CHAPTER 4

RESULTS AND DISCUSSION

The main aim of the present study was to observe the effect of mindfulness on attention, learning and memory among adolescents. The total data of 600 subjects was collected. In the present research study, main aim was to assess the main effect of independent variable (Mindfulness) on the subjects who were found to have low level on the variable of attention, learning and memory. For intervention, total sample of 60 subjects was selected.

The results of present study are described under respective headings in the following sections:

4.1 DESCRIPTIVE STATISTICS

Table 4.1 depicts the descriptive information about all the variables. The mean and SD of attention is 144.95 and 22.7 respectively. The mean values of learning and memory are 11.28 and 14.20 and SD is 3.33 and 3.98 respectively.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>MEAN</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATTENTION</td>
<td>144.95</td>
<td>22.7</td>
</tr>
<tr>
<td>LEARNING</td>
<td>11.28</td>
<td>3.33</td>
</tr>
<tr>
<td>MEMORY</td>
<td>14.20</td>
<td>3.98</td>
</tr>
</tbody>
</table>

4.2 INTERCORRELATIONS

The correlation coefficients were computed among all possible pairs of variables through Pearson’s product moment method. Here, intercorrelations between different sets of variables have been described under their respective headings:
**TABLE – 4.2**

**INTERCORRELATION MATRIX**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Attention</th>
<th>Learning</th>
<th>Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>1</td>
<td>-.57**</td>
<td>.55**</td>
</tr>
<tr>
<td>Learning</td>
<td>-.57**</td>
<td>1</td>
<td>-.53**</td>
</tr>
<tr>
<td>Memory</td>
<td>.55**</td>
<td>-.53**</td>
<td>1</td>
</tr>
</tbody>
</table>

** Correlation is significant at .01 level**

4.2.1 Correlation between Attention and Memory

Results revealed the positive relationship between attention and memory as depicted in table no. 4.2. It may be noted that the correlation between attention and memory (.55) is significant at .01 level. The correlation between attention and memory is positive. The finding is in accordance with hypothesis no. 1, which states that attention and memory are significantly correlated with each other and it reveals that there is a strong relationship between attention and memory. Thus, hypothesis no. 1 has been proved.

Results of present study revealed that memory and attention are strongly associated with each other. To memorize information one should focus on attention when information is existed. If an individual is found unable to pay attention, consequently, he will find complexity in memorizing information. In opposition, it is also considered if one focuses his attention in a proper way, he or she will effectively be capable to memorize information. The findings of the present study have also been supported by the previous findings of the research studies conducted by Gluksb & Cowan (1970), Allport, Antonis and Reynolds (1972), Rollins & Thibadeaus (1973), Kellog (1980), Wollford & Morrison (1980) which indicated that stimulus event that are not attended are poorly remembered. Memory is much better for attended events than unattended events.

Many other researchers have also described very strong relationship between memory and attention. Classic psychologists such as James (1890) stated long ago that “we cannot deny that an object once attended to will remain in the memory, while one inattentively allowed to pass will leave no traces behind”. Smith (1895) defines that it
can be based on the principle that individuals’ memorize only attended information and forget unattended information.

Furthermore, it has been noted that attention and memory are associated with each other. Individuals pay attention and memorize information of the environment which is strongly connected to differential reproductive success over evolutionary time (McArthur & Baron, 1983; Buss, 1989a; Klein, Cosmides, Tooby, & Chance, 2002; Schützwohl & Koch, 2004; Schützwohl, 2006; Maner, Gailliot, Rouby, & Miller, 2007; Nairne, Pandeirada, Gregory, & Van Arsdall, 2009).

The present findings emphasized that attention is a major element of distinguished process of memory like selection, encoding, storage, and retrieval. To support the present findings, there are other explanations which define the function of attentional process in memory development such as attention is required for retention of the contents in short term memory (Pashler, 1998; Cowan, Nugent, Elliott, Ponomarev, & Saults, 1999), short term memory reflects stimulus in the current focus of attention (Anderson, 2005) and episodic encoding has been affected by attention (Naveh-Benjamin, Guez, & Marom, 2003). For memory retrieval, attention is important and acts in two ways i.e. by the activation of memory representations and by the facilitation of their ensuing storage and retrieval (Cowan et al. 1999; Gavens & Barrouillet, 2004). Roelof (2008) concluded that at the time of retrieval, selection processes between opposing responses are also affected by attention.

To emphasize the involvement of attention in memory, Thompson & Gathercole (2006) considered attention as the cognitive process that allows working memory to retain information when people execute cognitive tasks and adjust their behavior according to the nature of a particular task. Because attention is necessary during encoding of information, and those students who have problems like distractibility and inattention also have memory related problems (Ashcraft & Krause, 2007).

To study that attention and memory cannot function without each other, Chun and Brown (2007) reviewed that the capacity of memory is limited but attention play an important role in determining which information should be encoded. During encoding, divided attention inhibits the configuration of conscious memories and in the development of unconscious memories; the role of attention is more intricate. Further, they revealed that what information should be attended is directed by past experiences.
retained in the memory. Some brain areas play essential role in developing memory e.g. medial temporal lobe structures and hippocampus are engaged in attention tasks and memory has a direct effect on a frontal parietal network which is included in spatial orienting.

4.2.2 Correlation between Attention and Learning

It is evident from the intercorrelation matrix that the correlation between attention and learning is significant at .01 level. The correlation between attention and learning is -.57. Findings mentioned in table no. 4.2 reveal that attention is inversely related with the variable of learning (-.57). Here the high score on learning is the indicator of poor learning. The finding is in accordance with hypothesis no. 2, which states that attention and learning are significantly correlated with each other and it depicts that there is a strong relationship between attention and learning. Hence, Hypothesis no. 2 has been proved.

Thus the positive relationship between learning and attention reveals that children with high attention perform better on learning task. The researchers Kim (1975), Lubus (1975), Ellis (1976) & Shoom (1977) supported the view that children high on attention span are capable of showing superior performance on learning tasks than children with low attention span.

The study of Verma & Loomba (1990) on learning and attention span also supported the view that learning is related to attention. Learning is affected by the attentive nature that is present in the child. So it can be considered that attentional behavior of children makes them successful learners in life. There is a substantial research literature to support a positive relationship between learning and attention. It can be concluded that attention is related to learning, children who have high attention span can learn much more than those who are low in attention span.

Importance of attention in learning procedures was also considered by James (1902) who wrote: “whether the attention comes by grace of genius or by dint of will, the longer one does attend to a topic the more mastery of it one has”. To support the present findings, Medin and Schaffer (1978) viewed that participants learned the aspects which they attended to in correspondence to the amount of attention they focused on them.
The present research continued to confirm the relationship of attention and learning and suggests that attention might be significantly related to the learning when learner focuses to a learning task. Anderson, (1982) and Ainley et al. (2002) viewed that when learners pay more attention to learning tasks, they achieved better. Hidi (1995) revealed from his studies that a positive impact of attention on learning can be achieved by longer period of attention, by higher intensity and more cognitive effort.

Present research suggests that initial and foremost step in learning is to pay attention. If one can pay attention to his learning material, it enhances his learning. Harris et al. (1994) argued that enhanced attention will influence learning only when learners comprehend instructions. Teachers continuously try to guide-to gain and sustain-the students' attention. 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 (Anderson, 1993).

In the 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).

To support the relation between attention and learning, Ashcraft & Krause (2007) exhibited that to learn something, mental efforts are required. Complex learning or another multi-component skill is based on the student’s ability to control the attention. In addition, learning will be adversely affected if students are unable to control their attention and interfering information will not be filtered out (Palladino, 2006).

4.2.3 Correlation between learning and memory

Findings mentioned in table no. 4.2 suggest that correlation between learning and memory is -.53. The intercorrelation matrix shows inverse relation between each other which is significant at .01 probability level. Here the high score on learning is the indicator of poor learning. The result of present research states that learning and memory are significantly correlated with each other. Thus, Hypothesis no. 3 has been proved.

Present research concluded that memory and learning are strongly correlated to each other. Memory is essential to recall or retrieve any learned material. Without memory
neither one can learn something nor recall the learned material. There is a strong connection between each other. The similarity of the study of Lutz & Huitt (2003) with the present study is that if learning is to occur, it has to be ensured that new information is processed in memory appropriately. So, relationship must take place between earlier learned memory and novel information. Further, the study concluded that more intensely the information is processed then more associations can be established between the existing memory structures and the novel information and as a result long-term memory will retain maximum information.

For many researchers, memory can be considered as the only evidence of what has been learned. To support the idea, Pinel (2009) noted that learning is considered as the procedure for attaining memory. Memory is essential for learning and all kind of memory has been accumulated through the structures of the brain which is its original experience.

Wesson’s (2010) study supports the idea of present research which reveals that memory is necessary for all living beings. In learning activities, one cannot manage in the present and think about the future without the past memory. One can learn nothing without memory that’s why memories are the internal mental records which one sustains, it provides immediate access to past experience, complete with all of the facts that one knows and the skills that have been developed which are important in learning.

To confirm the relation between learning and memory, it has been demonstrated that students’ capacity of working memory is considered as a good predictor of his or her capability to retrieve information precisely, which is necessary because accurate retrieval of acquired information is required for learning to occur (Ecker, Lewandowsky, Oberauer, & Chee, 2010). Further, Martinez (2010) concluded that if students’ try to process information overloaded in their working memory, learning and understanding will be negatively affected. There are other supported findings which are consistent with present study (Radvansky & Copeland, 2006 and Naveh-Benjamin, Guez, & Sorek, 2007) which exhibit the relation between learning and memory.

### 4.3 SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS

In order to examine the effect of mindfulness on attention, learning and memory, paired t-test was used. The outcomes of the pre and post intervention program were analyzed
by calculating the mean, standard deviation and the significance level with the help of paired t-test.

4.3.1 Effect of Mindfulness on the Variable of Attention

**TABLE – 4.3.1**

**SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS ON THE VARIABLE OF ATTENTION (N=60)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>Pre-Test</td>
<td>102.23</td>
<td>8.29</td>
<td>-22.05</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>178.71</td>
<td>26.89</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation

The outcomes shown in table no. 4.3.1 represent the effect of mindfulness on attention. The paired sample t-test showed significant difference as depicted in table no. 4.3.1. At pre-test, the mean for students on the variable of attention was 102.23 which significantly increased to 178.71 at post-test and the t value is -22.05 (p < .01). The higher mean on the post-test indicate the significant increase in attention after intervention.

![Graphical presentation of mean scores on pre-test and post-test on the variable of attention](image)

Figure 4.3.1 Graphical presentation of mean scores on pre-test and post-test on the variable of attention
The paired t-test outcomes are obtained and the trend of increasing mean scores from the pre-testing to post-testing (intervention program for six months) is the indicator of the effectiveness of the mindfulness in increasing and maintaining the capacity of attention. This difference between pre and post-test proved statistically significant.

This suggests that the mindfulness intervention was successful in improving attention. As table no. 4.3.1 indicates that from pre-test to post-test there is a lot of improvement in subjects’ attention and it also shows the effect of mindfulness in managing the individual’s attentional capacity. The finding is in accordance with hypothesis no. 4 which states that the mindfulness has significant effect on attention.

This pattern of result suggests that mindfulness meditation practitioners experienced awareness of each and every moment of present situation which inculcates the skill to think mindfully. The post intervention result reveals that participants having improved performance on attention show keen sense of self-awareness at the end of intervention. Present result revealed that mindfulness is closely related to improvements of attentional functions and cognitive flexibility.

### 4.3.2 Attention score difference by Quartile Distribution on the basis of pre-test score

Further, present research analyzed attention scores based on quartile distribution established from the participants’ pre-test scores. We are interested in whether the performance of the students with the lowest pre-test score had improved from pre-test to post-test and analysis was also done to see the significance of difference in scores after intervention of the group having comparatively higher score on the basis of upper quartile distribution. So, we divided the students into quartiles based on pre-test scores.

**TABLE – 4.3.2.1**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>Pre-Test</td>
<td>92.62</td>
<td>3.28</td>
<td>-15.15</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>170.12</td>
<td>20.68</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation
On the basis of quartile deviation, paired sample t-test indicated that students with the lowest level of attention in intervention group demonstrate significantly greater improvement from pre-test to post-test. As indicated in table no 4.3.2.1 the mean value of lower quartile is 92.62 significantly increased to 170.12 at post-test ($t = -15.15$, $p< .01$).

![Graphical presentation of mean scores on pre-test and post-test on the variable of attention (lower quartile)](image)

**Figure 4.3.2.1** Graphical presentation of mean scores on pre-test and post-test on the variable of attention (lower quartile)

**TABLE – 4.3.2.2**

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS ON THE VARIABLE OF ATTENTION (UPPER QUARTILE GROUP) N=18

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attention</td>
<td>Pre-Test</td>
<td>112</td>
<td>5.8</td>
<td>-17.1</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>187</td>
<td>18.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation

On upper quartile based score the mean value of variable of attention in pre-test is 112 and post-test is 187, $t = -17.1$ ($p< .01$). The higher mean on the post-test indicate increase in the attention on upper quartile group. The paired t-test outcomes obtained from table no. 4.3.2.2 depicts that students with the highest level of attention in intervention group demonstrate significantly greater improvement from pre-test to post-test.
The outcomes obtained from the present study can be supported with the outcomes obtained from the previous study where mindfulness has shown its efficacy in improving attentional function as well as cognitive flexibility and participants performed significantly better than nonparticipants on all measures of attention (Moore and Malinowski, 2009).

The findings of the present research are also in agreement with the findings of Jha et al. (2007) where in 8 weeks of therapeutic intervention improvement was reported on the sustained attention task relative to control group. Shapiro, Arnett, & Raymond (1997) study also confirmed the findings which revealed that three months meditation practice is helpful in increasing attentional capacity of meditators in comparison to non meditators.

The outcomes of the present study are also in line with the Hart’s findings (1987) in which the mindfulness training shared marked improvement in self regulation of attention and improved emotion regulation. To support the idea, Lazar et al. (2005) conclude from their findings that regular meditation promote structural changes in a subset of cortical regions in areas of interoceptive and somato sensory processing and attention regulation.
Present research continued to confirm that mindfulness training program is very much useful for students to increase their ability to maintain their attention. Several reviews regarding mindfulness suggest that there is a strong association between mindfulness and the ability to control attention strategically (Bögels, Sijbers, & Voncken, 2006; Shapiro, Brown, & Biegel, 2007). In similar line, research by Valentine and Sweet (1999) on mindfulness meditation showed that practitioners in comparison to control group reported higher scores on sustained attention. To support the finding of research, Baer (2003) investigated mindfulness meditation focusing on improvement in attention. Shapiro et al. (2007) study is also in line with present research which concludes that mindfulness-based stress reduction training is helpful in diminishing ruminative attention.

The main objective of mindfulness is to increase the children capacity to pay attention, however, remaining benefits also have been found. Mindfulness programs which have positive effect on children revealed improved concentration, self control, decrease anxiety and disruptive behavior (Feindler, Marriott, & Iwata, 1984; Fluellen, 1996; Ryan, 2000).

Different studies found consistent results with regards to the effectiveness of mindfulness on attention. For example, Teasdale et al. (1995) found that mindfulness meditation focuses on increasing the ability to control attention. In addition, Brown & Ryan, 2003; Bishop, Lau & Shapiro, 2004; Lau et al. 2006 supported the viewpoint that mindfulness meditative programs are helpful in enhancing self regulation of attention. On the other hand, instructors of mindfulness meditation program have noted the benefits that this program might have positive impact on cognitive abilities involving attention, memory and other cognitive functions (e.g. Kapleau, 1965; Gunaratana, 1993; Teasdale, Segal, & Williams, 1995).

In contrast, the study of Napoli (2004) found that mindfulness practices produce positive transformation both inside the class room and outside the classroom. Those students, who practice mindful breathing, reported benefit, for instance, more focused and relaxed, lessen anxiety before any exam, in conflicting situation make better judgement and effortlessly capable to transmit their attention when disengaged. Wenk-Sormaz (2005) used the Stroop task, (Stroop, 1935) stated that improvement has been found on executive attention measures in mindfulness group.
Schonert-Reichl & Hymel (2007) observed great improvement in behaviour, attention and focus on 9-13 years old age group. In similar line, Saltzman and Goldin (2008) and Semple et al. (2010) reported improvement in attention, some areas of meta-cognition and reductions in anxiety and behaviour problems compared to those who are not involved in the program.

4.3.3 Effect of Mindfulness on the Variable of Learning

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning</td>
<td>Pre-Test</td>
<td>18.06</td>
<td>1.99</td>
<td>25.28</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>8.8</td>
<td>2.37</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The paired t-test outcomes obtained from table no 4.3.3 depict significant results of the effectiveness of mindfulness on learning. The mean value of variable learning in pre-test is 18.06 and post-test is 8.8. The findings obtained in table no. 4.3.3 reported ($t = 25.28 \ (p<.01)$ which was found to be significant.

Figure 4.3.3 Graphical presentation of mean scores on pre-test and post-test on the variable of learning

(Note: Lower score on learning indicates better learning)
According to the results, the mean score significantly decreased from the pre-testing to post-testing. Here, lower means score indicate better learning due to scoring procedure of serial learning task. It shows meaningful and statistically significant difference between pre-test and post-test which indicates that mindfulness is helpful in increasing the participant’s learning. If we look at the outcomes on the variable of learning obtained by the participants as presented in table no. 4.3.3, it suggests that mindfulness can be considered as a core ingredient in the students learning and mindfulness training allows students to make their learning in a better way at the end of intervention program. The hypothesis no. 5 regarding the effect of mindfulness on learning has been accepted which stated that mindfulness has significant effect on learning.

4.3.4 Learning score difference by Quartile Distribution on the basis of pre-test score

Present research also analyzed learning scores based on quartile distribution established from the participants’ pre-test scores.

| Table – 4.3.4.1 |

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS ON THE VARIABLE OF LEARNING (LOWER QUARTILE GROUP) N=16

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEARNING</td>
<td>Pre-Test</td>
<td>16.0</td>
<td>.00</td>
<td>20.48</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>7.87</td>
<td>1.58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation

On the basis of quartile deviation, paired sample t-test indicated that students with the lowest level of learning in intervention group demonstrate significantly greater improvement from pre-test to post-test. As indicated in table no. 4.3.4.1 the mean value of lower quartile is 16.0 which significantly decreased to 7.87 at post-test and (t=20.48, p<.01) which indicates improved learning.
Figure 4.3.4.1 Graphical presentation of mean scores on pre-test and post-test on the variable of learning (lower quartile)  
(Note: Lower score on learning indicates better learning)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEARNING</td>
<td>Pre-Test</td>
<td>20.76</td>
<td>1.30</td>
<td>16.7</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>9.29</td>
<td>2.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation

As shown in table no. 4.3.4.2, on upper quartile based score the mean value of variable of learning in pre-test is 20.76 and post-test is 9.29. The lower mean on the post-test indicate improved learning. The findings obtained at variable of learning reported t=16.7, p<.01. The paired t-test outcomes obtained from table no. 4.3.4.2 depicts that students also with the highest level of learning in intervention group demonstrate significantly greater improvement from pre-test to post-test.
The findings of the relationship between mindfulness and learning in present study are consistent to some other studies too. Mindfulness in students learning process allows students to think creatively, recognize the novelty of information, experience cognitive flexibility, and better understand the information to enhance memory for instructional retention (Langer, Hatem, Joss, & Howell, 1989; Wong 1994; Richart & Perkins, 2000). Rempel (2012) suggests that mindfulness training enhances student learning in all situations.

Further, the study conducted by Napoli et al. (2005) also supports the findings of present study. Deploying mindfulness training is helpful in encouraging learning environment and reduces the possibility of students’ disruptive and negative behaviour. To begin mindfulness into the classroom would have positive effect on students’ capability to sustain their attention, enhance learning and decrease anxiety and stress. Langer (1989, 1997, and 2000) introduced the concept of “mindful learning” which presents learning more effectively, stimulating, pleasant, and innovative. The spirit of this concept is to include the students’ active 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 dimensions of mindfulness in educational setting allow learners to extend and expand the nature of learning in their whole life as learners. 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 (Fontana & Slack, 1997).

To support the findings, Salmon, Santorelli, & Kabat-Zinn (1998); Davidson et al., (2003) indicated that the first and foremost step in mindfulness practice is to pay attention on the breath. Other chief basics are the capability to make harmony into actions which takes place in the body and mind. Rhythmic breathing influence the autonomic nervous system, mind and raises the levels of self-awareness of their learning performances. Langer, Hatem, Joss, & Howell (1989) reported that in a mindful situation, students are able to look learning situations in original and new perspective while focusing on earlier learned matters (Langer, Hatem, Joss, & Howell, 1989).

4.3.5 Effect of Mindfulness on the Variable of Memory

The present research examined the impact of mindfulness based intervention program on memory among students. The result of this study shows that after the intervention program, the scores of the subjects on the variable of memory had a significant difference compared to before the intervention. This difference has been particularly significant in relation to memory.

Table – 4.3.5

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS ON THE VARIABLE OF MEMORY (N=60)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning</td>
<td>Pre-Test</td>
<td>6.8</td>
<td>1.13</td>
<td>-24.36</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>17.7</td>
<td>3.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation

The paired sample t-test showed significant effect of mindfulness on memory as depicted in table no 4.3.5. At pre-test, the mean for students on variables of memory
was 6.8 which significantly increased to 17.7 at post-test (t= -24.36) which is significant at .01 level. The higher mean on the post-test indicate improved memory which states that mindfulness has significant effect on memory. The outcomes obtained between pre-test and post-test on variable memory has been found statistically significant. It has been concluded that the intervention program of mindfulness proved successfully effective in improving memory. The finding is in accordance with the hypothesis no. 6 which reveals that there is a significant effect of mindfulness on memory.

Figure 4.3.5 Graphical presentation of mean scores on pre-test and post-test on the variable of memory

4.3.6 Memory score difference by Quartile Distribution on the basis of pre-test score

TABLE – 4.3.6.1

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS ON THE VARIABLE OF MEMORY (LOWER QUARTILE GROUP) (N=21)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEMORY</td>
<td>Pre-Test</td>
<td>5.5</td>
<td>.74</td>
<td>-20.06</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>17.8</td>
<td>2.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation
On the basis of quartile deviation, paired sample t-test indicated that students with the lowest level of memory in intervention group also demonstrate significantly greater improvement from pre-test to post-test. As indicated in table no. 4.3.6.1 the mean value of lower quartile is 5.5 which significantly increased to 17.8 at post-test. The findings obtained in table no. 4.3.6.1 reported (t = -20.06; p<.01) were found to be significant.

![Graphical presentation of mean scores on pre-test and post-test on the variable of memory (lower quartile)](image)

**Figure 4.3.6.1** Graphical presentation of mean scores on pre-test and post-test on the variable of memory (lower quartile)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEMORY</td>
<td>Pre-Test</td>
<td>8.0</td>
<td>.00</td>
<td>-11.4</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Post-Test</td>
<td>17.46</td>
<td>3.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE – 4.3.6.2**

**SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS ON THE VARIABLE OF MEMORY (UPPER QUARTILE GROUP) (N=21)**

Note: N - Number of Participants; M - Mean; SD - Standard Deviation

On upper quartile based score the mean value of variable memory in pretest is 8.0 and post-test is 17.46. The paired t-test outcomes (t = -11.4, p<.01) obtained from table no. 4.3.6.2 depicts that students with the high level of memory in intervention group also demonstrate significantly greater improvement from pre-test to post-test.
Present research study suggests mindfulness as a skill which trained the mind to concentrate and remain non-judgemental by focusing on the current moment which also deals with other cognitive functions like memory and concludes that specific and significant relationship exists between mindfulness and memory. The similarity of the study of Bishop et al. (2004) and Tang et al. (2007) with the present study is that mindfulness intervention program increases in memory specificity and meta awareness. Other studies (Wenk-Sormaz, 2005; Redick & Engle, 2006; McVay & Kane, 2009) are also in line with the present research.

Different studies found consistent effects of mindfulness meditation program on memory. For example, Langer & Moldoveanu (2000) examined that in mindful condition participants creatively use objects and demonstrate increased attention and improved memory. In similar line, Hooker & Fodor (2008) believed that applying mindfulness techniques, children may improve memory. In addition, Chambers et al. (2008); Zeidan, Johnson, Diamond, David, & Goolkasian (2010) and Chiesa et al. (2011) studied the impact of mindfulness training on working memory capacity and have found significant enhancement in working memory capacity.

Participants who completed mindfulness training demonstrated significant improvement in memory. Chambers, Lo, Cheun and Allen (2008) noted that self-
reported mindfulness, performance measures of working memory and sustained attention are found increased in meditative group than non meditative group. On the other hand, (Semple 2010; Heeren and Philippot, 2011) researches also revealed that mindfulness training leads to enhancement in performance on attention, working memory and cognitive control.

In addition, Jha, Stanley, Kiyonaga, Wong, and Gelfand (2010) examined that the stressful experiences may deplete working memory capacity which leads to emotional conflict and cognitive breakdown. They hypothesized that mindfulness training alleviate these detrimental effects by strengthening working memory capacity. Findings revealed that working memory capacity increased in meditators groups with high practice than low practice time and mindfulness training also guarded from disturbances related with high-stress situations.

**4.4 SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS ON THE VARIABLE OF ATTENTION, LEARNING AND MEMORY BETWEEN BOYS AND GIRLS**

**4.4.1 Gender differences on the variable of Attention**

Present research examined the difference in attention between boys and girls by using t-test for independent sample. The t-test was applied on raw scores across the entire sample. The results in table no. 4.4.1 demonstrate significant difference between boys and girls on the variable of attention. A total of 600 students were tested, 300 boys and 300 girls respectively. There was significant high score in girls mean than boys on the variable of attention.

**TABLE – 4.4.1**

**SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS OF BOYS AND GIRLS ON THE VARIABLE OF ATTENTION (N=600)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATTENTION</td>
<td>GIRLS</td>
<td>147.2</td>
<td>24.42</td>
<td>2.47</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>BOYS</td>
<td>142.6</td>
<td>20.67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation
The independent sample t-test showed significant difference as depicted in table no. 4.4.1. The mean for girls on the variable of attention was 147.2 significantly higher than boys mean i.e. 142.6. The obtained t value is 2.47, p<.05. It means that girls have better attention than boys. Girl’s ability of concentration is higher than boys.

![Graphical presentation of mean scores between boys and girls on the variable of attention](image)

Figure 4.4.1 Graphical presentation of mean scores between boys and girls on the variable of attention

Supporting findings revealed that Girls have lesser attention span problems and were effectively able to carry out transitions between lessons (Gurian & Stevens (2004). Similarly, Warrick, Pamela & Naglieri’s (1993) study revealed that girls significantly outperformed boys on attention tasks. Thus hypothesis no.7 has been proved which states that there is a significant difference in attention between boys and girls.

Various other studies also show that girls are more attentive than boys. Naglieri and Rojahn (2001) viewed that girls exhibited better letter-word identification, passage comprehension, dictation, and proof-reading. Their results suggest girls have stronger verbal skills and pay more attention to details than males when reading. Particularly, it came into view that boys demand and given more attention and keep in activity related discussion to a higher extent than girls (Leindhart et al. 1979). Merritt et al. (2007) pointed that are few scientific proofs which show that boys and girls differ in selective attention but more researches are required in this field.
4.4.2 Gender differences on the variable of Learning

**TABLE – 4.4.2**

SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS OF BOYS AND GIRLS ON THE VARIABLE OF LEARNING (N=600)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEARNING</td>
<td>GIRLS</td>
<td>11.61</td>
<td>3.5</td>
<td>2.41</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>BOYS</td>
<td>10.95</td>
<td>3.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation

The independent sample t-test showed significant difference as depicted in table no. 4.4.2. The mean for girls on the variable of learning was 11.61 and mean for boys were 10.95. The obtained t value is 2.41, p<.05. Here lower score on learning implies better learning. Present research concludes that boys learning capability is stronger than girls. It proves the hypothesis no. 8 which reveals significant difference in learning between boys and girls.

![Graphical presentation of mean scores between boys and girls on the variable of learning](image)

*Figure 4.4.2 Graphical presentation of mean scores between boys and girls on the variable of learning*

*(Note: Lower score on learning indicates better learning)*
Girls think and learn differently from boys. Askew and Ross (1988) observed that girls and boys are involved in different types of learning processes, even when the activities in which they are involved are the same.

Pizzo, (1990); Greb, (1998) hold the view that individuals are distinguished by gender. Boys and girls learn in a different way from each other. Boys are more kinesthetic, tactual, and visual. In addition to this boys prefer to be more mobile when they are in the environment which is informal while this preference is less comparatively in females. On the other hand, girls are more auditory, authority-oriented and better able to sit passively at conventional classroom desks and chairs in compare to boys. During learning, they remain quieter (Pizzo, 1990); be more self- and adult–motivated and conforming than boys (Marcus, 1977).

4.4.3 Gender differences on the variable of Memory

![Table 4.4.3](image)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Level</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEMORY</td>
<td>GIRLS</td>
<td>14.58</td>
<td>4.08</td>
<td>2.33</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>BOYS</td>
<td>13.83</td>
<td>3.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: N- Number of Participants; M- Mean; SD- Standard Deviation

As indicated in table no. 4.4.3, the present research shows a significant difference between boys and girls in terms of mean scores obtained in memory test. The obtained t value is 2.33; p< .05 and the mean for girls on the variable of memory was 14.58 which is significantly higher than 13.83 of boys. The findings obtained in table no. 4.4.3 reported higher score in girls’ means on the variable of memory than boys. Significant difference was found on the variable of memory which indicates that girls have better memory than boys. Present research concludes that girls are more able to retain information and recall the material than boys. Thus hypothesis no. 9 has been proved which states that there is a significant difference in memory between boys and girls.
Various other studies supported the data of present research and shows that girls tend to have more detailed memories than boys. For example, Johnson and Bouchard (2007) indicated that girls show normally superior memory than boys. In addition, Voyer et al. (2007) exhibited that to some extent girls show greater accuracy in definite fields like memory for object locations; on the other hand, Lewin et al. (2001) revealed that boys show perfection in memory for visuospatial stimuli which is more difficult.

Although girls and boys think and remember differently but there are more studies which are related with the present research. A study reveals that girls are found superior at sensory memory, sitting still, listening, tonality, mental cross talk, and the complexities of reading and writing (Gurian & Stevens, 2004). In his study, Banks (2012) showed that girls are stronger in short-term memory than boys. Girls work more creatively and usually memorize minute details in comparison to boys. Later on, Banks (2012) also concludes that girls are more capable of recalling the materials than boys and have more creativity to remember the terms and ability to retain information. In contrast, some authors found no difference in context of memory (Kail & Siegel, 1977) but some found greater performance in girls (Postma Izenoorn, 1998; Silverman 2006).
DISCUSSION

Findings of the study provide generous support to most of the theoretical formulations relating to attention, learning and memory. One assertion put by Samuel Johnson is, "The true art of memory is the art of attention" (Klatzky, 1984). Attention is generally described as an individual capability to concentrate on a task. Thus the main and foremost step in learning and memory is to focus attention. The activity that captures one’s attentiveness and involves the mind has the capacity to generate learning. It can be said that, no attention, no engagement, no learning (Banikowski, 1999).

The present research supports the view that there is a strong relationship between attention, learning and memory. Findings reveal high correlation of learning (-.57) and memory (.55) with attention supporting the hypothesis no. 1 and 2. There is a positive and significant relationship between memory and attention. To examine the relationship between learning and memory, present data supports that memory and learning (-.53) are significantly correlated and supports the hypothesis no. 3. Here, higher learning scores reveal poor learning due to scoring pattern of serial learning task, that’s why, learning, has positive but inverse relation with memory and attention. Attention is a fundamental skill that makes people efficient to complete their daily tasks either in home or work environment. Attention is a focal point of entire learning and memory process. Naveh-Benjamin, Kraig, Guez, & Kreuger, (2005) also considered that students who have problem in paying attention to information are found to keep on struggling during encoding of information (i.e. initial acquisition). Attention supports memory which is very important for students to make efficient and proper use of memory in the learning process.

Some earlier studies also exhibited the existence of interaction between learning and memory. For example, Caine and Caine (1997) introduced that the memory related with the recall of sets of instructions and specific facts, lists or dates of information, has need of memorization and effort. Though, memory, instead of focusing on learning, also considers remembering, linking, attending, and employing the proficiency and knowledge which one encounters constantly. For educators, memory is considered as the only evidence that something has been learned.

Further, the present study examined the effect of mindfulness on attention, learning and memory among adolescents. Paired t-test shows significant effect of mindfulness on
attention (t = -22.05; p<.01), learning (t = 25.28; p<.01) and memory (t = -24.36; p<.01). The results of this study reveals that after the intervention program, all dependent variable (attention, learning and memory) have shown a significant increase. Based on post-test results for the variable of attention, it reveals not only the participants performing significantly higher, but more effect of mindfulness is also seen in other variables such as learning and memory. Overall results suggest that variables of attention, learning and memory are positively affected by meditation practice and levels of mindfulness.

The present research data support anecdotal evidence that the mindfulness intervention program lead to enhanced focus and concentration, betterment in social skills, self-awareness and greater sense of control. Thus, mindfulness training influences participants to remain in present and involved in maintaining their attention, and those who have been labeled as having difficulties with attention, learning and memory, were better able to approach with their capabilities. When students learn to be remaining in the present, which reinforce their abilities to concentrate they are found to pay better attention, enhance their learning and memory, improve the quality of performance, use and relate knowledge effectively, more able to approach situation in new perspective in their respective areas like in classroom, sports fields etc.

Findings of the study provide ample support to most of the hypotheses and theoretical formulation relating mindfulness, attention, learning and memory. One assertion put forward by (Bhikkhu, 2007) that with the help of mindfulness, one develops “street smarts” to control the mind. Mindfulness helps one to identify when he or she required developing other mental qualities—like alertness, concentration, loving, kindness, and effort for the purpose of diminishing distress adeptly.

However, Hjelle (1974), Murphy (1988), Flinton (1998) conclude that mindfulness enhances practitioners' sense of self control, by allowing them to see that thoughts, reactions, and mental events represent transitory functions of the brain, it is not their real self as an individual. Wider applications of mindfulness approach have positive effect and applying this technique on elementary students and found increased attention, in outdoor education (Frauman, 2010), in urban school populations (Mendelson et al. 2010), with low-attaining adolescents in Hong Kong (Lau and Hue, 2011). The present data clearly support these views. To prove the hypotheses 4, 5 and 6, paired t-test showed significant difference between pre-test and post-test which
indicate that mindfulness might be useful in maintaining the attention (t = -22.05) and enhancing the learning (t = 25.28) and memory (t = -24.36) (p<.01) of participants. It is clearly evident from these results that mindfulness is a skill that involves awareness of present experience, focuses on moment to moment basis by becoming non-judgemental, regulates one’s attention while maintaining focus on current experiences, uses existing knowledge in fresh perspectives and accommodates with new insight that enters into nature of one’s mind.

As present research reveals that mindfulness program is oriented to enhance the attention, learning and memory and certain earlier studies have also demonstrated existence of possible interaction of attention, learning and memory with mindfulness. For example, Langer, Hatem, joss, & Howell (1989); Thornton & Mcentee (1995) suggested that when students apply mindfulness in their learning processes, they make use of creativity, experience cognitive flexibility and capable to use information in order to increase memory for instructional retention. Further, Teasdale, Segal, & Williams (1995) suggested that mindfulness increases sensitivity to the current contingencies in the environment and allow the opportunity for new learning and helpful in developing meta-cognitive experience.

Furthermore, Reichl & Lawlor (2010) findings suggest that mindfulness increases attention, social and emotional competence, emotional regulation and significantly lowers the aggressive and oppositional behaviours. In both children and adults, self-management of attention appears to be a necessary prerequisite for learning to occur (Shiffrin & Schneider, 1977; Lam & Beale, 1991; Ehrenreich & Gross, 2002). In addition, the experience of struggle in maintaining a sense of concentration and motivation in managing distraction during mindfulness-based practices has been echoed in the adolescent and adult mindfulness literature (Mason & Hargreaves, 2001; Cohen-Katz et al. 2005; Finucane & Mercer, 2006; Allen, Bromley, Kuyken & Sonnenberg, 2009; Dellbridge & Lubbe, 2009; Stelter, 2009; Kerr, Josyula & Littenberg, 2011).

The hypotheses no. 7, 8 and 9 regarding the differences in attention, learning and memory between boys and girls has been accepted. Independent t-test shows significant difference between boys and girls in attention (t = 2.47), learning (t= 2.41) and memory (t = 2.33), p< 0.05. It is clearly evident from these results that girls have better attentive skills and more detailed memory but boys have better learning capability than girls.
Girls and boys differ in thinking, learning and remembering. Research shows that there are noticeable distinctions in boys’ and girls’ approach to some subjects (Gorman et al. 1982; Cresswell and Gubb 1987; Hendley et al. 1995). The present findings are found to be in line with the studies where it has been shown that girls are better than boys in context of attention and memory (Warrick, Pamela, Naglieri, Jack 1993; Gurian & Stevens, 2004; Johnson and Bouchard, 2007; Voyer et al. 2007) and in context of learning boys perform better.

Therefore, the present data, like earlier studies, add to the stability and consistency of the findings and also relating supportive role of mindfulness in managing attention, learning and memory.

**CONCLUSION**

The overall findings of the present research study have shown that Mindfulness intervention program has given promising results in maintaining the attention, learning and memory. Students who undergo mindfulness training reported more alertness, attentiveness, patient and non judgemental attitude. It is notable that chief element of mindfulness training is concentration and focused attention. The earlier stage of mindfulness practice requires meditator to detect when his mind wanders from the object onto which focused attention was directed and in later higher stages meditator gradually reduces his focus on external object and the ability of sustained attention is enhanced (Lutz, Dunne, et al. 2008; Lutz, Slagter, et al. 2008). In addition, mindfulness meditation program could have positive impact on cognitive abilities, involving attention, memory and other cognitive functions (Kapleau, 1965; Gunaratana, 1993; Teasdale, Segal, & Williams, 1995) and improved cognitive abilities are related with mindfulness training. Mindfulness appears to be the effective therapy among adolescents in context of attention, learning and memory, with more adherences, compliance and also flexibility on the part of the participants. Thus, the outcomes of the present study lead towards the acceptance of the hypotheses of the present research that mindfulness intervention program significantly worked in maintaining and enhancing the attention, learning and memory of participants. Further, implementation of the mindfulness practices strengthens the present research study. Limitations of the present study are that the intervention program was conducted on the small sample. There was no control group in the present research.
FUTURE IMPLICATIONS OF STUDY

Findings of the present research study have documented the efficacy of the mindfulness in managing and enhancing the attention, learning and memory among adolescents. An academic success is the main goal for students. The goals seem to be unachievable when social and emotional factors such as anxiety, frustration, motivation, depression and inattentiveness occur. These stressors and challenges strongly have an effect on the performances of student. Some competencies like handling frustration, understanding and managing emotion, maintaining motivation when tasks are challenging and directing attention to more productive work should be learned by students for progress. The training modules target to enhance the skills of the students in such a manner that they are able to recognize their thoughts and actions which usually results in improving concentration, conflict resolution, building a calm climate in the classroom, and improving the school environment. Mindfulness is considered as a key strategy which has positive effect on the wellbeing outcomes of children in educational setting. Evidence suggests that mindfulness practices not only reduced the negative effects of stress, anxiety, depression but also enhanced the wellbeing, increased resilience, calmness, behavioral regulation as well as cognitive flexibility in attention, learning and memory. When one completely experiences what is occurring in their bodies, minds and emotional lives, one starts to perform intentionally and remain in the present moment (Siegel, 2007). James is quoted as saying “the faculty of voluntarily bringing back a wandering attention over and over again is the very root of judgement, character and will. An education which should improve this faculty would be the par excellence” (as cited in Kabat-Zinn, 2007). To bring mindfulness in classroom serves as a core ingredient in students’ life which improves classroom behavior and enhances the ability to remain attentive increases students’ learning and memory.

Thus, mindfulness intervention program has been designed for the purpose of developing skills, academic interest, enhanced awareness, insight, achievement and to improve the level of happiness. These remarkable findings reveal the power of mindfulness and clearly mark our attention towards effectiveness of mindfulness. This study recommends that the flexibility of the mindfulness allows the educationist as well as therapists and the clinicians to use the different techniques and modules of the mindfulness as per the requirement of the specific case.
The results of the study can also be helpful for the educational policy makers to recommend and include the adoption of certain techniques like mindfulness for making the students mentally more agile, psychologically healthy and for their overall positive development in the pursuit of higher creative goals by remaining focused. Further, it can also be implied that the application of Mindfulness technique can serve both the purposes related to preventive and curative aspects pertaining to deficit in attention, learning and memory in the students. The mindfulness technique can be of tremendous importance if its application is made the regular feature in school students’ life and can play the preventive role by helping them saved from the distracted attention, decline in learning and poor memory. This consequently will result in heightened attention and better learning and memory – the essential cognitive capacities required for the fulfillment of academic soundness and success peculiar to the students. Mindfulness technique can also be used as treatment strategy or for intervention purposes for those showing decline in academic performance and related activities due to reduced attention, learning and memory.