CHAPTER 2

REVIEW OF LITERATURE

The review of related literature has been presented under separate headings:

2.1 Review in relation to Attention, Learning and Memory

2.1.1 ATTENTION AND MEMORY

It has been suggested by a number of psychologists and neuroscientists that mechanisms of attention are partial to choose task appropriate information because of the representations in our memory (James, 1890; Pillsbury, 1908). As proposed through various modern theories of attention, the internal representations that researchers use to direct attention to the task appropriate matters one seeks in cluttered environments are sustained in working memory (Duncan & Humphreys, 1989; Bundesen, 1990; Desimone & Duncan, 1995; Bundesen, Habekost, & Kyllingsbaek, 2005).

While exploring the connection between attention and memory, traditional view affirms that attention play important role in developing durable memory traces (e.g. James, 1890; Cherry, 1953; Broadbent, 1958; Norman, 1969). In regard to this statement, there are many researches which revealed that during memory encoding, division of attention diminishes later memory performance (Murdock, 1965; Baddeley, Lewis, Eldridge, & Thomson, 1984; Craik, Govoni, Naveh-Benjamin, & Anderson, 1996; Mulligan, 1998). Baddeley et al. (1984) employed various secondary tasks (e.g. digit load or card sorting) to observe the consequence of divided attention on both memory encoding and retrieval by considering free recall, cued recall, and recognition memory tests. It has been found that dividing attention leads to inaccurate memory performances during encoding.

A number of researchers describe attentional processing in memory (e.g. Bower, 1967; Underwood, 1969; Tulving & Walkins, 1975) considered it useful to conceive of to-be-remembered items as bundles of elements, and memory traces as the collection of those elements which had been encoded. The framework defines the general concept of memory traces that when an individual focuses on an input, some of its elements are
entered into permanent memory traces through effortful processing and others entered automatically into long term memory. Elaboration of elements and the encoding of associations among objects also necessitate effortful processing. When the person attends to an input, encoding of frequency doesn’t require any concentrative process, further whereas elaboration of these interrelated elements, necessitate other attentional processing.

To study the effect of divided attention at retrieval, (Johnston, Greenberg, Fisher & Martin, 1970; Trumbo & Milone, 1971) conducted a study and assessed performance on a visual tracking task executed simultaneously in two phases of verbal memory task i.e. the learning phase and the recall phase. These studies revealed that tracking performance was disrupted by encoding and retrieval; recall was found much more attentionally demanding than learning, which is assessed by errors on the tracking task. In same way, recall has been found more attention demanding by employing a technique of auditory digit targets displaying concurrently with visually showing verbal memory task in both phases (Griffith, 1976).

Collins and Hagen (1979) described the developmental processes of perception, memory and attention in two transitions. The first transition takes place at the age of 8 to 12 months. During this time, perceptual processes are more conscious and motor-efferent. The second transition takes place more progressively, over a time of many years, which transfers disorganized and scattered processing into well organized automatized processing that makes focal attention possible. This study considered the interrelation among perception, attention and memory as elements of a unified cognitive system.

Frisk and Schneider (1984) conducted two experiments. In first experiment, he observed that in a category search task, subject’s memory for distractor words was superior as the search task was quietly unskilled and executed alone. In second experiment, memory for distractor words was poor because the search task was good in practice and executed with a secondary task. Hence, subjects can memorize the distractor words accurately when the search task was only needed attention to display and was not needed by another task but when the search was involuntary and subjects had to allocate their attention to another task, they are unable to memorize the distractors.
Whitmore, Hart, & Willems (1999) reviewed that attention has voluntarily selected the material to hold in short term memory for mental processing. The role of attention is to simultaneously reject the unwanted sensory stimuli. If not rejected or filtered, the extraneous sensory stimuli entered into conscious awareness which lead to distraction and material in short-term memory will be vanished.

Attention is a developmental process (Blythe, 2000). Effectiveness of attention is determined by the capacity of an individual to repress disturbing or conflicting activity involving sensory stimuli, in concern to plan or persist in goal (Majorek, Tuchelman, & Heusser, 2004). In similar line, Taylor, Houghton & Chapman, (2004); Kratzig & Arbuthnott, (2006) viewed that lack of attention lead to forgetfulness, high distractibility, impulsiveness, restlessness, and difficulty with concentration and focus. If basic perceptual motor functions mature, the capability for sustained, self-directed attention increases.

Kane, Bleckley, Conway, & Engle (2001) conducted two experiments in which they examined individual differences in working memory (WM) capacity which are associated to attentional control. In the first experiment, they tested two groups a) high WM span and b) low WM span. Subjects, in a prosaccade task, identified target letter when visual cue presented in similar position and in an antisaccade task, target presented in opposite of the cued location. It has been found that both groups recognized equally well in prosaccade task presenting equality in automatic orienting however, in the antisaccade task, low-span subjects were less accurate and slower than high span subjects showing dissimilarity in attentional control. In second experiment, they assessed eye movements in antisaccade session. Low span group created slower and erroneous saccades than high-span group did. Findings revealed from both experiments that low span subjects executed poorly during task shifting from antisaccade to prosaccade blocks. These findings suggested a controlled-attention view of working memory capacity.

Lavie, Hirst, De Fockert, & Viding (2004) reported that during visual selective attention tasks it has been suggested that the working memory has the significant role in controlling the processing level of irrelevant visual distractors. Furthermore, role of working memory (Dalton, Lavie, & Spence, 2009) has been examined in auditory selective attention. In this experiment the subjects were instructed to concentrate their
attention on short continuous bursts noise (targets) while ignoring the pulsed bursts noise (distractors). In this auditory task the distractor interference was measured by differentiating the performance between two distractor trials (i.e. congruent and incongruent) increased significantly under high (vs. low) load in a simultaneous working-memory task. These results suggested the function of working memory in decreasing interference via irrelevant auditory distractors.

Many researchers demonstrated that the attentional processes have vital role in memory development. Anderson (2005) explains that the material of short term memory reflects stimulus in the current focus of attention. Later on, researchers concluded that active rehearsal which is needed for the retention of contents in short term memory, needs attention (Pashler, 1998; Cowan, Nugent, Elliott, Ponomarev, & Saults, 1999). Naveh-Benjamin, Guez, & Marom (2003) found that episodic encoding has been affected by attention. Further, Cowan et al. (1999) and Gavens & Barrouillet (2004) viewed that for memory retrieval, attention is required and attention acts in two ways i.e. by the activation of memory representations and by the facilitation of their ensuing storage and retrieval. Roelofs (2008) concluded that at the time of retrieval, selection processes between opposing responses are also affected by attention. Badre, Poldrack, Pare´-Blagoev, Insler, and Wagner (2005) suggested that memory retrieval may be reflected as a form of selective attention toward internal representations. Thus, memory incorporates attention as a fundamental attribute of dissimilar processes of memory.

Lojzito and Mulligan (2006) proposed that semantic encoding which leads to retrieval is greatly predisposed to divided attention. To study this hypothesis, three experiments were applied and demonstrated that in dividing attention condition semantically encoded items are not selectively affected. Subjects were asked to encode a list of words in two ways: semantically or phonetically. After that, in the first experiment memory was evaluated by standard recognition test and in experiments second and third, memory evaluated by rhyme recognition test. The subjects completed the memory test in both condition (full attention and divided attention). Findings suggested that in divided attention condition, recognition accuracy on both recognition tests were diminished in which semantically and phonetically encoded words were affected in equal manner.
Chun and Brown (2007) explored the interaction between attention and memory. They reviewed that attention determines which information will be selected for encoding. At the time of encoding, some information is not allowed to enter in conscious memories because of division of attention, even though in formation of unconscious memories, the function of attention is more difficult. While the presence of another simultaneous task, these memories can also be encoded but which stimuli are to be encoded should be chosen from among other opposing stimuli. Secondly they suggested that memory from past experience also guides what must be attended. Medial temporal lobe structures, and hippocampus are engaged in attention tasks and these brain areas are essential for memory and in similar way memory straightly affects frontal parietal networks which is involved in spatial orienting.

To understand attentional processes, Scerif (2007) demonstrated that attentional processes filter relevant and irrelevant information in our environment and are considered as gateway for learning and memory, and are keys in performing any task at hand. Consistent to this view, Anderson (1993) reported that attention is limited in its capacity, it allows to attend only one task which is more demanding and one continues to pay attention to that till that task is turned automatic. Hence, the initial step in learning and memory is to focus attention. Long-term memory has been affected by internal attention. Attention assist in determining what kind of message should be encoded in long-term memory and how it can be retrieved (Yi & Chun 2005). Every day, individuals attend different types of information, but all attended messages are not encoded and memorized.

Gathercole, Alloway, Kirkwood, Elliott, Holmes, & Hilton (2008) explored the classroom behavior of students concerning to attention and executive functions with poor working memory, and also studied that working memory and inattentive behavior problems co-exist in students. With the help of teachers rating measures of attention and executive functions behaviors, teachers identified 52 children having low score on working memory. Findings suggested that students with low working memory scores have short attention spans, inattentive symptoms, difficulties in monitoring the excellence of their work, high levels of distractibility, and difficulty in producing new solutions.
Thompson (2011) conducted a study on 38 children having poor working memory with control group. Class teachers rated them on the working memory rating scale and also assessed on inhibition, planning, shifting and attention. Scores of both groups were compared which discovered that children having poor working memory scored low on measures of attention, planning, difficulties related to working memory and executive impairment.

**2.1.2 ATTENTION AND LEARNING**

Many studies for example, Gluksb & Cowan (1970); Allport, Antonis, & Reynolds (1972); Rollins & Thibadeaus (1973); Kellog (1980); Wollford & Morrison (1980) indicated that unattended stimulus events are poorly remembered. These studies suggested that for attended events memory is much better than unattended events.

Medin and Schaffer (1978) examined that subjects learned those elements which they attended to in term of proportionate amount of attention they gave to them. Logan (1988, 1990) explained that attention during encoding considers what is entered into an instance and attention during retrieval considers what instances would be retrieved.

In another study, Rock and Guttman (1981) displayed some overlapping green and red figures to subjects. They were asked to rate figures of one color and at the same time ignore the other figure. Further, the subjects were assessed on the recognition test and they recognized figures very accurately which they had rated previously. Similarly, Carlson and Dulany (1985) observed that stimulus displayed through visual array which are not attended and not cued for report, lead to no learning and those information which are attended and also cued for report are quietly well learned.

Curran and Keele (1993) acknowledged that “When an individual refers to one form of leaning as nonattentional, he do not wish to imply that no attention whatsoever is used on the primary task, undoubtedly, subjects must in some sense attend to a visual stimulus to make a response”. Learning without attention is considered complex in both ways i.e. methodologically and theoretically. When attention is completely absent, and learning occurs, methodologically, it is considered complex (Schmidt, 1995). Detection is the fundamental nature of attention and learning necessitate detection, theoretically, learning is impossible without attention (Truscott, 1998).
Logan & Etherton (1994); Boronat & Logan (1997) determined that when objects are displayed in central vision, subjects seem to learn relations between objects which are attended by them and learn less about objects which they ignored. Further, Hillstrom & Logan (1998) indicated that participants are capable to learn where to attend in multi item displays, giving proper attention on coming display position, screening out distracting stimuli (Chum & Jiang, 1998) and avoiding unnecessary positions (Haider & French, 1996, 1999).

Craik et al. (1996) investigated that attention has important role in encoding. He conducted an experiment in which subjects were allowed to memorize 15 words which displayed auditorily in two conditions i.e. full attention condition and divided attention condition. Under full-attention condition, subjects were not provided any other secondary task but in the divided-attention condition, subjects were also instructed to observe the location of an asterisk on a computer screen and also press one of four buttons as the position changed during word presentation. Findings revealed that subjects memorize 9 of the 15 words approximately when encoding was performed in the full attention condition, but under divided attention only 5 words are remembered when encoding was performed in a conjunction with the secondary task. It has been concluded that attention is essential for effective encoding.

By employing the “contextual cueing” paradigm, Chun & Jiang (1998, 1999) studied the impact of selective attention on implicit learning. For this, they conducted four experiments in which observers task is to be engaged in visual search during items displayed in an attended colour (red) or in an ignored colour (green). In the attended colour, (Experiments 1, 3, and 4) when items related to spatial configuration were constantly paired with the target location, it resulted in contextual cueing. In Experiments 2 and 4, when configuration of the ignored items are paired and repeated with the target location, it showed no contextual cueing. It has been concluded that implicit learning is strong only when predictive and important information is attended selectively.

During childhood, most of the children faced with learning problems, particularly in the field of reading comprehension, arithmetic and problem-solving (Swillen et al. 1999; Moss et al. 1999). As research progresses (Moss et al. 1999; Swillen et al. 1999a; Wang
et al. 2000; Woodin et al. 2000) it has been drawn that these learning problems are the basis of strengths and weaknesses of cognitive and behavioral profile.

To describe the positive relationship between learning and attention, Anderson (1982) and Ainley et al. (2002) viewed that when learners pay more attention to learning tasks, they achieved better. Hidi (1995) reveals from his studies that a positive impact of attention on learning can be achieved by long period of attention, by higher intensity and more cognitive effort. In similar line, Limón (2003) considered that in order to facilitate the conceptual change, child should pay attention to learned material. Pay attention to any task which is not consistent with one’s existing explanation should encourage a voluntary act like checking one’s existing conception and recognizing what is required for change (Keller, 1987a; Lee, 2000).

For the success of education teacher’s full participation should be necessitated in order to create children’s total participation (Smith, 2005). While making contact with different types of children in the classroom, it is not possible for teachers to consider some factors like (dedication and keenness for any assignment, proficiency while performing any task, psychological, physical and emotional state, and the student’s house and educational environments) in consideration of each student for the sake of attaining optimize and soothing environment of learning. Therefore, Khine & Fisher (2003) conclude that if students discover modes of attention seeking and classroom activities outdated, instructors should seriously employ new techniques and make proper use of it in order to maximizing the learner’s capacity in learning. Harris et al. (1994) viewed that learning has been facilitated by enhanced attention only when learners comprehend instruction.

2.1.3 LEARNING AND MEMORY

Fildes (1923) conducted a study on normal and defective children to find out the characteristic differences of learning power and memory. A sample of fifty defective and fifty normal boys were employed. In this experiment, four different types of presentation were presented: visual, tracking while blindfolded, drawing and tracing while looking. Another experiment was conducted with nonsense syllabus, and with a four line rhyme. Findings indicated that the group of normal children of lower average age is better in learning than the group of high grade defective boys. Analysis regarding
learning and memory by various criterion revealed that the normal children are three times more efficient.

Woodworth (1952) viewed that memory include retention, learning and remembering of previous learned material. Whatever material has been learned, firstly entered into the memory and when it is required, one elicit the material and narrate them accordingly.

The mutual relationship which is found between learning and memory, between environment and knowledge, has been considered as the motivating power behind the formulation of theories of cognitive development (Piaget, 1968) and of cognition (Neisser, 1976). Learning has been found most effective when structures of memory are suitable to what is going to be learned are generated or stimulated by advance organizers (Ausubel, 1963).

Many researchers suggested that learning is influenced by the attentive nature and everyone should acquire the capability to focus attention towards the task which he is attending to. Neisser (1967) reported that one attends only a small amount of information and processed carefully. Basic to learning is the ability of a child to pay attention to his task. To relate learning and memory, it can be concluded that attentional behavior makes one a successful or an efficient learner in life. In addition, there is considerable research literature which indicates the positive relation between learning and attention span (Kim, 1975, Lubus, 1975, Ellis, 1976 and Shoon, 1977). Verma and Loomba (1990) in their research study concluded by F values revealed statistically significant and positive effect of attention span on learning task. It indicated that attention span is highly related to learning, children with high attention span can learn much more than other children who are low on attention span.

In one study (Gadzella, 1995) compared students' with course grades on the Inventory Learning Process scales (ILP) (for 86 freshmen enrolled in psychology classes). Data revealed that students who got A grades in the course (in contrast to students who achieved B, C, or D grades) showed significantly higher scores on the Deep Processing (DP), Elaborative Processing (EP), and Methodological scales of the ILP. Further, Gadzella et al. (1987) used responses of the ILP scale to find out the differences between high academic achievers and low academic achievers by computing the
median of subjects grade point average (GPA) (for 158 psychology students). Findings revealed that in comparison to low academic achievers, high achievers scored significantly high on DP (Deep Processing) and FR (Fact Retention) scales. In another study, Schmeck & Grove, 1979; Schmeck (1983) found similar result that, high academic achievers are inclined to be high scorers on Deep Processing (DP), Elaborative Processing, Fact Retention (FR) scales of the ILP (Inventory of Learning Processes).

Processing the information successfully in memory depends on the ability of students to master or achieve the content of the daily basis information and further this instruction of information has been transferred from STM to LTM and where it get stored for longer period (Carlson, Chandler & Sweller, 2003). However, Martinez (2010) revealed that if students trying to process information overloads in their working memory, it will adversely affect to learning and understanding. Comparatively, poor performance in memory tasks revealed by the aged (Botwinick, 1973), the young (Brown, 1975a; Flavell, 1977), the depressed (Miller, 1975) and the highly aroused (Eysenck, 1976) due to the ineffectively utilization of effortful learning process.

Many researchers supported the idea that working memory play important role in academic achievement. For example, Children’s expertise on working memory is strongly related to academic achievement in both reading (Swanson, Ashbaker, & Lee, 1996; Gathercole, Pickering, Knight & Stegmann, 2004) and mathematics (Geary, Hoard, Byrd, De Soto, & Craven, 2004; Swanson, 2006). It has also been found that children suffering from learning problems in these fields show low expertise on working memory (Pickering & Gathercole, 2004; Gathercole, Alloway, Willis, & Adams, 2006).

To consider the effect of memory and learning, Ecker, Lewandowsky, Oberauer, & Chee (2010) have shown that the students working memory capacity is considered as a good predictor of his or her capability to precisely retrieve information, which is necessary because accurate retrieval of obtained information is required for learning to occur. Teachers confirm the fact that those students, who have working memory deficits, lead to less accurate and slower processing of classroom instruction and these students have difficulty in determining the most appropriate information and screening
and “blocking out” inappropriate information, a difficulty which lessen their working memory capacity. That’s why, limitations of the students working memory capacity are related with academic deficits in the area of social, mathematics, reading and writing skills, Alloway (2009).

**2.1.4 ATTENTION, LEARNING AND MEMORY**

Adolescence is considered as an essential time for learning (Greenleaf, 2002). He pointed to the notion that “During adolescence, the brain begins to define what is important to remember; discards useless or irrelevant information; and develops ways to retain, access, and learn new information”. Further, Kovalik and Olsen (1998) suggested the important connection between attention, memory, learning and emotion: “One of their key roles [emotions] is to tell the brain what is worth attending to and the ‘attitude’ with which one attends.” Goleman (1995) also considered the significance of emotion and learning, stating “Good moods, while they last, enhance the ability to think flexibly and with more complexity”.

Students struggle with the encoding of information, which have difficulty paying attention to specific information. Naveh-Benjamin, Kraig, Guez, & Kreuger (2005) considered attention as the cognitive process; it is the basic fundamental of working memory which is required for learner and make competent and appropriate utilization of working memory in the procedure of learning. On the basis of this assertion it has been concluded that learning requires both memory (Radvansky & Copeland, 2006) and attention (Naveh-Benjamin et al. 2007).

Thompson & Gathercole (2006) examined that when an individual executed any cognitive task, attention permits working memory to retain information which manage their behavior according to the requirements of a specific task. For instance, learning complex, multi-component skills like reading depends on the learner’s ability to regulate their attention and the mental effort which is necessitated for learning a new skill. Ashcraft & Krause (2007) studied that information encoding has affected by attention, students having distractibility and inattentiveness in their behavior will lead to memory problem as well. So, it has been concluded that if student’s attention has disturbed, opportunity to learn any tasks is weaken because attention is necessary to sustain information in working memory. Furthermore, Palladino (2006) demonstrated
that if students are unable to control their attention and intrusive information are not filtered out and then learning would be affected adversely.

Kyndt, Cascallar, & Dochy (2012) investigated the interrelations between attention, learning and memory on 128 students. Findings revealed that attention is negatively associated with deep approaches to learning. It has been found that children who are high on attention utilize deep approaches to learning more in comparison to those who are low on attention and the children who scored low on working memory capacity seem to use more surface and deep approaches to learning than group of scored high on working memory capacity. Further, they suggested that high scorer children are better able to acquire process and integrate all types of novel and fresh information before transferring it to storage.

Ritter, Baxter, & Churchill (2014) explained that memory, attention and learning provide the basis for cognition and these are the basic mechanisms of the user’s cognitive architecture. Users have various kind of memory which is essential for computer use. Attention could be viewed as the group of items being processed concurrently and also considers the way of processing. If more items are stored in memory and the items in memory are well organized, then these effects will lead to improvement in performances and offer the manifestation of more attention. Users also give importance to learning constantly. The impact of learning lead to more items being stored in memory and permit the user to attend more features of a task.

2.2 Mindfulness in Relation to Attention, Learning and Memory

2.2.1 MINDFULNESS AND ATTENTION

Linden (1973) conducted a study on age of 8-11 years old children and imparted 18 weeks’ (twice weekly) training which focused on breathing meditation. Findings suggested that children were found to be more attentive and were able to avoid disturbing stimulus than those who were not the part of the training. In similar point, Alexander et al. (1989) conducted 12 weeks’ (practiced 20 minutes of two times daily) mindfulness meditation program on elderly participants. Findings suggested that trained participants executed better results on the stroop task in comparison to those who were trained in a creative word production task, and also with who were not involved in
training group. Overall, findings revealed that well structured and time limited treatment setting of mindfulness meditation also makes positive improvement in selective attention ability and it also revealed that impact of mindfulness training is distinguished from the impact of other mental training on attention.

The goal of mindfulness training is to increase the children’s ability to focus attention, yet, there are other residual benefits which also have been found. Many researchers, Feindler, Marriott, & Iwata (1984), Fluellen (1996), Ryan (2000), exhibited that implementation of mindfulness training program on children has shown positive results in enhancing focused attention, ability of self control and lessening disturbing behavior and anxiety problems in children.

In mindfulness, attention is needed for the awareness of inner experiences that occur at each and every instance, by considering an approach of non-judgemental attitude (Hart, 1987; Kabat-Zinn, 2003). Proper practices lead to improvement of emotional regulation and self-regulation of attention (Hart, 1987). According to Lazar et al. (2005) proper practice of meditation influenced structural modifications in a subset of cortical regions in areas of interoceptive and somatosensory processing and attention regulation.

Cognitive psychology describes different phases of attentional abilities, involving the ability to attend an object for longer time period (vigilance or sustained attention, Posner & Rothbart, 1992; Parasuraman, 1998), the capability to reallocate the attentiveness between mental sets or objects at will (switching) (Posner, 1980) and the capability to restrain secondary elaborative processing of sensations, thoughts and feelings (cognitive inhibition) (Williams, Mathews, & MacLeod, 1996). Shapiro et al (2006) constructed three axioms of mindfulness which are 1) intention 2) attention or 3) attitude based on Kabat-Zinn’s (1994) description of mindfulness that implies bringing attention on the purpose in the present moment and being non-judgemental. The self-regulation of attention is the core feature of mindfulness and forms the basis of development of all three skills.

In another study, it has been investigated that whether 3 month retreat meditation practice would enhance an individual attentional capacity. In this study, researchers introduced the concept of phenomena known as “attentional blink.” In this process, two stimuli are displayed in sequence quickly in which individuals found difficulty in
recognizing the second stimulus. Shapiro, Arnell, & Raymond (1997) viewed that responses of meditators on attentional blink are less which proved the hypothesis that attentional capacity of meditators has improved than those who were not meditating during 3-months’ retreat. At the same time electroencephalography (EEG) was also recorded which exhibited that those meditators who performed better on the attentional blink task showed the less use of brain activity during the arrival of the first stimuli. This finding demonstrated that these people are capable to reserve attentional resources for the second stimulus, able to maintain attention on breath increases; subjects are progressively educated to widen their attention to other external and internal stimulus (Slagter et al. 2007).

Valentine and Sweet (1999) compared the mindfulness and concentration meditation on sustained attention. The main goal of concentrative meditators is to focus their attention on a particular point and give no attention to unwanted stimulus in their practice and the goal of meditators was to distribute their attention and incorporate extraneous stimulus as observational events in their practices. The task of these meditation subjects was to count rapidly presented beeps, which measured the sustained attention. Results revealed that both meditative groups were found to be significantly superior to control group due to having the ability of the recognition of all stimulus. It suggests that both groups had expanded their heightened attention as an outcome of their practices during meditation. Though, in comparison to the concentration group, mindfulness meditators were considerably superior in their capability of identifying unpredicted stimulus (tones with different repetition frequencies) consistent with the objective of every practice.

Mindfulness educates one to remain attentive toward his actions and which is described by an attitude of openness and acceptance of experiences (Martin, 1997; Brown & Ryan, 2003; Kabat-Zinn, 2003). Baer (2003) investigated that mindfulness has been the focus of enhanced attention over the last decade. Several reviews of the mindfulness literature revealed that mindfulness is strongly associated with the ability to strategically control attention (Bögels, Sijbers & Voncken, 2006; Shapiro, Brown, & Biegel, 2007). Shapiro et al. (2007) demonstrated that mindfulness-based stress reduction technique is helpful in reducing ruminative attention.
Napoli (2004) found that mindfulness practice produces positive transformation both inside the classroom and outside the classroom. Those students who practice mindful breathing, reported benefit, for instance, they were found to be more focused and relaxed, showed less anxiety before any exam, in conflicting situation made better judgement and were effortlessly capable to transmit their attention when disengaged.

Lutz et al. (2004) studied the neurological effects of mindfulness meditation on two groups i.e. novice group and another is highly meditative group. He suggested that increased attention and positive affect can be acquired through mental training. The highly trained Tibetan Buddhist meditators, who indulged in 10,000 hours of meditation, compared to novice meditators had markedly higher amplitude and long-range global gamma synchrony in bilateral frontal and parietal/temporal regions. Enhancement in gamma synchrony was also seen in baseline measurements (before meditation) and in the trained Tibetan meditators that became increased and more global throughout meditation. To support above study, many researchers (Fries, Reynolds, Rorie, & Desimone, 2001) concluded that gamma-band frequencies were found to correspond with attention, working memory, learning, conscious perception, and the dreaming state.

Mindfulness training involved various exercises which define the role of attention. For example, in mindfulness practice the main and first step is to focus attention on breath and associate sensation with normal breathing. During this process if attention inexorably wanders to other thoughts and perception, then subjects are persuaded to monitor the reason of the distraction without any judgement. After that subjects were requested to return their attention back on their breathing process and refocusing attention to current moment. During the mindfulness practice, the main focus is to promote the non-judgemental attitude in an attempt to demoralize judgemental thoughts which may distort the simple awareness of current experience (Kabat-Zinn, 2005). The main aim of each distinguished form of meditation is to focus the attention on present experience. Some forms may focus on a specific idea or sensation, for example breathing, where as other’s attempt is to focus on the all features of present experience. The objectives of these exercises are to enhance one’s attention and alertness of current
moment, not only for the period of meditation exercises, but also in their daily life experience (Kabat-Zinn, 2005).

Wenk-Sormaz (2005) examined 120 undergraduate students who have no previous experience of meditation on measure of selective attention and mindfulness training. He formed three groups of attention task. First group was given meditation training related to breath, second group was given mnemonic learning task, and a third group was asked to allow their minds to wander freely. Stroop task was also given to the participants before and after the 20 minutes of attention task. Findings indicated significantly improvement in stroop performance in the first group, while the other two groups did not show any improvement. These findings indicated that by enhancing one’s selective attention skill, meditation has the capability to diminish habitual responding (i.e. word reading) in the short term, even though the intervention has been given for brief time.

Schmertz (2006) investigated that there is strong association exists between self report mindfulness and three forms of attention i.e. a) sustained attention b) selective attention C) switching attention. This study was conducted on fifty undergraduate students who completed a battery of attention tasks and self-report mindfulness questionnaires. Findings revealed that mindfulness meditation practice is significantly related with improved attentional skills and it also shows that higher self-report mindfulness has positive association with performance on tasks of attention.

In one study the effect of meditation on attention was compared on three attentional sub-processes (sustained attention, alerting, conflict monitoring) which was recorded by performance on the Attention Network Test (ANT); (Fan, McCandliss, Sommer, Raz, & Posner, 2002). Researchers took two groups: first group was of experienced meditators (one month retreat based on pre test and post test), second group was of novice meditators (8-week of MBSR treatment program based on pre-testing and post-testing) along with control group tested after 8 weeks. Findings indicated that at the end of treatment program both groups (experienced and novice meditators) were found to show significant improvements on the sustained attention task as compared with control group. There was no change in other two types of attention which shows the specificity of the results. In fact, this study suggested that mindfulness training is helpful in modifying subsystems of attention (Jha, Krompinger, Baime, 2007).
An 8 week group program based on MBSR intervention was administered on 31 children (non clinical samples) of grades 4-7 who participated with their parents assessed by Saltzman & Goldmin (2008). The teachers were experienced mindfulness instructors. Findings demonstrated increased ability of attention, emotional reactivity and some areas of meta-cognition of children and parents both as measured by attention network test and self and parent report measures.

Bogels et al. (2008) evaluated the effect of mindfulness on adolescents group identified with attention and behaviour-control deficits and revealed significant improvements in sustained attention, personal goals, happiness and mindful awareness. These changes were also noticed by their parents.

Moore and Malinowski (2009) examined the relationship among self-reported mindfulness, meditation, cognitive flexibility and other attentional functions. They used d2-concentration and endurance test stroop interference test and compared the meditators experienced group in mindfulness meditation with non meditators naïve control group. Results revealed the positive relation of attentional performance and cognitive flexibility with meditation practice and levels of mindfulness. On all measures of attention, meditators group performed significantly better than the non-meditators group. Further, it has been found that meditators reported better in self-reported mindfulness than non-meditators and on all the measures of attention correlations were of moderate to high strength. Overall, findings suggested that mindfulness is closely linked to enhancement of attentional functions and cognitive flexibility.

Roeser and Peck (2009) concluded from their studies that mindfulness training has been acknowledged as one way to foster self-regulatory control during adolescence. Mindfulness is a form of mental training which leads to the development of skill in which the individual can direct and redirect attention/awareness to specific kinds of events (e.g. breathing). As depicted by Broderick and Metz (2009) the mindfulness therapy promotes the attention, emotional regulation whereas reduces stress and develop the feeling of self assurance in the phase of uncomfortable feelings which otherwise might provoke unhealthy responses such as intake of drugs, violent behaviour or become depressed.
Semple et al. (2010) evaluated the impact of MBCT after 12-week group program in 9 to 13 year old children who were struggling academically and reported significant decrease in anxiety and behaviour problems and improvements on measures of attention compared to those who were not involved in program.

Josefsson & Broberg (2010) used a case control design and took two groups: long term meditators and control group. They observed that meditators in comparison to controls were found to be significantly improved in task performances including sustained attention. Polak (2009) exhibited that increased selective attention and enhanced self reported mindfulness were positively significant to each other. On the other hand, Hodgins and Adair (2010) used Change blindness flickering task (Rensink, O'Regan, & Clark, 1997) which assessed non directed attention and revealed that in comparison to non-meditators, meditators recognized a large number of changes quickly in flickering scenes.

Van den Hurk, Giommi, Gielen, Speckens, Barendregt (2010) examined the attentional processing in association to mindfulness. The 20 mindfulness meditators participated in the attention network test and they were compared to the participants of the control group. It was found that the mindfulness practitioners have better orienting and executive attention and further findings suggests the reduction in the fractions of errors in responding to the same reaction time. These outcomes indicates that attentional processing is associated to mindfulness meditation and offers new insight that with an extensive mental training there is the possibility of increasing the efficiency of attentional networks.

Hasenkamp & Barsalou (2012) examined the impact of meditation practice on brain networks involved in cognitive processes during contemplative practice. They specified four intervals in a cognitive cycle: a) mind wandering b) awareness of mind wandering c) shifting of attention d) sustained attention. During meditation, they recognized activity in two regions a) salience network regions (during awareness of mind wandering) and b) executive network regions (during the process of shifting and sustained attention). During mind wandering brain regions related with the default mode were active. The study focused on repetitive practice over a period of time activates the brain networks related to attention which may provoke enduring
functional connectivity changes within relevant circuits. To explore this possibility, they created seeds showing the networks that were active during the four intervals of the study, and also investigated functional connectivity during the resting position in the same subjects. Further, they compared the connectivity maps between high vs. low meditation experience subjects. Subjects with high meditation experience showed the enhanced level of connection within attentional networks and same found to have between attentional regions and medial frontal regions and these neural associations are involved in the development of cognitive skills (e.g. disengaging from distraction and maintaining attention). In addition, because altered connectivity of brain regions has been observed in experienced meditators than non-meditative (resting) state, it represents a transference of cognitive abilities “off the cushion” into daily life.

2.2.2 MINDFULNESS AND LEARNING

Mindfulness based training adopted by schools generally views that students and teachers both are equally associated with learning experience. Langer, Hatem, Joss, & Howell (1989) suggested that if learners used mindfulness during learning, they make use of creativity, experience more flexibility in cognition, and make proper utilization of information to increase memory for instructional retention. Consequently, they learn to have proper control in their lives.

Mindfulness is a core element in the learner centered classrooms. Wong (1994); Richart & Perkins (2000) revealed that mindfulness practices enhanced students experiences related to learning and those students have been found to be more able to shift learned material into novel & innovative situations which made them more inventive and creative and also made their thinking more autonomous. These findings revealed that such results definitely allow learners to enhance their learning process.

In the school setting, mindful awareness practices included into the classroom routine decrease the likelihood of student disruptive behavior and helps in creating the supportive learning environment for all the students. Further, these practices encourage emotional and bodily control, which increases receptivity and lessens the likelihood of anxiety or acting out (Rubin, 1996; Flinton, 1998; Siegel, 2007; Singh et al. 2007). In addition, Hjelle (1974), Murphy (1988), Flinton (1998) concluded that mindfulness increases the participants sense of self control, through focusing on feelings, thoughts,
reactions, and mental events which are the transitory actions of the brain, these are not the real facts of their personality as an individual.

Langer (1989, 1997, and 2000) has proposed the concept of “mindful learning” which presents learning more effectively, stimulating, pleasant, and innovative. The spirit of this concept is to include the student’s energetic involvement in the procedure of learning itself. This form of mindfulness adopted by students reflects that their own attitude will direct the way of the learning process. In addition, Sternberg (2000) suggested that mindful learning comprised of openness to innovation; alertness to distinction; sensitivity to diverse situations; implicit, if not explicit, awareness of several viewpoints; and orientation to the present. Considering these aspects of mindfulness in educational setting allow learners to extend and expand the nature of learning in their whole life as learners.

The principal of mindfulness meditation practices is to concentrate on the breath. Other important basics are the capability to make harmony actions which takes place within the body and mind. Function of breathing is to regulate the autonomic nervous system, concentrate on the mind and enhance self-awareness. In the same way rhythmic breathing also influences the autonomic nervous system, mind and raises the levels of self-awareness of their learning performance (Salmon, Santorelli, & Kabat-Zinn, 1998; Davidson et al. 2003).

In education setting, Langer & Moldoveanu (2000) research examined that in mindful situation; subjects are capable to use things in creative way, liking for the task, and enhanced attention and memory. Furthermore, it is also helpful in enhancing competency, remembrance, creativeness, and optimistic attitude, and diminishing the accidents, mistakes, and distress.

Napoli, Krech & Holley (2005) employed 24 weeks mindfulness training on 228 students involving bodyscan, breathwork, movement, and sensorimotor awareness activities. This research investigated whether mindfulness practices have an impact on first, second, and third grade students’ outcomes on assessment of attention. This mindfulness training was proposed or planned to assist learners learn to pay and focus attention. Results from three attentional measures (sky search, map mission and
sustained attention) revealed positive differences between those participants who were the part of mindfulness practice training than those who were not.

Beauchemin, Hutchins and Patterson (2008) diagnosed 34 adolescents with learning difficulties by 5-week mindfulness meditation intervention. Findings revealed significant improvement in those participants who finished the program and also reported decreased state and trait anxiety, improved academic performance and enhanced social skills.

Rempel (2012) viewed that mindfulness is organized for the improvement of student learning in all contexts. Orr (2002) considers mindfulness in view of encouraging ‘anti-oppressive pedagogy’. Various researchers concluded that mindfulness is effective in enhancing English teaching (Kroll, 2008), encourages teachers’ capability to attain classroom management efficiently (Thomas, 2008) and it may be helpful in boosting the efficiency of education researchers (Conklin, 2009).

2.2.3 MINDFULNESS AND MEMORY

Mindfulness meditation trainers noted the benefits of mindfulness meditation program and found positive effects on cognitive abilities, involving attention, memory and other cognitive functions (Kapleau, 1965; Gunaratana, 1993; Teasdale, Segal, & Williams, 1995). In addition, Raes, Dewulf, Van Heeringen, & Williams (2009) noted that mindfulness training significantly linked with psychological benefits and reduced cognitive reactivity and Kumar, Feldman, & Hayes (2008) pointed that it helps in decreasing avoidance and rumination processes.

Nyaniponika (1973) recognized that when attention and meta-awareness intertwined together, mindfulness achieves better. Bodhi (2006) has entitled this connection of attention and awareness “integrated wise attention.” Further, Brown et al. (2007) suggested that the mind is skilled at “time-traveling” into memories of the past, fantasies about the future and away from the realities of the present. Further, Sheldon & Vansteenkiste (2005) noted that this time travel provides essential regulatory purpose of protecting, maintaining, and enhancing the self, for example, the pursuit of goals, but it is effortlessly elapsed because individual live in the present moment and have no direct experience with past and future. With consciousness dwelling in present reality, as it actually offers itself, instead of engaging in thought created process about the past,
present, and future, reality is more considerable rather than ignoring or controlling and thereby only experienced partially. In fact, in this experimental approach of processing, thoughts related to past, present and future could be attentively occupied in the similar manner.

On a behavioral level, mindfulness meditative practices concentrate on raising the capacity to manage attention, and lessening the automatic reactions (Teasdale et al. 1995). On a neuropsychological level, findings reveal that it improves performance on tasks assessing executive functioning like working memory, cognitive control and attention (Semple, 2010; Heeren & Philippot, 2011).

Redick & Engle (2006) & McVay & Kane (2009) described that mindfulness and working memory are closely associated with each other and both are significantly related to various fields of attention. Bishop et al. (2004) revealed that mindfulness enhances in memory specificity and meta-awareness, may be linked to the inhibition of unnecessary elaborative processing.

Schonert-Reichl & Hymel (2007) observed improvements in behavior, attention and focus ability in age group of 9 to 13 years by using the “MindUP” program reported by teachers which promotes the development of well-being traits using emotional, social, self-regulation, and attentional strategies including mindfulness exercises. Ivanovski and Malhi (2007) also concluded from their study that mindfulness practices have an impact on cognitive processes such as autobiographical memory and ruminative thinking and also lead to improved attentional and perceptual processes.

Chambers, Lo, Cheun & Allen (2008) focused on retreat mindfulness meditation with a longer duration. They observed that those participants who have undergone mindfulness training program in a group revealed improvements in sustained attention, self-reported mindfulness, and performance measures of working memory, depressive symptoms and rumination than control group at post test.

Hooker & Fodor (2008) believed that children will also benefit, like adults, if mindfulness techniques are imparted to children. Children often fail to remember things frequently because they did not pay attention in a proper way. If they are focused, give attention to things, aware about them, they can remember things in a better way which may help learning and sports. The finding reveals that mindfulness techniques are
helpful in improving memory. In addition, children by developing skills of self awareness and by becoming concentrative on themselves, will learn their working process of mind, process of thinking, encouraging better self-understanding of their own experiences of the daily life, which they do not experience generally (Fontana & Slack, 1997).

The impact of mindfulness meditation program on working memory capacity and affective experience was investigated. Jha, Stanley, Kiyonaga, Wong, and Gelfand (2010) used the Operation span (Ospan) task (Unsworth, Heitz, Schrock, & Engle, 2005) as it includes memory of non affective stimulus e.g. letters over short period during the performance of simple arithmetic count. This found that stressful experiences may deplete working memory capacity which leads to emotional conflict and cognitive breakdown. They hypothesized that mindfulness training alleviates these detrimental effects by strengthening working memory capacity. Findings revealed that working memory capacity was found increased in meditators groups with high practice than low practice time and mindfulness training also guarded from disturbances related with high-stress situations.

Wider applications of mindfulness approach have positive effect. Lau and Hue (2011) used this technique with low-attaining elementary students and found improvement in attention, in outdoor education (Frauman, 2010), in urban school populations (Mendelson et al. 2010) and increased the teaching of communication and emotional intelligence in schools (Huston, 2010). In similar line, Zeidan et al. (2010) supported the idea that mindfulness has positive impact on intellectual skills, increasing working memory, visuo-spatial memory, concentration and sustained attention.

Chiesa, Calati, & Serretti (2011) examined the impact of mindfulness meditation practices on objective measures of cognitive functions. Overall, findings revealed that early stage of mindfulness training is related to considerable developments in selective and executive attention and improved focused attention. The subsequent stages, which involve observation of internal and external stimuli and chiefly related to enhanced unfocused sustained attention abilities. Additionally, mindfulness meditation practices also lead to enhancement of working memory capacity and some executive functions.
Morrison, Goolsarren, Rogers, & Jha (2014) examined the benefits of mindfulness with students who have wandering mind and create interference with academic and learning success. They provide short-form MT (7 hour over 7 weeks) and suggested that it may decrease mind wandering and enhance working memory. In this training sustained attention to response task (SART) and working memory tasks i.e. operation span and delayed-recognition with distractors were indexed in both control and mindfulness group. The results revealed that the mindfulness training has significantly benefitted the SART performance. After the seven week training period participants of mindfulness group revealed significant higher task accuracy, along with this they reported being more task oriented and focused as compared to control group however not much benefit of MT has been noticed on the operation span task and the delayed-recognition.