF TERMS

In order to understand the basic concepts of the problem of this research, the following terms should be specifically understood as follows:

Age: Age has been understood as the chronological period of life. After birth the years, months and days that have been passed indicate the age of an individual. Age indicates the state of maturity. There may be different ages of a person such as chronological age, anatomical age, physiological age, mental age etc. In the present study chronological age has been understood as the age of the subjects.

Height: Body height is the vertical height above the base of support. It is the tallness. It is measured as the perpendicular distance between the supportive base and the vertex. It is measured in meters.

Weight: Body weight indicates the heaviness of the body of a person. It is caused due to the gravitational pull acted on the mass of the body. It is measured in kg unit.

Kinesthetic sense: It is an ability to feel to be aware of muscular movement and position. By providing information through receptors about muscles, tendons, joints, and other body parts, the kinesthetic sense helps to control and coordinates activities such as walking and talking (Mosby's Medical Dictionary).

Kinesthetic perception: A factor that is very much involved in movement and specially in learning specific skills is kinesthesia may be defined as the sense that gives the individual an awareness of position of the body or parts of the body as it moves through space (Barrow and McGee, 1979).

Motor creativity: Motor creativity is the combination of perception into new motor patterns. These perceptions could be a solution to a given problem or an idea which is expressed through movement (Wyrick, 1968).

Cognitive ability: It covers every mental activity that is commonly regarded as thinking or knowing, perceiving, learning, conceptualizing, imagery, problem-solving, remembering, reasoning and judging (Guinnies, 1990).
Proprioceptive sense: The receptors for movement sense and those which give information about the position of the body in space are called proprioceptors. As one of the 'near' senses, proprioception is the sense responsible for letting us know when and how far we stretch our muscles. Otherwise known as the kinesthetic sense, it is our internal gauge responsible for telling us where our body is in space. For a person with a well organized proprioceptive sense, this process is automatic, and is rarely even thought of. When they see an object in front of them, especially one they have held before, they will know almost exactly how much force to use in order to lift, hold, or move that object. If their first guess is ever wrong, they can usually correct it immediately. Because they are able to correctly judge how much effort to apply when handling objects and moving and positioning their bodies, they will not have to put a ton of effort into learning new motor activities and correcting their posture.

Chronic exercise: Exercise may be categorized into acute (high intensity for short period) and Chronic. Chronic exercises are generally systematic, planned and regular which are continued for a long period of time.