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CHAPTER - 1

INTRODUCTION

1.1 Preamble

Generally people express their unusual thoughts through creativity. In school environment unusual thoughts and behaviors are not cuddled in classroom rather they are suppressed as teachers need to complete exam syllabus on time, assessment is only done through written mode, teacher student ratio and various numbers of reasons are responsible to neglect the major attribute of a students which plays a very important role in future for the child. In the present scenario our teachers lack the efficiency to identify any kind of learning problems in classroom. A proper training and awareness is required as these children go unnoticed and suffer with low self-esteem, social withdrawal, isolation in school and at home. Sometimes even the parents are not aware about the problem and their hyperactivity is punished with physical assault.

1.2 Creativity

Creativity is any thought that is unusual and different form the usual one.

1.2.1 Concept of Creativity

Creativity is free from any gender, caste, creed, religion or any geographical boundary. In this study creativity is shared from a very different perspective. This study is a special tried to check the creativity among a special group of children in class. Darya Zebelina and colleagues have found that real life creative achievement is associated with ability to broaden attention and have a “leaky” mental filter- something in which ADHD excel.

Scott Barry Kaufman, a cognitive psychologist and scientific director at the Imagination Institute in the Positive Psychology Center at the University of Pennsylvania, says that people diagnosed with ADHD and people who we consider to be creative thinkers are actually extremely similar.

In order to be creative, a person needs to be able to view things in innovative ways or from a different perspective. Among other things, a person needs to be able to generate new
possibilities or new alternatives. Different tests of creativity measure not only the number of alternatives that people can spawn but the uniqueness of those alternatives. The ability to generate alternatives or to see things uniquely does not occur by change; it is linked to other, more fundamental qualities of thinking, such as flexibility, tolerance of ambiguity or unpredictability, and the enjoyment of things heretofore unknown.

Ways that "creativity" is commonly used:

- Persons who express unusual thoughts, who are interesting and stimulating - in short, people who appear to unusually bright.
- People who experience the world in novel and original ways. These are (personally creative) individuals whose perceptions are fresh, whose judgements are insightful, who may make important discoveries that only they know about.
- Individuals who have changes our culture in some important way. Because their achievements are by definition public, it is easier to write about them. (e.g., Leonardo, Edison, Picasso, Einstein, etc.)

1.2.2 Definition of Creativity

As the term defines creativity means something close to creation. And creation has to be innovative and different.

Creativity implies the production of a ‘totally or partially’ novel identity.

Stranger and Karwoski (1973)

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

Spearman (1931)

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

David Ausubel (1963)

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.

M.J Levin (1978)
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.  

_Paplia and Olds (1987)_

The creative process is a 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.  

_Wilson, Guilford and Christensen (1974)_

### 1.2.3 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.** It is not confined to any caste, creed or religion. It is universal in nature and is not bound by the barriers of age, location, boundaries or culture. Each individual do possesses and is capable of demonstrating creativity to some degree.

- **Creativity is innate as well as acquired.** Many research finding and incidents support the suggestion that creativity is an inborn talent in an individual. 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 is an ability of an individual to produce something new or novel, but this novelty does not necessarily imply the production of an absolutely new idea or object which has never been experienced or has never existed before. The only precondition for naming an idea to be novel is when it is neither a repetition nor reproduction of what has already been experienced or leaned by an individual.

- **Creativity is adventurous and open thinking.** Creativity is actually a departure from rigid, stereotyped, closed and monotonous thinking. It generally demands an individual to think out of the box and come up with ideas or solutions which are sometimes may not be accepted by general population.
• **Creativity has a wide scope.** Creative expression is not restricted by any limits or boundaries. It covers all fields and activities of human life where any individual can demonstrate creativity by expressing or producing new idea. Literature, drama, plays, teaching, innovation, business, painting, cooking, sculpture, and many other professions and even the routine activities of daily life.

• Creativity and school achievement are not correlated.

• Creativity and intelligence are interdependence.

**1.2.4 Types of creativity**

Building on J.P. Guilford's work and created by Ellis Paul Torrance, the Torrance Tests of Creative Thinking (TTCT), a test of creativity, originally involved simple tests of divergent thinking and other problem-solving skills, which were scored on four scales:

• **Fluency.** The total number of interpretable, meaningful, and relevant ideas generated in response to the stimulus.

• **Flexibility.** The number of different categories of relevant responses.

• **Originality.** The statistical rarity of the responses.

• **Elaboration.** The amount of detail in the responses.

**1.2.5 Creativity and its relation with Intelligence**

The relationship between intelligence and creativity is not fully understood, although recent research suggests that intelligent people naturally crave higher levels of creativity. Research also suggests that intelligence and creativity overlap each other, meaning that intelligent individual has a high aptitude for creativity, and vice versa. This is somewhat counter to previous ideas that suggested creativity raises intelligence levels.

According to intelligence models, creativity enhances, or even highlights, intelligence but does not significantly raise it. An article featured in "Psychology Today" furthers this idea in its assertion that those who are creative are more adept at language, science, artistic interpretation and technology, all of which are associated with higher levels of intelligence.
There is also research that supports a correlation between high levels of creativity and those with IQs of 120 or higher. Psychologists warn, however, that those who have high convergent intelligence, which applies to problems for which there is one correct answer, do not always have high levels of divergent intelligence, which is the ability to think outside the box in order to generate multiple possible solutions. Creative intelligence, however, relies not on prolific results but on profound ones.

It takes only a nominal amount of creativity to capitalize on intelligence. Psychologists warn that the lack of a correlation between convergent and divergent intelligence is not necessarily indicative of a lack of a relationship between intelligence and creativity.

Although empirical creativity research can meanwhile look back on a scientific tradition of over 60 years of investigation, it is still unclear how the concepts of creativity and intelligence relate to each other. (Kaufman & Plucker, 2011) (Sternberg & O’Hara, 1999) provide a general framework for researchers encompassing five possible relationships: Intelligence and creativity can either be seen as a subset of each other, they may be viewed as coincident sets, they can be seen as independent but overlapping sets, and lastly as completely disjoint sets.

Intelligence is highly relevant for creativity, but the kind of relationship depends on the level of intelligence as well as on the actual indicator of creativity. In line with early assumptions, intelligence may increase creative potential up to a certain degree where it loses impact and other factors come into play. At this, it possibly applies that the more complex the measure of creativity that is considered, the higher the threshold up to which intelligence may exert its influence. For the most advanced indicator of creativity, namely creative achievement, intelligence remains relevant even at the highest ability range.

1.2.6 Creativity and its presence in ADHD students

ADHD is one of the most prevalent and vigorously studied psychiatric conditions in child psychology. Yet, despite the large amount of research into this disorder, a number of myths have arisen over the years (Kaplan, 1998). For example, Kaplan, Dewey, Crawford and Fisher (1998) showed that children with ADHD do not necessarily have memory problems.
The ADHD brain may not be held back as much by constraints on thinking. In a study by Abraham et al. (2006), adolescents with ADHD, adolescents with conduct disorder, and a control group were each assessed with creativity measures. The ADHD group was found to have a higher rate of being able to overcome constraining examples ("thinking outside the box"), but had difficulty creating an invention from an imagery task.

In a study by White and Shaw (2006), people with ADHD were found to score higher than those without ADHD in a measure of divergent thinking (ie. coming up with creative solutions to a problem). However, people with ADHD did not score as well as those without ADHD on a measure of convergent thinking (ie. giving the "correct" answer to a test question).

A later study by White and Shaw (2011) also found that people with ADHD scored higher in original creativity and creative achievement than those without ADHD. It was also found that people with ADHD preferred generating ideas, while those without ADHD preferred clarifying problems and developing ideas.

Contrary to popular opinion, stimulant medication may not actually hamper creativity. In a double-blind placebo-controlled study, Farah et al. (2009) measured sixteen young adults on four measures of creativity. Two of the measures required divergent thought, while the other two required convergent thought. The study found that Adderall did improve convergent thought. No negative effects were found on convergent and divergent thought measures.

While more studies need to be done on ADHD and creativity, it does appear that there may be a correlation between ADHD and increased creativity.

1.3 Attention Deficit Hyperactivity Disorder (ADHD) as per DSM – IV

Attention Deficit Hyperactivity Disorder (ADHD) is characterized by pervasive and developmentally inappropriate difficulties with inattention, hyperactivity, and impulsivity (Birchwood & Daley, 2012; DuPaul et al., 2011).
Attention-Deficit/Hyperactivity-Disorder (henceforth ADHD) is the most common mental health disorder among young children. Approximately 3-5% of children suffer from the disorder, which is characterized by attention deficiencies, hyperactivity, and impulsiveness but often children with ADHD also suffer from comorbidities and learning problems (Child and Youth Psychiatric Society, 2008).

As per Diagnostic and Statistical Manual of Mental health Disorder- 4th edition (DSM-IV) ADHD is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequently displayed and more severe than is typically observed in individuals at a comparable level of development”

ADHD is a condition of the brain that affects a person's ability to pay attention. It is most common in school-age children.

ADHD is a chronic disorder, meaning that it affects an individual throughout life. The symptoms are also pervasive, meaning they occur in multiple settings, rather than just one. Current research supports the idea of two distinct characteristics of ADHD, inattention and/or hyperactivity-impulsivity. A child with these characteristics typically demonstrates the following signs.

1.3.1 Essential features of ADHD:

A. Persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequently displayed and is more severe than is typically observed in individuals at comparable level of development.
B. Some hyperactive-impulsive or inattentive symptoms must have been present before seven years of age.
C. Some impairment from the symptoms must be present in at least two settings.
D. There must be clear evidence of interference with developmentally appropriate social, academic or occupational functioning.
E. The disturbance does not occur exclusively during the course of a Pervasive
Developmental Disorder, Schizophrenia, or other Psychotic Disorders and is not better accounted for by another mental disorder.

1.3.2 Three Subtypes of ADHD:

**Attention-Deficit/Hyperactivity Disorder Predominantly Inattentive Type:** This subtype is used if six (or more) symptoms of inattention (but fewer than six symptoms of hyperactivity-impulsivity) have persisted for at least six months.

**Attention-Deficit/Hyperactivity Disorder Predominantly Hyperactive-Impulsive Type:** This subtype should be used if six (or more) symptoms of hyperactivity-impulsivity (but fewer than six of inattention) have persisted for at least six months.

**Attention-Deficit/Hyperactivity Disorder Combined Type:** This subtype should be used if six (or more) symptoms of inattention and six (or more) symptoms of hyperactivity-impulsivity have persisted for at least six months.

1.3.3 Diagnosis of ADHD

Practitioners often use DSM criteria to diagnose ADHD based on reports from both parents and teachers. This process involves establishing the presence of six or more DSM symptoms of inattention or hyperactivity/impulsivity and impairment; symptoms must be seen in more than one setting. Symptoms should be present over a period of 6 months by the age of 7 and must significantly obstruct daily function (Daley & Birchwood, 2009; Sibley et al., 2011; Wheeler et al., 2008). It is preferable to combine informant (parents, teacher, clinicians, etc.) reports to improve diagnosis (American Academy of Pediatrics, 2011; Sibley et al., 2011). The diagnostic symptoms should not occur during another condition or be better accounted for by other mental disorders (Goldstein & Naglieri, 2008).

1.3.4 Causes of ADHD

The aetiology of ADHD has not yet been clearly identified, but genetic factors are believed to play a very important role. Faraone *et al.* (2005) document that twin studies estimate the heritability of ADHD to be 76%, which shows the highly heritable nature of the disorder.
Besides genetic factors, studies indicate that some biological factors that negatively affect brain development in the prenatal and perinatal life may be risk factors for ADHD.

These include maternal smoking (Linnet et al., 2003), alcohol consumption during pregnancy (Mick et al., 2002a), and low birth weight (Mick et al., 2002b). Furthermore, pregnancy and birth complications also seem to predispose for ADHD. Some studies show that the interplay between genetic and environmental factors are important, for example the risk associated with maternal smoking during pregnancy may be higher if the child is genetically disposed to ADHD (Laucht et al., 2007). This knowledge about the causes of an ADHD disorder is important to be able to include the most important confounders in the conditioning set.

Diagnosing a child or an adolescent with ADHD is a specialist task and is performed by a psychiatrist or a specialist physician. Actually, Auerbach et al. (2004) suggest that symptoms are present in infants with a familial risk of ADHD. They tend to have a higher temper, be easily moved to tears, and are less able to calm themselves. In addition, a small study by Thunstrom (2002) suggests that poor sleep patterns in infancy and early childhood is associated with a subsequent ADHD disorder. Thus, the impact on parents’ labor supply and relationship may occur early in the child’s life and long before the actual diagnosis.

Besides the core symptoms, children with ADHD often suffer from comorbid problems such as depression, anxiety, behavioral problems, tics, social dysfunction, as well as literacy and other learning problems (Child and Youth Psychiatric Society, 2008).

1.3.5 Treatment of ADHD

Optimal treatment for ADHD is still a matter of debate in our country. Current treatments typically involve therapy, medication or both. However, recent research indicates that a combination of therapy and medication may be the most helpful treatment. Children and adults with ADHD often greatly benefit from counselling or behaviour therapy, which may be provided by a psychologist or other mental health care professionals.
Some people with ADHD may also have other conditions such as anxiety disorder or depression. In these cases, counselling may help both ADHD and the coexisting problem.

Counselling therapies may include:

- **Psychotherapy.** This allows older children and adults with ADHD to talk about issues that bother them, explore negative behavioural patterns and learn ways to deal with their symptoms.

- **Behaviour therapy.** This type of therapy helps teachers and parents learn strategies (contingency management procedures) for dealing with children's behaviour. These strategies may include token reward systems and timeouts. Behaviour modification using contingency management techniques has proved especially beneficial for people with ADHD.

- **Family therapy.** Family therapy can help parents and siblings deal with the stress of living with someone who has ADHD. As children with ADHD faces lot of problem in school and at home. Only family support to understand their problem will help the child deal with the situation.

- **Social skills training.** This can help children learn appropriate social behaviours as they have to deal with friends, teachers and parents too.

- **Support groups.** Support groups can offer adults and children with ADHD and their parents a network of social support, information and education.

- **Parenting skills training.** This can help parents develop ways to understand and guide their child's behaviour that is required to deal in a day to day life.

The best results usually occur when a team approach is used, with teachers, parents, and therapists or physicians working together. You can help by making every effort to work with your child's teachers and by referring them to reliable sources of information to support their efforts in the classroom.

1.3.6 Medications

Drugs known as psycho stimulants are the most commonly prescribed medications for treating ADHD in children and adults. Commonly used psycho stimulants include:
- Methylphenidate (Ritalin, Concerta)
- Dextroamphetamine/amphetamine (Adderall)
- Dextroamphetamine (Dexedrine)

Another medication that works in a similar manner, but is not a stimulant, is atomoxetine (Strattera). Sometimes antidepressants also may be used — especially for adults and for children who don’t respond to stimulants or who are depressed or have other problems.

These medications are available in short-acting and long-acting forms. The short-acting forms last about four hours, while the long-acting preparations last between six and 12 hours. With the exception of methylphenidate, these medications come only in an oral form. Methylphenidate was recently introduced in a long-acting — about nine hours — patch that can be worn on the hip. This form was approved for use in children between the ages of 6 and 12 under the brand name Daytrana.

Although scientists don’t understand exactly why these drugs work, stimulants appear to boost and balance levels of the brain chemicals called neurotransmitters.

These ADHD medications help alleviate the core signs and symptoms of inattention and hyperactivity — sometimes dramatically. However, effects of the drugs wear off quickly. Additionally, the right dose varies between individuals, so it may take some time in the beginning to find the dose that’s right for you or your child.

There’s been some concern about using medications to treat preschoolers who have ADHD. One large-scale study found that low doses of the commonly used medications are safe and effective in young children. However, the study did find that the younger children were more susceptible to medication side effects.

**Medication Side effects**

The most common side effects of psycho stimulants in children include decreased appetite, corresponding weight loss, nervousness and problems sleeping. Some children experience
irritability or increased activity as the effect of the medication tapers off. Adjustments in
doses can often offset these side effects.

A small percentage of children may develop jerky muscle movements, such as grimaces or
twitches (tics), but these usually disappear when the dose of medication is lowered.
Stimulant medications may also be associated with a slightly reduced growth rate in
children, although in most cases growth isn't permanently affected.

The nonstimulant medication Strattera has been linked to side effects that include rare liver
problems. If your child is taking Strattera and develops yellow skin (jaundice), dark-
 coloured urine or unexplained flu symptoms, contact your doctor right away. In September
2005, the Food and Drug Administration (FDA) issued a public health warning to doctors
about the risk of suicidal thinking in children and adolescents being treated with Strattera.
The FDA urged doctors to closely observe children being treated with Strattera for signs of
suicidal thinking.

Adderall has raised concerns because of reports of sudden unexplained deaths in children
taking the medication. Health officials in Canada suspended sales of Adderall XR in
February 2005, but allowed the drug back on the market in August 2005 after
recommending that the drug not be used in children with heart abnormalities. In the United
States, the FDA also is recommending that the medication not be used in anyone with
known cardiac abnormalities.

Dextroamphetamine has also raised concerns because sudden deaths in youngsters with
heart abnormalities have occurred. The drug may also cause troubling psychological side
effects, such as delusional thoughts or hallucinations.

Parents also are understandably concerned about psychostimulants — which are similar to
amphetamines — and the risk of addiction. But dependence hasn't been reported in children
who take medications orally and at the proper dosage. That's because drug levels in the brain
rise too slowly to produce a "high." On the other hand, there's concern that siblings and
classmates of children and teenagers with ADHD might abuse ADHD medications.
In general, psychostimulant side effects in adults are similar to those in children. But ADHD drugs are also more likely to cause certain problems specifically in adults, including mild increases in blood pressure that may be significant for people who already have hypertension, and the liver disease hepatitis. In addition, because adults usually require higher dosages of these medications than children do, the risk of abuse or addiction may be greater. Antidepressants, either alone or in combination with a psychostimulant, can help reduce mood instability and disturbances. Side effects may include dry mouth, urinary retention, weight gain, drowsiness and sexual dysfunction.

**Experimental Treatments**

Behavior therapies and medications are the most thoroughly researched treatments for ADHD. Other approaches are being studied but are still considered to be unproved and experimental.

- **Biofeedback.** Ordinarily, this stress-reduction technique is used to help people learn to control certain body responses, such as heart rate and muscle tension. It has also been used with the intent of teaching adults and children with ADHD to change their brain wave patterns to more normal ones.

- **Brain wave biofeedback.** The goal of brain wave biofeedback (Neurobiofeedback) is to teach people to control their own brain wave patterns using electroencephalography (EEG) feedback, sometimes combined with a video game. EEG measures the waves of electrical activity of the brain.

- **Special diets and supplements.** Over the years, a great deal of media attention has focused on diets for ADHD. Most diets involve eliminating additives and foods thought to increase hyperactivity, such as sugar and caffeine, and common allergens such as wheat, milk and eggs. So far, however, studies haven't found a consistent link between diet and improved symptoms of ADHD. If you think certain foods affect your child's behavior, however, try eliminating them for a time. Additionally, there's no evidence that dietary supplements, such as fatty acids, ginkgo or megadoses of vitamins, can reduce ADHD symptoms.
1.3.7 Concerns of ADHD students

ADHD is a consistent predictor of conduct disorder and physical aggression and has been linked to delinquency, drug and alcohol abuse, and criminal behavior. Between 24 and 67% of prison inmates display symptoms of ADHD (Beaver et al., 2012). Adolescents with ADHD continue to display impairments of children; for example, they have difficulty with peer relationships, academics, and family conflicts. However, they are beginning to experience the impairments of adults, like substance abuse, driving problems, delinquency, increased drop-out rates, and early initiation of sexual behavior. Adolescents display serious impulsive and inattentive behaviors that may have permanent negative consequences (Sibley et al., 2011).

Research has demonstrated that individuals with ADHD demonstrate deficiencies in executive functioning, which refers to a variety of processes including attention, working memory, flexibility of thought, planning, and the regulation of goal-directed behavior. Working memory is a system that allows one to temporarily hold information in mind long enough to utilize it. This is a key function that is necessary for cognitive tasks, such as remembering instructions and completing tasks, and is implicated in academic learning and reasoning (Beck et al., 2010; Goldstein & Naglieri, 2008).

1.4 WHAT IS INTELLIGENCE?

Intelligence is a complex topic. An overview of some of this complexity is provided in Hunt (1995).

Howard Gardner, David Perkins, and Robert Sternberg have all been quite successful in helping spread knowledge about the meaning of "intelligence" and applications of this knowledge to education.

Reading a road map upside-down and generating synonyms for the word "brilliant" are two very different skills. But each is a measurable indicator of general intelligence, a construct that includes problem solving abilities, spatial manipulation and language acquisition. (Courtesy: psychology today)
1.4.1 Definition of Intelligence:

This definition of intelligence is a very optimistic one. It says that each of us can become more intelligent. We can become more intelligent through study and practice, through access to appropriate tools, and through learning to make effective use of these tools (Perkins, 1995).

The following definition is a composite from various authors. Intelligence is a combination of the ability to:

1. Learn. This includes all kinds of informal and formal learning via any combination of experience, education, and training.
2. Pose problems. This includes recognizing problem situations and transforming them into more clearly defined problems.
3. Solve problems. This includes solving problems, accomplishing tasks, fashioning products, and doing complex projects.

Stern (1914) Intelligence is a general capacity of an individual consciously to adjust his thinking to new requirements. It is the general mental adaptability to new problems and conditions of life.

Thorndike (1914) Intelligence may be defined as “the power of good responses from the point of view of truth or Fact”.

Jean Piaget (1952) Intelligence is the ability to adapt to one’s surrounding.

David Wechsler (1944) Intelligence is the aggregate or global capacity of an individual to act purposefully, to think rationally, and to deal effectively with is environment.

Stoddard (1943) The ability to undertake activities that are difficult, complex and abstract and which are adaptive to a goal, and are done quickly and which have social value and which lead to the creation of something new and different.

Terman (1921) An individual is intelligent in the proportion that he is able to carry on abstract thinking.
**Wagon (1937)** Intelligence is the capacity to learn and adjust to relatively new and changing conditions.

### 1.4.2 Nature of Intelligence:

The true nature of intelligence can be understood by first defining it to understand its meaning, discussing the various theories explaining its structure in terms of the several constituents and factors, and identifying the numerous other aspects and characteristics related to intelligence and its functioning.

**Distribution of intelligence**

The Distribution of intelligence is not equal among all human beings. It resembles the pattern of distribution of health, wealth, beauty and similar other attributes or endowments. It is a normal distribution that is governed by a definite principle which state *the majority of people are at the average, a few very bright and a few very dull.*

**Individual differences in Intelligence**

Wide individual differences exist among individuals with regard to intelligence, truly speaking, no two individuals, even identical twins or individuals nurtured in identical environments, are endowed with equal mental energy. The assessment of intelligence by various tests has given reasons enough to believe that not only does intelligence vary from individual to individual but it also tends to vary in the same individual form age to age and situation to situation.

**Intelligence and changes in age**

As the child grows in age, so the intelligence as shown by intelligence tests. The question which now arises is at, what age does this increase stop? The age at which mental growth ceases, varies from individual to individual. It tends to stabilize after the age of 10 and is fully stabilize during adolescence. The idea that intelligence continues to grow throughout life is not strictly true. However, in the majority of the cases, the growth of a person’s intelligence reaches its maximum sometime between age of 16 and 20 years after which the vertical growth of intelligence almost ceases. Horizontal growth i.e. achievement, the
realization of the intelligence in terms of accumulation of knowledge and acquisition of skills etc. may continue throughout an individual’s life.

**Intelligence and the sexes**

Many studies have been conducted to find whether men are more intelligent than women and vice versa but no significant difference has been found. It may, therefore, be stated that differences in sex does not contribute towards difference in intelligence.

**Intelligence and racial or cultural differences.**

The hypothesis whether a particular race, caste, or cultural group is superior to another in intelligence has been examined by many research workers. It has now been established that intelligence is not the birth right of a particular race or group. The ‘bright’ and the ‘dull’ can be found in any race, caste or cultural group and the differences which are found can be the result of environmental factors and influences.

1.4.3 **Theories of Intelligence**

The study and measurement of intelligence has been an important research topic for nearly 100 years IQ is a complex concept, and researchers in this field argue with each other about the various theories that have been developed. There is no clear agreement as to what constitutes IQ or how to measure it. There is an extensive and continually growing collection of research papers on the topic. Howard Gardner (1983, 1993), Robert Sternberg (1988, 1997), and David Perkins (1995) have written widely sold books that summarize the literature and present their own specific points of view.

PBL can be used as a vehicle in which students can use and improve their intelligence. More detail on the work of Gardner, Sternberg, and Perkins is given in the next three subsections.

**Howard Gardner**

Some researchers in the field of intelligence have long argued that people have a variety of different intelligences. A person may be good at learning languages and terrible at learning music--or vice versa. A single number (a score on an IQ test) cannot adequately represent the complex and diverse capabilities of a human being.
Howard Gardner has proposed a theory of multiple intelligences. He originally identified seven components of intelligence (Gardner, 1983). He argues that these intelligences are relatively distinct from each other and that each person has some level of each of these seven intelligences. More recently, he has added an eighth intelligence to his list (Educational Leadership, 1997).

The following table lists the eight intelligences identified by Howard Gardner. It provides some examples of the types of professionals who exhibit a high level of intelligence. The eight intelligences are listed in alphabetical order.

**Table 4.1 Examples for each of the eight intelligences.**

<table>
<thead>
<tr>
<th>Intelligence</th>
<th>Examples</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodily-kinesthetic</td>
<td>Dancers, athletes, surgeons, crafts people</td>
<td>The ability to use one's physical body well.</td>
</tr>
<tr>
<td>Interpersonal</td>
<td>Sales people, teachers, clinicians, politicians, religious leaders</td>
<td>The ability to sense other's feelings and be in tune with others.</td>
</tr>
<tr>
<td>Intrapersonal</td>
<td>People who have good insight into themselves and make effective use of their other intelligences</td>
<td>Self-awareness. The ability to know your own body and mind.</td>
</tr>
<tr>
<td>Linguistic</td>
<td>Poets, writers, orators, communicators</td>
<td>The ability to communicate well, perhaps both orally and in writing, perhaps in several languages.</td>
</tr>
<tr>
<td>Logical-mathematical</td>
<td>Mathematicians, logicians</td>
<td>The ability to learn higher mathematics. The ability to handle complex logical arguments.</td>
</tr>
<tr>
<td>Musical</td>
<td>Musicians, composers</td>
<td>The ability to learn, perform, and compose music.</td>
</tr>
<tr>
<td>Naturalistic</td>
<td>Biologists, naturalists</td>
<td>The ability to understand different species, recognize patterns in nature, classify natural objects.</td>
</tr>
<tr>
<td>Spatial</td>
<td>Sailors navigating without modern navigational aids, surgeons, sculptors, painters</td>
<td>The ability to know where you are relative to fixed locations. The ability to accomplish tasks requiring three-dimensional visualization and placement of your hands or other parts of your body.</td>
</tr>
</tbody>
</table>
Robert Sternberg

Many teachers have provided testimonial evidence that PBL encourages participation on the part of their students who do not have a high level of "school smarts." They report that some of their students who were not doing well in school have become actively engaged and experienced a high level of success in working on projects. These observations are consistent with and supportive of the research of Robert Sternberg.

As noted earlier in this chapter, different researchers have identified different components of intelligence. Sternberg (1988, 1997) focuses on just three main components:

1. Practical intelligence--the ability to do well in informal and formal educational settings; adapting to and shaping one's environment; street smarts.

2. Experiential intelligence--the ability to deal with novel situations; the ability to effectively automate ways of dealing with novel situations so they are easily handled in the future; the ability to think in novel ways.

3. Componential intelligence--the ability to process information effectively. This includes metacognitive, executive, performance, and knowledge-acquisition components that help to steer cognitive processes.

Sternberg provides examples of people who are quite talented in one of these areas but not so talented in the other two. In that sense, his approach to the field of intelligence is somewhat like Howard Gardner's. However, you can see that Sternberg does not focus on specific components of intelligence that are aligned with various academic disciplines. He is far more concerned with helping people develop components of intelligence that will help them to perform well in whatever they chose to do.

Sternberg strongly believes that intelligence can be increased by study and practice. Quite a bit of his research focuses on such endeavors. Some of Sternberg's work focuses specifically on "street smarts" versus "school smarts." He notes that some people are particularly talented in one of these two areas, and not in the other. This observation is consistent with the work of Lev Vygotsky (Fosnot, 1996) who argues that the type of learning that goes on outside of school is distinctly different than the type of learning that goes on in school.
While some students are talented in both informal and formal education, others are much more successful in one rather than the other. A teacher who is skillful in developing PBL can help students to design projects that are consistent with their learning abilities and interests.

David Perkins

In his 1992 book, Smart Schools, David Perkins analyzes a number of different educational theories and approaches to education. His analysis is strongly supportive of Gardner's theory of multiple intelligences. Perkins' book contains extensive research-based evidence that education can be considerably improved by more explicit and appropriate teaching for transfer, focusing on higher-order cognitive skills, and the use of project-based learning.

Perkins (1995) examines a large number of research studies both on the measurement of IQ and of programs of study designed to increase IQ. He presents detailed arguments that IQ has three major components or dimensions.

1. Neural intelligence. This refers to the efficiency and precision of one's neurological system.
2. Experiential intelligence. This refers to one's accumulated knowledge and experience in different areas. It can be thought of as the accumulation of all of one's expertises.
3. Reflective intelligence. This refers to one's broad-based strategies for attacking problems, for learning, and for approaching intellectually challenging tasks. It includes attitudes that support persistence, systemization, and imagination. It includes self-monitoring and self-management.

There is substantial evidence to support the belief that a child's neural intelligence can be adversely affected by the mother's use of drugs such as alcohol and cocaine during pregnancy. Lead (such as from lead-based paint) can do severe neural damage to a person. Vitamins, or the lack thereof, can affect neural intelligence.
Moreover, there is general agreement that neural intelligence has a "use it or lose it" characteristic. It is clear that neural intelligence can be maintained and, indeed, increased, by use.

Experiential intelligence is based on years and years of accumulating knowledge and experience in both informal and formal learning environments. Such knowledge and experience can lead to a high level of expertise in one or more fields. People who live in "rich" learning environments have a significant intelligence advantage over people who grow up in less stimulating environments. Experiential intelligence can be increased by such environments.

Reflexive intelligence can be thought of as a control system that helps to make effective use of neural intelligence and experiential intelligence. A person can learn strategies that help to make more effective use of neural intelligence and experiential intelligence. The habits of mind included under reflexive intelligence can be learned and improved. Metacognition and other approaches to reflecting about one's cognitive processes can help.

**Raymond Cattell and John Horn**

Skipping over some details, human intellectual competence appears to divide along three dimensions. Following Raymond Cattell (1971) and John Horn (1985), they refer these dimensions as:

**Fluid intelligence** is the ability to develop techniques for solving problems that are new and unusual, from the perspective of the problem solver.

**Crystallized intelligence** is the ability to bring previously acquired, often culturally defined, problem-solving methods to bear on the current problem. Note that this implies both that the problem solver knows the methods and recognizes that they are relevant in the current situation.

**Visual-spatial reasoning** is a somewhat specialized ability to use visual images and visual relationships in problem solving—for instance, to construct in your mind a picture of the sort
of mental space that I described above in discussing factor-analytic studies. Interestingly, visual-spatial reasoning appears to be an important part of understanding mathematics.

Intelligence is defined as general cognitive problem-solving skills. A mental ability involved in reasoning, perceiving relationships and analogies, calculating, learning quickly... etc. Earlier it was believed that there was one underlying general factor at the intelligence base (the g-factor), but later psychologists maintained that it is more complicated and could not be determined by such a simplistic method. It is generally accepted that intelligence is inherited but can also be related to the environment. While studies showed that heredity is an important factor in determining intelligence; it was also suggested that environment is a critical factor in determining the extent of its expression. An investigation done recently revealed that 70 percent of the differences in the twins’ I.Q. scores were attributable to inherited traits. Previous studies had suggested that about 50 percent of the differences in scores were inherited. Studies showed that the grey matter volume is strongly determined by genes, and reflected cognitive performance. It was also suggested that there is a strong genetic influence on IQ, verbal and spatial abilities. So in short our genes determine the quality of our intelligence, our ability to integrate and process information. The level of our intelligence determines how well we cope with changes in our environment. It is believed that race and culture have their share in intelligence as well, but so far there is no confirmed conclusion that intelligence varies from race to race. Environmental factors can play a role as well, but in fact they are capable of slowing down our mental processes more than enhancing it. There is no evidence to indicate that our environment can increase intelligence to a relatively high level. It is also inherently easier to degrade brain tissue than to create more complex brain tissue. Enhancements in brain structure require long periods of evolutionary selection, in addition to the availability of extraneous sources of energy. While brain degradation can happen in a relatively shorter time. An intelligence quotient or IQ is a score derived from a set of standardized tests developed to measure a person's cognitive abilities ("intelligence") in relation to their age group.
1.5 WHAT IS ACADEMIC ACHIEVEMENT?

Academic achievement is the educational goal that is achieved by a student, teacher or institution achieves over a certain period. This is measured either by examinations or continuous assessments and the goal may differ from an individual or institution to another.

Children often are just evaluated on the basis of academic performance in our country. The results of these studies make sense if we consider that creativity and ADHD may share some common genetic vulnerability which mediates underlying deviations in attention. These shared vulnerabilities may be expressed as either creative ability or a cognitive disorder (or both), depending upon the presence or absence of other cognitive strengths or deficits. In other words, deviations in normal attention patterns may have an upside in enhanced creativity – but only in specific cases.

The problem with misdiagnosing the creative child as ADHD is that the creative child uses deviations in attention, such as distractibility, as a tool for creative thinking. However, the standard treatments for ADHD focus on reducing the impact of distractibility and attentional deviations. For example, educational accommodations typically prescribed for the ADHD include breaking complex assignments into smaller pieces, reducing distractions, and providing more structured educational supervision. Because the creative brain craves novelty and complexity, these interventions may do more harm than good for the creative child.

The possibility of misdiagnosis suggests that some sort of creativity testing should be included in diagnostic battery for ADHD (especially when a child has demonstrated high IQ or other cognitive strengths). However, a subset of highly creative children may also qualify for ADHD diagnosis because of their level of dysfunction in either academic or social realms. Therefore, high scores on creativity testing won’t necessarily rule out a diagnosis but will merely inform the treatment options. (Note that there is currently little evidence that the misdiagnosed creative child will suffer from the administration of pharmaceuticals such as methylphenidate other than the known side effects).
1.5.1 Importance of academic achievement:

Academic achievement is important because it prepares students for future careers. It also allows students to enter competitive fields. Academic achievement is often a sign of a refined intellect, which can help students in all areas of their lives. Graduating from high school allows students to earn far more, and many employers only hire those who graduated. As a result, academic achievement helps students avoid poverty. College education provides even more benefits, and employers are increasingly looking for employees with college degrees even in unrelated fields.

Academic achievement also allows students to enter competitive fields. Those who wish to enter the medical field need a thorough educational background in biology, and engineering certification requires adequate educational credentials. Those looking to enter academia need strong academic achievements.

Academic achievement also helps shape the minds of students. Knowledge about history helps people interpret news events while mathematical knowledge helps people learn about mortgages and car loans. Critical thinking also helps people interpret the world around them, and colleges place an emphasis on teaching students how to work through problems. While the lessons learned in class give students specific skills, the process by which they learn this material and the original ideas they are asked to consider have an effect on many aspects of their lives as well.

1.5.2 Factors affecting academic achievement:

Academic achievement can be influenced by a variety of factors, from simple demographic factors, such as age, gender and family socioeconomic status to more variable factors like the quality of the teaching faculty at a student's school and the way that students with special needs are grouped together. For example, in some cases, students of a certain gender or race may have a statistically better chance of academic success than their peers of a different gender or race. Additionally, home life, including parental financial status and the amount of support and stability offered at home, can have a big impact on how students perform in school.
An academic study published in 2013 has indicated that factors that are entirely out of most young students' control can have a big influence on how they perform in school, showing that a parent or guardian's socioeconomic status can have a strong influence on that student's academic achievement. However, not all factors that influence academic achievement are out of a student's hands entirely. The same study showed that students tend to maintain the same level of academic achievement throughout all of their years in school, with students who start out performing relatively poorly maintaining that level of performance until they leave school.

1.5.3 ADHD and academic achievement

In the classroom, individuals with ADHD have difficulty taking turns, talk excessively, appear to not be listening when spoken to, and tend to interrupt and intrude on others (Daley & Birchwood, 2009). Pre-schoolers have been shown to have problems with memory, reasoning, academic skills, conceptual development, general cognitive ability, and acquiring basic pre-reading and mathematical skills. Children ages 7 to 9 have been found to have poorer reading ability. Children with ADHD are more likely to need to repeat a school year than their peers (Daley & Birchwood, 2009).

Children, and especially adolescents, with ADHD have been found to have impairments in working memory, which results in increases in distractibility and the inability to retain material given in classroom lectures. This plays directly into the difficulties children and adolescents have with complex reasoning, forgetfulness, organization, planning, and goal setting (Beck et al., 2010). As a result of their children’s behavior, parents often have an adversarial relationship with educators, which further exacerbate the student’s problems (Mautone et al., 2011).

As children reach adolescence, there is a decrease in symptom severity. However, this often comes to a screeching halt with the transition to middle school, where the decline in symptoms of inattention, hyperactivity, and impulsivity was exhibited and then interrupted. The change to an environment that has less structure seems to present problems for children with ADHD. This transition is linked with significant decreases in grade point averages and confidence in academic abilities. They seem to struggle in dealing with multiple classes and
teachers, the increased academic demands during and following school, and the amplified importance of peer interactions. The increased demand for independent functioning, higher levels of organization, and management of deadlines can exacerbate the students’ ADHD symptoms and can result in severe procrastination (Langberg et al., 2008). Langberg et al. (2008), found higher rates of delinquency and substance experimentation in these children during this transition period than in their peers.

Adolescents with ADHD experience significant academic impairment in high school relative to other students. They have lower overall and main academic subject grade point averages (GPA), lower levels of class placement, higher rates of course failure, poor attendance, problems with study skills, and were more likely to drop-out prior to graduation (Kent et al., 2011; Mautone et al., 2011) Birchwood and Daley (2012) report that adolescents with ADHD are more likely to receive special education and have a history of suspension or expulsion as well. In their 2009 article, Daley and Birchwood also found that by age 15, adolescent with ADHD were more reading-disabled than any of their peers.

On a 100-point scale, adolescents with ADHD had a five to nine-point lower GPA than other students. On average, students with ADHD obtain C- grades, while student without ADHD obtain average grades of B-/C+. This problem in GPA persists through all course types. Students with ADHD did demonstrate a tendency to slightly increase their GPA as they progressed through high school. This does not occur in students without ADHD, where their GPA decreases as they proceed through high school. However, Kent et al. (2011) suggest that this may be as a result of ADHD students who receive the worst grades dropping out, a tendency of students with ADHD to take “easier” courses, or from them becoming acclimated to the more strenuous nature of high school.

Kent et al. (2011) found that adolescents with ADHD are four to five times more likely to have a lower class placement than their peers and are more likely to be in remedial level classes. They also found that students with ADHD were three to five times more likely to fail courses, regardless of difficulty, than their peers. These students completed less work than their peers, which could be a major reason for their low GPA and high failure rates.
Adolescents with ADHD also have poor attendance in high school; they miss 9.7% of days in comparison to the 5.8% of their peers (DuPaul et al., 2011; Kent et al., 2011). These students were absent or tardy 26 days per school year, which is twice that of their peers without ADHD. What is even more disconcerting is the rates of drop-outs in students with ADHD. Students with ADHD are 8.1 times more likely to drop out of school (DuPaul et al., 2011; Kent et al., 2011). Adolescents that drop out are at risk for serious negative outcomes such as criminal behavior, incarceration, and substance abuse (Kent et al., 2011).

In addition, men who were diagnosed with ADHD complete an average of 2.5 years less schooling (DuPaul et al., 2011; Daley & Birchwood, 2009). In a study by Daley and Birchwood (2009), only 12% of individuals with ADHD had completed a bachelor’s degree and 1% had completed a postgraduate degree.

1.5.4 Effects of Treatments on ADHD and Education

Concerning working memory, stimulant medications could not ameliorate all problems that arise due to ADHD. Adaptive working memory training and verbal and visual-spatial working memory exercises have been shown to improve mathematical reasoning, nonverbal reasoning, and response inhibition. Parents reported that these training programs also improved symptoms of inattention and hyperactivity; however, the children’s teachers did not see such improvements (Beck et al., 2010).

In a study conducted by Beck et al. (2010) concerning working memory, students from ages 7 to 17 were given computer-based working memory training at home. These exercises included verbal tasks and visual-spatial tasks, such as presenting objects in a specific sequence and having participants reproduce the sequence. The computer would increase or decrease the difficulty of the test based on performance. This training had beneficial results on visual-spatial and verbal memory, and according to parent-reported results, inattentive behaviors and other ADHD symptoms were reduced (Beck et al., 2010). This work could have significant impact in improving the cognitive skills that are lacking in students with ADHD, and thus directly result in improvements in schooling.

The link between inattentive symptoms and academic performance, as a result of executive function deficits, is being explored as a method for combating academic struggles.
Academic interventions focusing on improving working memory, planning, response inhibition, and inattentive symptoms has been demonstrated to be advantageous (Daley & Birchwood, 2009).

Stimulant medications have been shown to not prevent the interruption in ADHD symptom decline during the transition to middle school. This can be attributed to the fact that although stimulants improve ADHD symptomology, they are unlikely to improve study skills, organizational skills, and the time management skills that are critical for success (Langberg et al., 2008). It has been suggested that the class size, number of teachers, increased demands, and greater workloads may contribute to the interruption of symptom decline; therefore, addressing these issues could be beneficial. Interventions that prepare children with ADHD and their parents for the changes associated with the move to middle school could be useful (Langberg et al., 2008). Kent et al. (2011) suggests that intervention may be beneficial in the transition from middle school to high school as well. They also suggest that teacher and parent training and involvement will also significantly benefit students with ADHD. Interventions in which the student is taught planning strategies can significantly improve cognition in children with ADHD (Goldstein & Naglieri, 2008).

In addition, adjustments to the academic environment can be very beneficial. A large class, with lack of one-on-one instruction, increases difficulties. Parent and peer tutoring has been shown to alleviate these difficulties. Reduction in task length, dividing tasks into sub-parts, giving explicit instructions, and modifying the delivery of instructions has demonstrated positive results (DuPaul et al., 2011; Daley & Birchwood, 2009). Goal setting and training students with specific strategies has been very useful (Daley & Birchwood, 2009). Setting personal best goals has shown significant and positive effects on education (Martin, 2012). As time spent on homework can be an accurate predictor of grades and achievement, homework interventions can boost academic success. This includes changing the amount and length of homework and breaking homework into sub-parts (DuPaul et al., 2011; Daley & Birchwood, 2009). Students with ADHD respond very strongly to active learning styles where they are able to move, talk, and debate freely (Goldstein & Naglieri, 2008).

Mautone et al. (2011) believe that strengthening the parent-child relationship, improving parent’s behavior management skills, increasing family involvement at home, and family-
school collaboration can be beneficial to addressing educational difficulties. They believe that a strong parent-child relationship can help the child to learn the self-regulation skills that will improve relationships in and out of the home. By improving this relationship, the child can rely on his or her parents in their education. Providing a structured and consistent discipline plan that uses positive reinforcement of good behavior can help mold desired behavior. It is important to provide positive reinforcement more often than negative. Family involvement in the child’s education is critical for success (Efron et al., 2008; Mautone et al., 2011; Wheeler et al., 2008).

Cooperation between the school and family will allow parents and teachers to work together to promote good behaviors and beneficial study skill, and prevent problems resulting from an adversarial relationship between parents and teachers (Efron et al., 2008; Mautone et al., 2011; Wheeler et al., 2008). A significant proportion of parents report feelings of frustration due to educator’s lack of knowledge regarding ADHD. In order to successfully teach all students, it is imperative for teachers to have a strong understanding of ADHD and how to manage students with the disorder. Universities could help by providing more opportunities for students to learn about the disorder and how it can be managed in the classroom. A cooperative relationship between schools and parents is necessary to provide all that is needed for students with ADHD (Efron et al., 2008; Wheeler et al., 2008).

1.5.5 Chapter summary

Attention Deficit Hyperactivity Disorder is a disorder that manifests in early life and, though symptoms typically decrease with time, persists throughout an individual’s lifetime. ADHD has a detrimental effect in all aspects of life; it impacts an individual’s education and relationships, which can lead to problems later in life. Medication is beneficial in treating the symptoms of ADHD, but behavioral therapy is necessary in order to aid the individual in being able to function well in school and society. ADHD cannot be cured, so it is crucial that we as educators have sufficient knowledge regarding the disorder in order to better educate all students.